FLORA OF AUSTRALIA

Volume 50
Oceanic Islands 2

FLORA OF AUSTRALIA

Volume 50 is one of two volumes in the series covering the whole vascular floras of Australia's offshore islands. It deals with Christmas Is., Cocos (Keeling) Is., Ashmore Reef and Cartier Is. (all in the Indian Ocean); the Coral Sea Islands; and Macquarie Is., Heard Is. and McDonald Is. in the Southern Ocean. Volume 49, to be published shortly, deals with Lord Howe and Norfolk Islands in the Tasman Sea.

For each island or island group there is an introduction to the geography, physical features, climate, vegetation and history of human usage. There is then a checklist of the species recorded for the island, followed by a key to the families present there.

The descriptive text, treating families, genera and species, is combined into a single sequence in order to avoid duplication where a species occurs on more than one island. Within each family are keys to genera and species.

Contributors, illustrators and photographers from Australia, England, New Zealand and the United States have prepared this volume.

The book should prove useful to anyone with an interest in island floras.

Cover: *Pandanus tectorius* var. *cocosensis* B.C.Stone, a screwpine endemic on Cocos Is. Painting by Diana Boyer.

Contents of volumes in the *Flora of Australia*, the families (current at January 1993) arranged according to the system of A.Cronquist (1981).

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Norfolk Island &
Lord Howe Island

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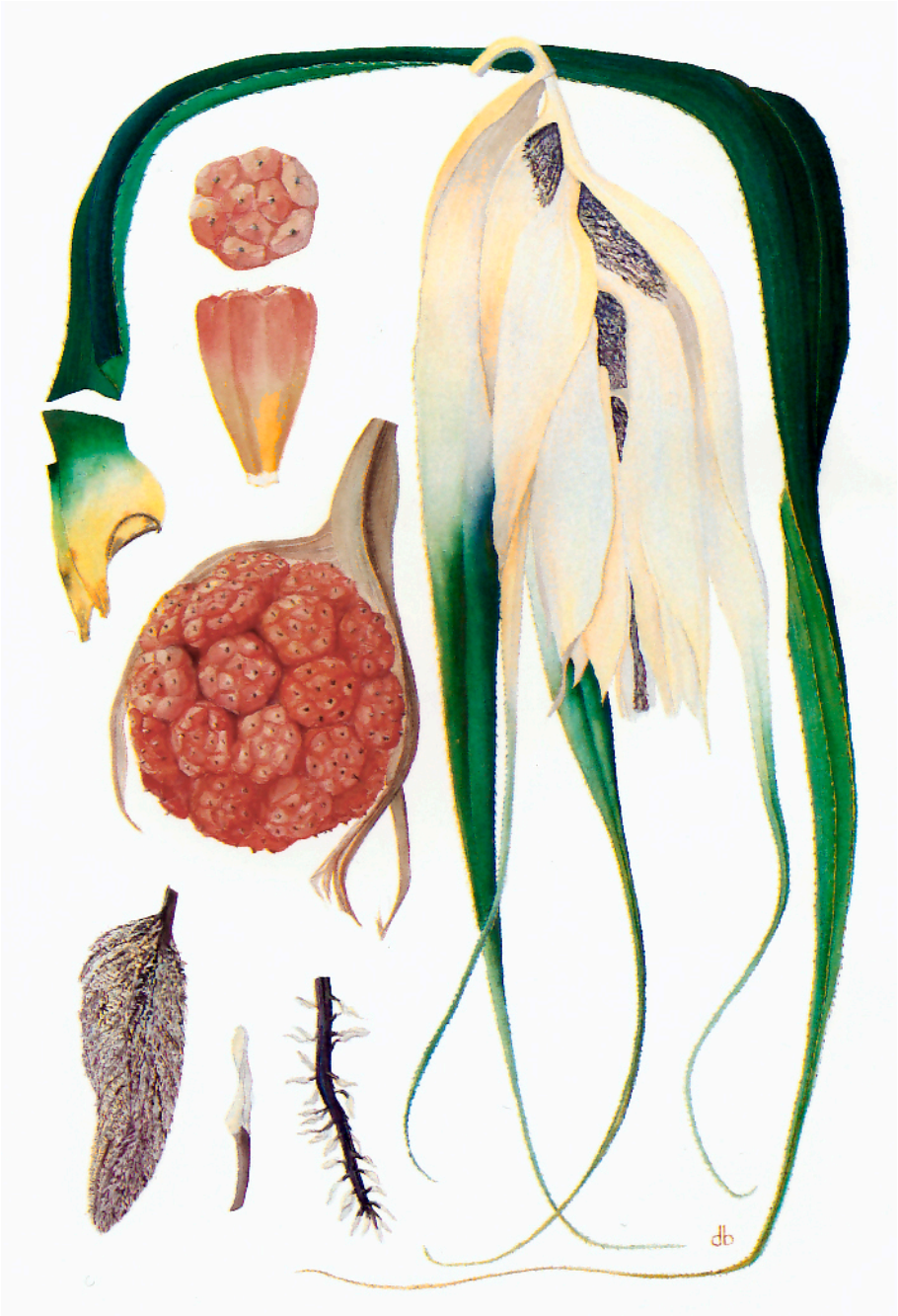
Volume 51 et seq.

Non-vascular plants

FLORA OF AUSTRALIA



Pandanus tectorius var. *cocosensis* B.C.Stone, a screwpine endemic on Cocos Is.
Painting by Diana Boyer.

AUSTRALIAN BIOLOGICAL RESOURCES STUDY, CANBERRA

FLORA OF AUSTRALIA

Volume 50
Oceanic Islands 2

An AGPS Press publication
Australian Government Publishing Service Canberra

This work may be cited as

Flora of Australia Volume 50, Oceanic islands 2, Australian Government Publishing Service, Canberra (1993)

Individual contributions may be cited thus:

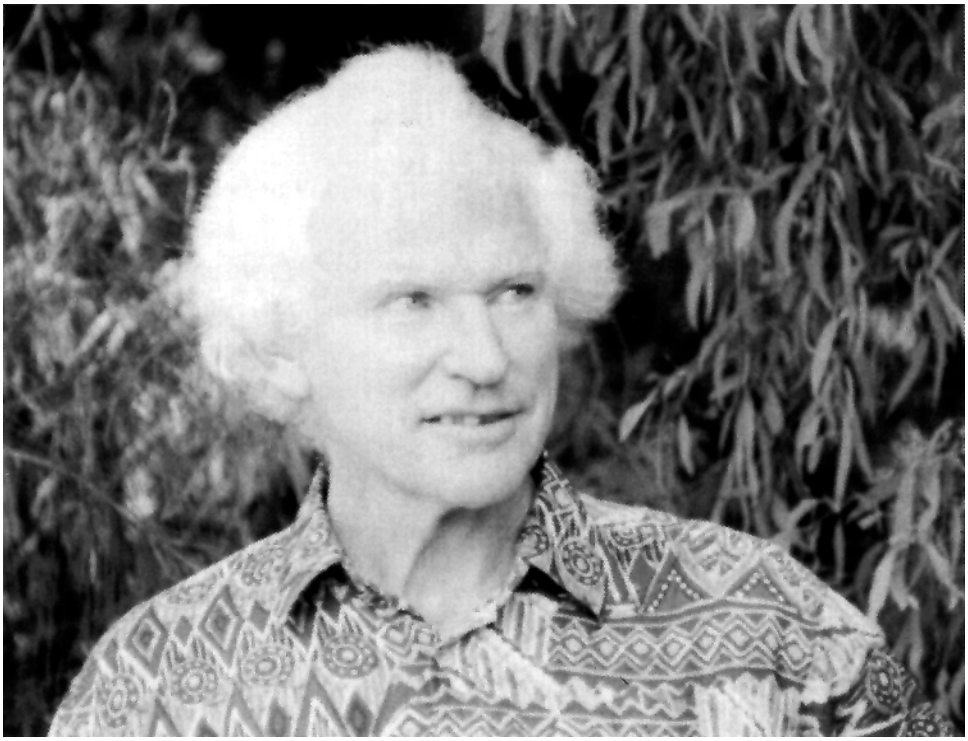
D.J.Du Puy, Annonaceae, *Flora of Australia* 50: 63–64 (1993).

National Library of Australia
Cataloguing-in-Publication entry

Flora of Australia. Volume 50, Oceanic islands 2.

Bibliography.
Includes index.
ISBN 0 644 14446 7.
ISBN 0 644 25875 6 (pbk.).
ISBN 0 642 07013 X (set).
ISBN 0 642 07016 4 (set : pbk.).
1. Botany – Australia – Classification. 2. Plants – Identification. I. George, Alexander S., 1939– . II. Australian Biological Resources Study. III. Title: Oceanic islands. 2.
581.994

This volume was produced using Word for Windows 2.0c
Printed by State Print Netley South Australia



This volume is dedicated to Alexander S. George, founding Executive Editor of the *Flora of Australia*.

Alex began his botanical career at the Western Australian Herbarium as a Laboratory Assistant in 1959. He completed a B.A. at the University of Western Australia in 1963, and from 1964 until 1981 held the position of Botanist at the Western Australian Herbarium. In 1981 he came to Canberra as the first Executive Editor of the *Flora of Australia*. Upon his resignation in January 1993 he returned to Perth as a freelance consultant.

His research career spans many families, with nearly 100 papers published, in preparation or in press. He has made major contributions to, in particular, the taxonomy of the families Orchidaceae, Myrtaceae and Proteaceae. In the latter he is the undisputed world authority on *Banksia*, and a number of other genera.

The contribution that Alex has made to the *Flora* project is difficult to over-estimate. He nursed the program through its formative years, encouraging and cajoling contributors until providing a 'Flora treatment' became an accepted part of an Australian taxonomic botanist's life. Together with the Flora Editorial Committee he developed the formats, guidelines and codes of practice that laid the foundations for this significant *Flora*; he has overseen the extension of the series to embrace the mosses, lichens, algae and fungi; he has helped implement electronic publication methods and he has brought a great sense of history, appreciation of illustration and depth of knowledge and experience of the Australian flora to the series.

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Endpapers

Front: Contents of volumes in the *Flora of Australia*, the families arranged according to the system of A.Cronquist, *An Integrated System of Classification of Flowering Plants* (1981).

Back: *Flora of Australia*: Index to families of flowering plants.

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INTRODUCTION

The Australian political region includes a number of islands in the Indian Ocean, the Coral Sea, the Tasman Sea and the Southern Ocean. For practical reasons, a decision was taken early in planning the *Flora of Australia* to exclude these islands from the main work and cover them in a single volume. Such a work would be used more easily than a treatment spread through 48 volumes. In 1982 an opportunity arose that encouraged ABRS to begin preparation of an island volume. Peter Green (Royal Botanic Gardens, Kew), who for many years had researched the flora of Lord Howe and Norfolk Islands, retired and offered to write up this work for the *Flora*. At that time, coincidentally, a checklist of the vascular plants of Christmas Island (Indian Ocean), was at a late stage of preparation, also at Kew, by Leonard Forman, in association with a resident on the island, David Powell. Contributors were arranged for the other islands, support for flora text preparation being provided through the ABRS grants program. The breakdown between contributors was primarily geographic, i.e. the contributor with responsibility for an island prepared all or most taxa present there, as well as the family description when the greatest representation of the family was on that island; other contributors prepared taxa for that family that occurred on 'their' islands. In addition to Peter Green's work on Lord Howe and Norfolk Islands, David Du Puy (supervised by Leonard Forman) undertook many of the Christmas Island families, the others being written by Robyn Barker; Ian Telford prepared Cocos (Keeling) Islands, Ashmore Reef, Cartier Island and the Coral Sea Islands; Tony Orchard prepared the dicotyledons for the subantarctic islands. Specialist contributions came from Elizabeth Edgar (subantarctic monocotyledons), David Jones (Orchidaceae *p.p.*), Peter Green (Oleaceae, Plantaginaceae) and Benjamin Stone (Pandanaceae). Roger Hnatiuk and Kevin Kenneally prepared the introductions to the subantarctic islands and Ashmore Reef/Cartier Island, respectively.

As research progressed, it became evident that the number of species on the islands would be too great for a single volume, and it was decided to place Lord Howe and Norfolk Islands in one volume (Volume 49) and the remainder in Volume 50. Although Volume 50 is the first of the pair to be published, Volume 49 has been written and will follow shortly.

A further decision taken early in planning was to combine the taxonomic treatments into a single text, rather than treat each island or island group separately. The arrangement is as follows. For each island or island group there is an introduction covering such aspects as geographical location (including a map), physical features, climate, vegetation and floristics. There is then a key to the families of plants recorded for that island. The descriptive text follows, arranged in the Cronquist System (see endpapers), with keys to genera and species in the usual way. The reason for this arrangement is economic, we wished to avoid duplication of text where a taxon occurs on more than one island and hence reduce printing costs. It is hoped that users will find the combined treatment of interest when comparing the floras of our islands. All keys are designed to assist determination of plants occurring on the islands and therefore often use characters (especially vegetative) that may not work with species from other regions.

Scope and presentation of the *Flora*

This volume covers Christmas Island (Indian Ocean), Cocos (Keeling) Islands, Ashmore Reef, Cartier Island, the Coral Sea Islands Territory, Macquarie Island and Heard Island. The introductory chapters include a checklist for each one, with overall figures for the size of the flora and endemism.

The flora treated in this volume covers the vascular plants – whisk ferns, clubmosses, ferns, cycads and flowering plants. Descriptions and discussion are concise and are supplemented by important references, synonymy relevant to the islands, information on type collections, published illustrations, and notes on distribution, habitat and uses.

Descriptions of families and genera cover the taxa as a whole rather than only those species present on the islands, since in many cases only one or a few taxa are represented. Descriptions of species are based on material from the islands except where that available was inadequate, in which case other material or published work has been used. Misapplied names are given in square brackets together with an example of the misapplication.

Attribution of contributors is given under the family heading, the principal one first, then the other(s), with their geographical responsibility denoted by the island abbreviations.

Acknowledgments

Volume 50 has been prepared by 11 contributors, 3 illustrators and 11 photographers. The editorial team acknowledges with pleasure their co-operation and commitment over a number of years to bring the work to fruition. The cover painting was prepared by Diana Boyer from fresh material collected by Paul Stevenson. The maps were drawn by Tracey Rand.

The directors and staff of Australian and overseas institutions have assisted preparation of the volume with loans of specimens and by making facilities available to contributors. A particular acknowledgment is due to the Royal Botanic Gardens, Kew, for providing space and facilities for Robyn Barker and David Du Puy.

Recent research on the flora of Christmas Island has relied greatly on extensive collections made by David A. Powell, with the assistance of H'ng Kim Chey, between 1968 and 1984. A list of taxa prepared from this material by Leonard Forman, Royal Botanic Gardens, Kew, formed an invaluable basis for preparing this volume. An expedition to the island by David Du Puy was supported by the Royal Botanic Gardens, Kew, the World Wildlife Fund (U.K.) and the Flora and Fauna Preservation Society. Assistance on the island, during a two-month stay, was provided by staff of the Australian National Parks and Wildlife Service.

Peter Green, Royal Botanic Gardens, Kew, kindly assisted the preparation of some families of monocotyledons and ferns. Charles Jarvis, Natural History Museum, London, gave expert advice on the typification of Linnaean names.

Dr E.J.Godley, formerly Director, Botany Division, New Zealand Department of Scientific and Industrial Research, greatly assisted Elizabeth Edgar with many discussions on the taxonomy and distribution of subantarctic monocotyledons. Rod D.Seppelt, Antarctic Division, Kingston, Tasmania, provided invaluable data on the growth habit and habitats of Macquarie Is. monocotyledons, recorded while making excellent collections there.

The co-operation of the referees is greatly appreciated.

The Volume has been seen through to publication by Alex George, until recently Executive Editor of the *Flora*. A very significant amount of editorial work was undertaken by Helen Hewson and Helen Thompson with assistance by Katy Mallett and Jane Mowatt. Arthur Chapman, formerly of the Flora staff, checked the bibliographic data. Barbara Barnsley undertook the initial compilation of figures and captions, this was completed by Tracey Rand. Over several years, keyboard support was provided by Felicia Barnes, Leanne Bayliss, Ai Ha Diep, Dawn Donald, Tanya Fiori, Savita Meek, Vicki Ochiltree, Sharon Rees and Norma Sturgeon. During the planning and preparation stages for Volume 50, the Flora program has been successively managed by Alison McCusker, Roger Hnatiuk, Alex George and Helen Hewson.

The co-operation of AGPS Press, Canberra, and State Print, Adelaide, is gratefully acknowledged.

KEY TO PLANT GROUPS

The following key is to assist the reader in deciding which key to families is appropriate for the specimen being determined.

1	Plants without flowers, reproducing by spores borne in sporangia, or by seeds in 'cones' with the ovules exposed at the time of pollination	
2	Plants producing spores in sporangia	**Pteridophyta and Allies**
2:	Plants producing seeds	**+Pinophyta = Gymnospermae**
1:	Plants with flowers, reproducing by seeds with the ovules enclosed within an ovary	**Magnoliophyta = Angiospermae**
3	Embryo with 2 cotyledons; leaves usually not sheathing at base, the venation usually reticulate; perianth typically 4- or 5-merous	**Dicotyledonae = Magnoliopsida**
3:	Embryo with 1 cotyledon; leaves often sheathing at base, the venation usually parallel or convergent; perianth typically 3-merous	**Monocotyledonae = Liliopsida**

+The only cycad treated in the volume, *Cycas rumphii* Miq. from Christmas Is., is not keyed out further. It is described on p. 530.

INDEX TO FAMILY KEYS

Figure 1. Christmas Island: south coast, view across Smithson Bight towards South Point.
Photograph — P.Goh.

Figure 2. Christmas Island: rainforest, with the buttressed base of *Syzygium nervosum*.
Photograph — J.Hicks.

Figure 3. Cocos (Keeling) Island: west coast of West Island. Cocos with scattered shrubs of *Scaevola taccada* and a ground cover of grasses and herbs. Fringing reef in the left distance.
Photograph — A.George.

Figure 4. Ashmore Reef: West Island. *Digitaria mariannensis* (foreground), with *Argusia argentea* beyond.
Photograph — K.Kenneally.

Figure 5. Cartier Island. Bare sandflats around the lagoon.
Photograph — K.Kenneally.

Figure 6. Coral Sea Islands: west side of South West Cay of Diamond Cays. *Argusia argentea* shrubland on foredune in foreground.
Photograph — J.Hicks.

Figure 7. Macquarie Island: Finch Creek, Sandy Bay, with a penguin rookery on the distant lower slope.
Photograph — D.Calder.

Figure 8. Heard Island: view across Atlas Cove to Mount Drygalski, with *Azorella selago* and *Poa* in foreground.
Photograph — J.Hughes.

Figure 9. *Peperomia laevifolia*
Photograph — D.Du Puy.

Figure 10. *Ranunculus crassipes*
Photograph — R.Seppelt.

Figure 11. *Suriana maritima*
Photograph — I.Telford.

Figure 12. *Ficus microcarpa* var. *microcarpa* f. *microcarpa*
Photograph — A.George.

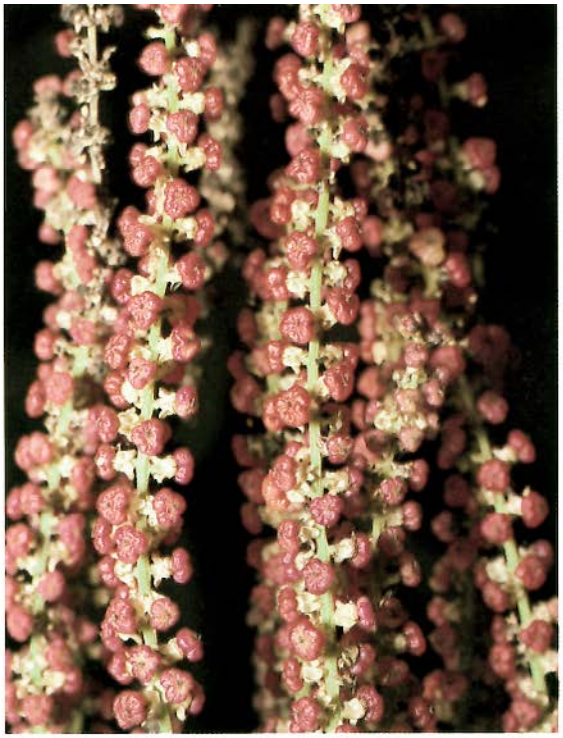


Figure 13. *Deeringia amaranthoides*
Photograph — D.Du Puy.

Figure 14. *Grewia glabra*
Photograph — P.Goh.

Figure 15. *Triumfetta repens*
Photograph — I.Telford.

Figure 16. *Pisonia grandis*
Photograph — I.Telford.

Figure 17. *Cleome rutidosperma*
Photograph — D.Du Puy.

Figure 18. *Stilbocarpa polaris*
Photograph — D.Calder.

Figure 19. *Abutilon listeri*
Photograph — D.Du Puy.

Figure 20. *Planchonella nitida*
Photograph — D.Du Puy.

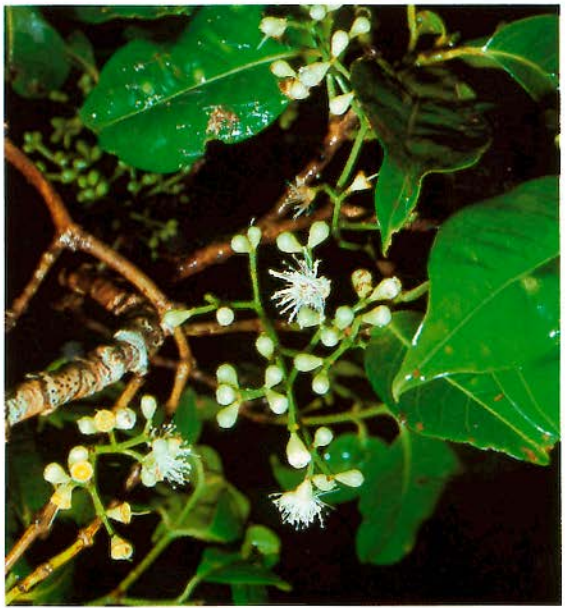


Figure 21. *Mimosa invisa*
Photograph — A.George.

Figure 22. *Syzygium nervosum*
Photograph — D.Du Puy.

Figure 23. *Combretum acuminatum*
Photograph — D.Du Puy.

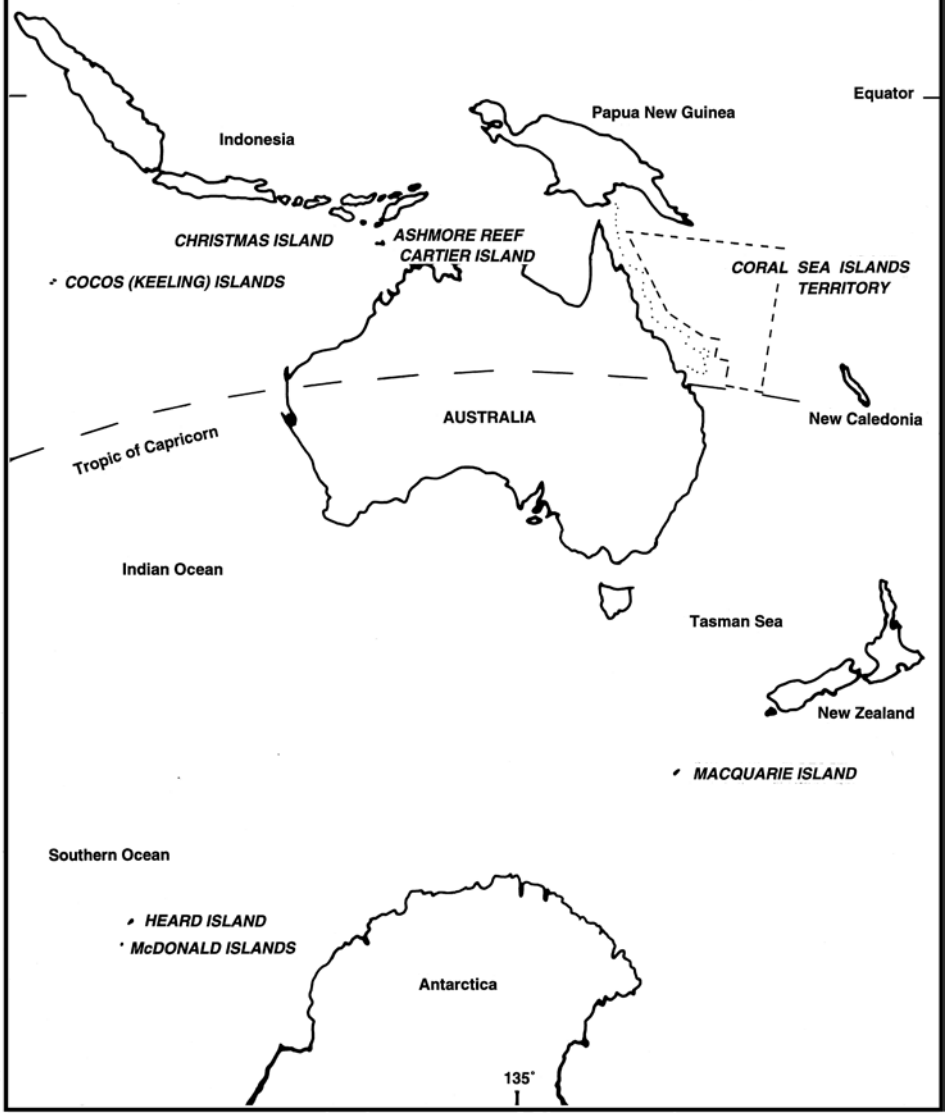
Figure 24. *Strongylodon lucidus*
Photograph — D.Du Puy.

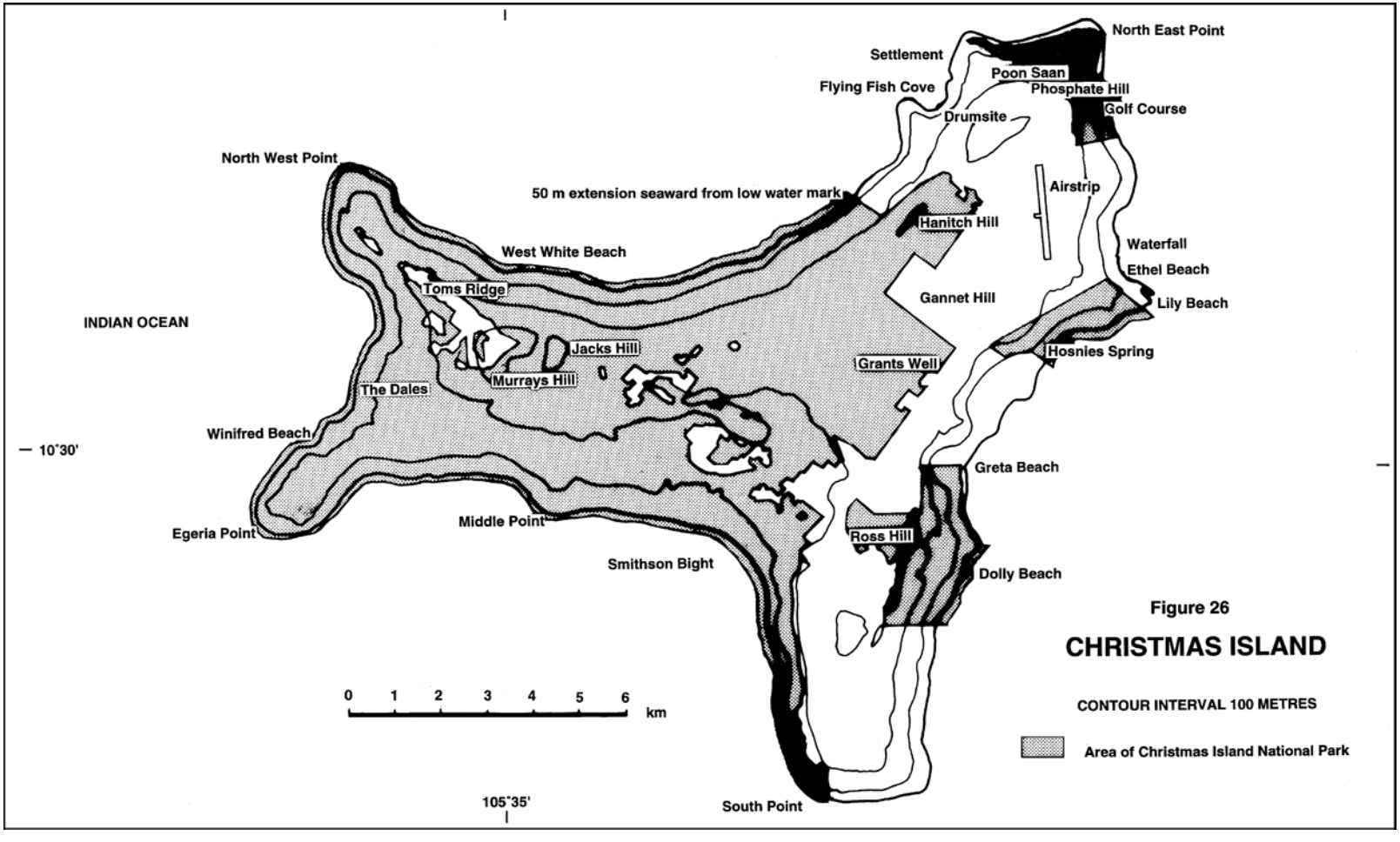
Figure 25

AUSTRALIA'S EXTERNAL TERRITORIES

(Excluding Norfolk and Lord Howe Islands)

AND SURROUNDING LAND MASSES




North East Point
Settlement
Poon Saan
Flying Fish Cove
Phosphate Hill
Golf Course
Drumsite
North West Point
Airstrip
50 m extension seaward from low water mark
Hanitch Hill
West White Beach
Waterfall
Ethel Beach
Toms Ridge
Gannet Hill
Lily Beach
INDIAN OCEAN
Jacks Hill
Hosnies Spring
Grants Well
Murrays Hill
The Dales
Winifred Beach
10°30'
Greta Beach
Egeria Point
Middle Point
Ross Hill
Smithson Bight
Dolly Beach
0 1 2 3 4 5 6 km
105°35'
South Point
Figure 26
CHRISTMAS ISLAND
CONTOUR INTERVAL 100 METRES
Area of Christmas Island National Park

CHRISTMAS ISLAND

D.J.Du Puy

GEOGRAPHY, TOPOGRAPHY AND GEOLOGY

Christmas Is. is a small, tropical island (137 sq km) situated in 10°25'–10°34'S and 105°32'–105°43'E, about 360 km south of Djakarta and the western tip of Java. It is the peak of a vast mountain of volcanic origin, rising steeply some 5000 m from the ocean floor and the Java trench. The highest point on the island, Murray Hill, is 361 m above sea level. The island has been raised above sea level in several stages, with the ocean cutting new cliffs at each stage, resulting in a stepped topography of terraces and inland cliffs rising to a central plateau at about 250–300 m. The lowest, most recent terrace was probably formed c. 120 000 years ago (Woodroffe, 1988). Much of the coast consists of undercut cliffs. Coral formed over the igneous core at each stage in the island's development, providing the thick, almost continuous crust of coralline limestone which now covers the island. This porous rock allows any rainwater to drain quickly away, and only in a few places where the impervious basalt breaks through is there any surface water. Large colonies of ocean-going seabirds have been at least partially responsible for the blanket of phosphate-rich soil that covers most of the limestone on the plateau and terraces. Over the last century this has been extensively mined, causing large-scale clearance of the native forest.

CLIMATE

Christmas Is. has a tropical climate and for much of the year enjoys warm and sunny weather (Gray, 1988). Temperatures remain steady at about 23–29°C and relative humidity is constantly around 80–90%. The average rainfall is about 2000–2500 mm annually, with a somewhat seasonal distribution, falling mainly during the wet season, December to April. High rainfall coincides with the monsoon wind from the northwest, which can bring stormy weather and large ocean swells batter the otherwise peaceful northern coastline, showering the shore terrace and even the upper terraces with salty spray, scorching the vegetation. In general, however, the wind is a light to moderate south-easterly, associated with blue skies and low rainfall, and from May to November there is a pronounced dry season. Those forest trees which are deciduous lose their leaves during this period, and the forest has a rather thirsty and dusty appearance, the epiphytes flagging through desiccation.

POPULATION AND INDUSTRY

Christmas Island has no indigenous population. Colonisation by European settlers started in 1888, as a response to the discovery of exploitable phosphate deposits, and the subsequent population increase was linked to mining of this resource. The dried soil was exported for use in the manufacture of fertilisers and detergents. The population (1988) of c. 1,500 inhabitants, predominantly Malay-Chinese mine workers, live in the small community around Flying Fish Cove, in the north-east of the island. This community is split into several separate areas, including Settlement around the bay and on the coastal terrace, linked by a steep road to Poon Saan higher up, and Drumsite at the head of the mining railway on the plateau. The population is falling as the mining operation becomes less viable.

VEGETATION

The natural vegetation of Christmas Island is a mainly evergreen forest, with a dense canopy with epiphytes, emergent trees, a few undercanopy species and a sparse forest floor vegetation of shrubs, herbs and ferns. During the dry season those forest trees which are deciduous lose their leaves and the forest appears rather parched, the epiphytes flagging through desiccation. The forest is tallest over areas with deep soil, becoming shorter but more diverse in composition in areas where the limestone is nearer to the surface.

The vegetation on Christmas Is. has predominantly Indo-Malesian affinities, with many species having distributions extending from SE Asia through Malesia to Australia (north-eastern Queensland), New Guinea, and into the Pacific islands. Christmas Is. is a high oceanic island and, unlike low atolls, supports a rich, dense forest. Many of the species occur elsewhere in more open vegetation types associated with coastal habitats, but on Christmas Is. they form a dense, closed forest community up to several kilometres from the coast and over 300 m above sea level. Many of the forest species appear to reach a larger size than they do elsewhere, perhaps through the absence of other inland species with which they would usually be in competition. All species on the island, except epiphytes, are tolerant of limestone and alkaline soils.

Three main categories of forest vegetation can be distinguished on Christmas Is.: primary ('plateau') rainforest, marginal ('terrace') rainforest and scrub forest. Some restricted habitats support unusual vegetation, such as in areas with surface water, on the inland cliffs, around the coastal fringe and on the sea cliffs.

PRIMARY RAINFOREST

The forest cover on the plateau and on the upper terraces where there is deeper soil is a tropical rainforest 30–40 m tall, with emergent trees reaching 50 m. The mainly evergreen canopy forms a dense cover, rich in epiphytic ferns, orchids, *Hoya aldrichii* and other climbers, stopping most of the sunlight from reaching the forest floor. It also maintains a humid atmosphere, even during the dry season, and prevents almost all air movement. Four of the most common trees in the forest, *Planchonella nitida*, *Syzygium nervosum*, *Tristiropsis acutangula* and *Inocarpus fagifer* (Tahitian Chestnut) have tall, stately boles with broad buttresses and often contorted, snaking roots. The boles rise straight and unbranched for many metres. *Hernandia ovigera* has a tall, rather swollen, water-retaining trunk. The undercanopy contains two common, endemic species: the Christmas Island palm (*Arenga listeri*) and a tall, tree-like pandanus (*Pandanus elatus*). Good examples of this type of forest occur around Murray Hill and Jacks Hill, and in the area bounded by Hanitch Hill, the Aerodrome, Stronach Knoll and the Central Area Workshop.

The composition of this forest changes somewhat over areas of thin soil or rocks, in that the frequency of *Hernandia ovigera* decreases, and that of *Tristiropsis acutangula* increases. Other species appear, such as the stinging tree *Dendrocnide sinuata* and an unusual, fleshy herb, *Procris pedunculata*. The rocks and forest floor generally are often bare of herb or shrub vegetation, due to the voracious appetites of the numerous red land crabs.

Some herbs, although previously recorded by C.W.Andrews in 1900 or H.N.Ridley in 1906, appear to be now absent. Such plant species include *Didymoplexis pallens*, *Remusatia vivipara* and the two endemic species *Peperomia rossii* and the orchid *Zeuxine exilis*.

The major constituents of the forest are as follows:

(Taxon marked § do not occur in other formations, and indicate primary rainforest.)

FREQUENT	OCCASIONAL
EMERGENTS	
§*Hernandia ovigera*	
Planchonella nitida	
Syzygium nervosum	
CANOPY	
§*Hernandia ovigera*	*Barringtonia racemosa*
Inocarpus fagifer	*Celtis timorensis*
Planchonella nitida	*Cryptocarya nitens*
Syzygium nervosum	*Dysoxylum gaudichaudianum*
	Ehretia javanica
	Ochrosia ackeringae
	Tristiropsis acutangula
UNDERCANOPY	
Arenga listeri	*Leea angulata*
Barringtonia racemosa	
Pandanus elatus	
Pisonia umbellifera	
SHRUBS	
Maclura cochinchinensis var. *cochinchinensis*	*Aidia* aff. *racemosa*
Pandanus elatus	*Amaracarpus pubescens*
	§*Ardisia colorata*
	Callicarpa longifolia
	Carmona retusa
	Claoxylon indicum
	Dendrocnide sinuata
	Leea angulata
	Ochrosia ackeringae
HERBS and FERNS	
Bolbitis heteroclita	*Amphineuron opulentum*
Corymborkis veratrifolia var. *veratrifolia*	*Balanophora abbreviata*
Nephrolepis biserrata	*Blumea lanceolaria*
	§*Leptochilus decurrens*
	Microlepia speluncae
	Procris pedunculata
	Pteris tripartita
	§*Pteridrys syrmatica*
	§*Tectaria devexa var. minor*
	§*Tectaria dissecta*
CLIMBERS	
Maclura cochinchinensis var. *cochinchinensis*	§*Arthropteris palisotii*
Schefflera elliptica	*Cayratia japonica*
	Combretum acuminatum
	Pachygone ovata

EPIPHYTES

Asplenium nidus
Hoya aldrichii
Microsorum punctatum
Pyrrosia lanceolata
Schefflera elliptica
Vittaria elongata
Asplenium polyodon
Brachypeza archytas
Davallia solida
Dendrobium crumenatum
§*Eria retusa*
Flickingeria nativitatis
Huperzia phlegmaria
Ophioglossum pendulum
§*Peperomia laevifolia*
§*Phreatia listeri*
Taeniophyllum hasseltii
§*Thelasis capitata*
§*Thrixspermum carinatifolium*

MARGINAL RAINFOREST

Lower, more open forest with a canopy layer at 20–30 m occurs on the thinner soils, mainly on the lower terraces. It has a higher species diversity than the primary rainforest. It is also more diverse in its habitats, ranging from the primary rainforest margin to the low, scrubby, open forest margin. The marginal forest floor on the shore terrace is sometimes almost devoid of a herb and shrub layer. This category of forest covers much of the National Park, including North West Point, Egeria Point, the Dales and below Aldrich Hill. Various rich examples also occur along the western shore terraces at South Point, along the eastern coastal terraces between Waterfall and South Point, and behind the golf course.

Certain species become more common in the lower forest on the drier and thinner soils of the terraces. *Pisonia grandis*, *Gyrocarpus americanus* and *Erythrina variegata* all have thick, swollen trunks for water storage. Some, such as *Gyrocarpus*, *Erythrina*, *Terminalia catappa* and *Celtis timorensis*, are also deciduous, helping them to survive the drier season in substrates that do not retain much water.

The forest trees are usually a diverse mixture in the marginal forest, not all species being represented in any single area. In some areas certain species can become dominant, especially on the lower terraces. Occasionally, almost pure stands of some species occur. Such species include *Arenga listeri* on basaltic soils (especially on valley slopes behind Greta Beach), and *Hibiscus tiliaceus* (especially on the east coast), *Pisonia grandis*, and *Barringtonia racemosa* on the shore terrace. Areas with surface water are also dominated by one or a few species.

This type of forest, just behind the inland cliffs and on associated limestone boulder and pinnacle slopes, is the habitat of *Cycas rumphii*, which grows up to 10 m tall. This unusual and ancient relative of the flowering plants is uncommon on Christmas Is. Most specimens occur as individuals scattered along the uppermost inland cliffs, but at one site, on North West Point, several magnificent specimens occur together with some juveniles.

The major constituents of the marginal rainforest are as follows:

FREQUENT

OCCASIONAL

CANOPY

Arenga listeri
Barringtonia racemosa
Berrya cordifolia
Celtis timorensis
Dysoxylum gaudichaudianum
Bruguiera gymnorhiza
Bruguiera sexangula
Calophyllum inophyllum
Carmona retusa
Cynometra ramiflora

Ficus microcarpa f. *microcarpa*
Guettarda speciosa
Gyrocarpus americanus
Inocarpus fagifer
Kleinhovia hospita
Macaranga tanarius
Melia azedarach
Ochrosia ackeringae
Planchonella nitida
Pongamia pinnata
Syzygium nervosum
Terminalia catappa
Tristiropsis acutangula
Erythrina variegata
Ficus saxophila
Grewia insularis
Heritiera littoralis
Hibiscus tiliaceus subsp. *tiliaceus*
Mammea odorata
Morinda citrifolia
Pisonia grandis
Pisonia umbellifera
Premna lucidula

UNDERCANOPY AND SHRUBS

Aidia aff. *racemosa*
Arenga listeri
Carmona retusa
Guettarda speciosa
Leea angulata
Maclura cochinchinensis var. *cochinchinensis*
Ochrosia ackeringae
Pandanus elatus
Pandanus christmatensis
Abutilon listeri
Acronychia trifoliolata var. *trifoliolata*
Allophylus cobbe
Callicarpa longifolia
Claoxylon indicum
Colubrina pedunculata
Combretum acuminatum
Cycas rumphii
Dendrocnide peltata
Dendrocnide sinuata
Grewia glabra
Grewia insularis
Ligustrum glomeratum

HERBS and FERNS

Achyranthes aspera
Bolbitis heteroclita
Corymborkis veratrifolia var. *veratrifolia*
Deeringia amaranthoides
Nephrolepis biserrata
Oplismenus compositus
Stachytarpheta jamaicensis
Turnera ulmifolia
Asystasia alba
Anisomeles indica
Dicliptera maclearii
Laportea ruderalis
Leucas flaccida
Microlepia speluncae
Pneumatopteris truncata
Sida rhombifolia subsp. *rhombifolia*
Synedrella nodiflora
Urena lobata var. *sinuata*

CLIMBERS

Canavalia cathartica
Hoya aldrichii
Maclura cochinchinensis var. *cochinchinensis*
Schefflera elliptica
Bauhinia binata
Caesalpinia bonduc
Caesalpinia crista
Cayratia pedata
Celastrus paniculatus
Cissus repens

Croton caudatus
Dioscorea bulbifera var. *bulbifera*
Entada rheedii
Grewia acuminata
Illigera appendiculata subsp. *stenoptera*
Ipomoea mauritiana
Pachygone ovata
Quisqualis indica
Strongylodon lucidus
Tinospora baenzigeri
Tinospora crispa

EPIPHYTES

Asplenium nidus
Brachypeza archytas
Davallia solida
Hoya aldrichii
Microsorum punctatum
Pyrrosia lanceolata
Schefflera elliptica
Vittaria elongata
Asplenium polyodon
Dendrobium crumenatum
Huperzia phlegmaria
Ophioglossum pendulum

LITHOPHYTES

Asplenium nidus
Maclura cochinchinensis var. *cochinchinensis*
Microsorum punctatum
Procris pedunculata

AREAS WITH SURFACE WATER

A. HOSNIES SPRING AND THE EASTERN TERRACES

Hosnies Spring is a small area of shore terrace about 100 m long and 50 m wide, c. 1 km to the east of Gannet Hill, that maintains a moist condition throughout the year. The area is a basaltic outcrop at the foot of the first inland cliff, about 100 m inland and 24–37 m above sea level, and is fed by a fresh-water spring (Woodroffe, 1988). Two species of *Bruguiera*, *B. gymnorhiza* and less frequently *B. sexangula*, dominate this area. These species are normally confined to coastal mangrove swamps. At Hosnies Spring they reach 40 m or more tall, an exceptional height for both species. The uniqueness of this occurrence was first indicated by C.G.G.J. van Steenis (*Blumea* 29: 395–397, 1984), who noted that these mangrove species must have persisted since the area was still at sea level. The stand contains almost no other vascular plants but is surrounded by marginal forest about 30 m tall, and is bordered mainly by *Barringtonia racemosa*, *Hibiscus tiliaceus*, *Pandanus christmatensis* and *Ficus microcarpa* f. *microcarpa*, with a few specimens of *Calophyllum inophyllum*, *Dendrocnide peltata* and *Terminalia catappa*.

Contrary to the notes of van Steenis, other back-mangrove species are not associated with this community. However, stands of two back-mangrove species have been recorded on the eastern terraces further south. Scattered clumps and individuals of *Heritiera littoralis* occur mainly on the shore terrace and first inland terrace between Greta Beach and Dolly

Beach. *Cynometra ramiflora* occurs in a single stand extending between the plateau edge and upper terrace c. 0.5 km south of Ross Hill summit, at 220–300 m altitude. They occur only in areas of damper soil near basalt rock outcrops. This is a further example of coastal mangrove community species persisting in inland forest since the time when the locality was at sea level. Inland, uphill dispersal of the large fruits of these species is unlikely as there is no coastal mangrove community to supply seed, although the land crabs may be involved in localised dispersal.

B. THE DALES

The western terraces of Christmas Is. are the site of several relatively recently extruded tongues of volcanic basalt rock, forming several parallel ridges running towards the ocean. This rock is impervious, causing water which percolates down through the limestone to come to the surface and form small streams and swampy areas. The Dales, as this undulating area is called, contains most of the surface water on Christmas Is. The streams have created waterfalls and have worn gullies out to the coast, ending in craggy breaks in the sea cliffs. Dissolved limestone is deposited by the water, creating rippling limestone 'flowstone' formations and soon enveloping fallen branches in a deposit of soft rock. These damp areas are dominated by magnificent specimens of *Inocarpus fagifer* (Tahitian Chestnut) with tall, fluted boles and a network of snaking roots. The vegetation around these damp areas contains an unusually diverse collection of tree species and epiphytes.

OPEN FOREST, SCRUBBY FOREST AND VINE FOREST

In exposed situations on thin, rocky soils, especially on the lower terraces, a much lower and more scrubby forest has developed, with many spinescent and scrambling shrubs and vines. It has a low, open, mainly deciduous canopy (c. 5–15 m) and contains many species, including the endemic *Colubrina pedunculata*. Typical forest of this type occurs behind the cliffs overlooking the golf course and on the tip of North West Point.

Major components are as follows:

FREQUENT	OCCASIONAL
CANOPY AND SHRUBS	
Acronychia trifoliolata var. *trifoliolata*	*Abutilon listeri*
Allophylus cobbe	*Arenga listeri*
Carmona retusa	*Berrya cordifolia*
Celastrus paniculatus	*Dendrocnide peltata*
Celtis timorensis	*Erythrina variegata*
Colubrina pedunculata	*Ficus microcarpa* f. *microcarpa*
Grewia insularis	*Ficus saxophila*
Guettarda speciosa	*Grewia glabra*
Gyrocarpus americanus	*Kleinhovia hospita*
Macaranga tanarius	*Leea angulata*
Ochrosia ackeringae	*Pittosporum ferrugineum*
Pandanus christmatensis	*Premna odorata*
Pipturus argenteus var. *lanosus*	*Trema tomentosa*
Terminalia catappa	
EPIPHYTES	
Pyrrosia lanceolata	*Brachypeza archytas*
	Hoya aldrichii

CLIMBERS

Canavalia cathartica
Cissus repens
Croton caudatus
Maclura cochinchinensis var. *cochinchinensis*
Pachygone ovata
Schefflera elliptica
Caesalpinia bonduc
Deeringia amaranthoides
Galactia tenuiflora
Grewia acuminata
Ipomoea triloba

HERBS

Achyranthes aspera
Deeringia amaranthoides
Sida rhombifolia subsp. *rhombifolia*
Turnera ulmifolia

INLAND CLIFFS

The inland cliffs sometimes rise above the forest of the terrace below and support a sparse community:

FREQUENT	OCCASIONAL
SHRUBS	
Ficus microcarpa f. *microcarpa*	*Abutilon listeri*
Pandanus christmatensis	*Combretum acuminatum*
	Dendrocnide peltata
	Ficus saxophila
	Macaranga tanarius
	Muntingia calabura
CLIMBERS	
Schefflera elliptica	*Caesalpinia bonduc*
	Croton caudatus
	Galactia tenuiflora
	Maclura cochinchinensis var. *cochinchinensis*
HERBS and FERNS	
	Achyranthes aspera
	Asplenium listeri
	Commicarpus chinensis subsp. *chinensis*
	Crinum asiaticum
	Davallia denticulata
	Deeringia amaranthoides
	Laportea ruderalis
	Nephrolepis multiflora
	Turnera ulmifolia

COASTAL FRINGE

The forest descends almost to the edge of the spray zone, with a narrow fringe of dense and almost impenetrable shrubs including a second endemic pandanus, *Pandanus christmatensis*, and the Christmas Island Abutilon, *Abutilon listeri*.

Major components are as follows:

FREQUENT	OCCASIONAL
SHRUBS	
Abutilon listeri	*Hibiscus tiliaceus*
Argusia argentea	*Guettarda speciosa*
Cordia subcordata	*Premna odorata*
Pemphis acidula	*Terminalia catappa*
Pandanus christmatensis	
Scaevola taccada	
CLIMBERS	
	Cayratia trifolia
	Schefflera elliptica
HERBS & SCRAMBLERS	
	Achyranthes aspera
	Clerodendrum inerme
	Mariscus javanicus
	Deeringia amaranthoides
	Laportea ruderalis
	Melanthera biflora

SHORE CLIFFS AND SPRAY ZONE

The area immediately behind the sea cliffs is often inundated with salt spray. Consequently there is a band of weathered, exposed, limestone pinnacles with little soil, supporting a low, sparse vegetation. This community consists mainly of species adapted to this environment and confined to this zone, including the endemic grass *Ischaemum nativitatis*:

FREQUENT	OCCASIONAL
SHRUBS	
Pemphis acidula	
HERBS	
Sesuvium portulacastrum	*Bothriochloa bladhii*
Fimbristylis cymosa	*Digitaria setigera*
Portulaca pilosa	*Ischaemum nativitatis*
	Laportea ruderalis
	Lepturus repens
	Portulaca oleracea
	Portulaca tuberosa
	Sporobolus virginicus

MINED AREAS

Approximately one third of the rainforest on the plateau has been cleared for open-cast mining of phosphate-bearing soil, leaving scars of bare limestone pinnacles. Even areas mined near the beginning of the century have only a sparse revegetation dominated by a few tough ferns with some introduced weeds. Areas with some remaining soil cover soon become covered by two weedy *Mimosa* species.

Resources are now being directed towards repairing the landscape. If stockpiled overburden soil, which is scraped off to allow the richer layers below to be excavated, is replaced in rows over the pinnacles, the herbs which germinate naturally, and shrubs such as *Macaranga*, *Pipturus* and *Muntingia* (which can be planted as nursery-grown seedlings), may be used as ground cover to protect native tree seedlings. Species that may tolerate the choking *Mimosa* and the harsh conditions include *Syzygium nervosum*, *Inocarpus fagifer*, *Mammea odorata*, *Tristiropsis acutangula*, *Terminalia catappa*, *Melia azedarach*, *Dysoxylum gaudichaudianum*, *Calophyllum inophyllum*, *Pittosporum ferrugineum* and perhaps *Gyrocarpus americanus*, *Ochrosia ackeringae*, *Guettarda speciosa*, *Cordia subcordata* and *Ficus saxophila*.

The major components are as follows:

FREQUENT	OCCASIONAL
SHRUBS AND TREES	
Leucaena leucocephala	*Aleurites moluccana* var. *moluccana*
Macaranga tanarius	*Mammea odorata*
Muntingia calabura	*Melia azedarach*
Pipturus argenteus var. *lanosus*	*Pittosporum ferrugineum*
Psidium guajava	*Tecoma stans*
	Terminalia catappa
HERBS (excluding ferns)	
Ageratum conyzoides	*Axonopus compressus*
Aster subulatus	*Cardiospermum halicacabum*
Bidens pilosa var. *minor*	*Chloris barbata*
Conyza bonariensis	*Chrysopogon aciculatus*
Euphorbia hirta	*Crassocephalum crepidioides*
Euphorbia prostrata	*Crotalaria pallida* var. *obovata*
Mimosa pudica	*Desmodium triflorum*
Spermacoce assurgens	*Eragrostis pilosa*
Sporobolus fertilis	*Euphorbia cyathophora*
Stachytarpheta jamaicensis	*Fimbristylis cymosa*
Tridax procumbens	*Ipomoea nil*
Vernonia cinerea	*Oldenlandia corymbosa*
	Paspalum conjugatum
	Passiflora foetida
	Physalis minima
	Pilea peploides
	Rhynchelytrum repens
	Sida acuta
	Scoparia dulcis
	Sonchus oleraceus
	Turnera ulmifolia

Urena lobata var. *sinuata*

FERNS AND FERN ALLIES

Davallia denticulata
Nephrolepis multiflora
Microsorum scolopendria
Psilotum nudum
Microsorum punctatum
Ophioglossum reticulatum f. *reticulatum*
Pityrogramma calomelanos var. *calomelanos*
Pteris vittata
Pyrrosia lanceolata

WEEDS OF HABITATION AND ROADSIDES

Since the turn of the century there has been a large increase in the number of species recorded on Christmas Is. H.N.Ridley published a fairly complete record of the vegetation prior to the major disturbance caused by mining activity and the associated infrastructure (Ridley, 1906). Most species not recorded by Ridley are weeds, often with pantropical distributions. They are often unable to grow in the inhospitable mine habitats, preferring the deeper, disturbed soil of roadsides, railways and areas surrounding habitation.

Among the most common and outstanding of these weedy species are:

SHRUBS

Carica papaya
Leucaena leucocephala
Macaranga tanarius
Muntingia calabura
Pipturus argenteus var. *lanosus*
Ricinus communis

CLIMBERS

Antigonon leptopus
Cardiospermum halicacabum
Centrosema pubescens
Ipomoea nil
Passiflora foetida

GRASSES

Axonopus compressus
Brachiaria reptans
Cenchrus brownii
Chloris barbata
Cynodon dactylon
Dactyloctenium aegyptium
Digitaria radicosa
Eleusine indica
Rhynchelytrum repens

HERBS

Acalypha indica
Achyranthes aspera
Ageratum conyzoides
Alternanthera pungens
Amaranthus viridis
Aster subulatus
Bidens pilosa var. *minor*
Boerhavia diffusa
Celosia argentea
Cleome rutidosperma
Desmodium triflorum
Indigofera hirsuta
Eleutheranthera ruderalis
Euphorbia heterophylla
Euphorbia hirta
Euphorbia prostrata
Mimosa pudica
Mirabilis jalapa
Oldenlandia pumila
Oxalis corniculata subsp. *corniculata*
Pilea peploides
Portulaca oleracea
Ruellia prostrata
Sida acuta
Sida rhombifolia subsp. *rhombifolia*
Spermacoce assurgens

Stachytarpheta jamaicensis
Tithonia diversifolia
Tridax procumbens
Turnera ulmifolia
Urena lobata var. *sinuata*
Vernonia cinerea

EFFECT OF LAND CRABS ON THE VEGETATION

The native forest is unusual in its species composition and in its sparse forest floor vegetation. There are areas almost clear of herbs, shrubs and ferns. It appears that these characteristics are at least partly due to the effects of the endemic Christmas Island red land crabs (*Gecarcoidea natalis* (Pocock)), which abound throughout the forest and live in burrows just beneath the surface. They have an almost entirely vegetarian diet, comsuming fallen leaves, fruits and seedlings. They are important in localised seed dispersal on the island. Presumably, the plant species which exist on the island are those less palatable to the crabs. These successful species have the opportunity to flourish in an environment of greatly reduced competition from other plant species which would be present in similar communities elsewhere. This seems to allow some species, which may be rare or restricted to inhospitable environments in other regions, to become important elements in the Christmas Island flora, and results in a forest community which is unique to Christmas Island (see Du Puy & Du Puy, 1989). It may also explain how the mangrove species at Hosnies Spring have persisted even though the site is now raised well above the sea level and is fed by fresh water (see Woodroffe, 1988).

Blue crabs (*Cardisoma hirtipes* Dana), another of Christmas Island's land crabs and sky blue in colour, prefer moist conditions and excavate deep burrows in the mud. They fill a similar niche to the red crabs, but in areas with water on or near the surface. They commonly eat the outer coat of the fruits of *Inocarpus fagifer*.

DISPERSAL TO THE ISLAND

The native plants on the island all arrived as seeds or other propagules carried by sea, wind or birds. Those that survived the journey and found a site which offered conditions suitable for germination and growth, then faced several factors which determined the success of the species. The plant had to be tolerant of the limestone and phosphate-rich soil which is otherwise poor in nutrients, it had to be able to survive the several months of low rainfall, and it needed to be sufficiently unpalatable to the crabs to allow it to become established beyond the seedling stage. The clearance of forested areas for mining operations has, over the last century, opened up more of the land to colonisation by adventive species and has lessened the selective effect of the crabs, which they are unable to survive in these more exposed habitats. Many weedy species have become established during this period. Ship and aeroplane transport has allowed the inadvertent introduction of many species to the island in clothing and freight. Concurrently there has been a deliberate introduction of food plants, decorative garden plants, colonising species for the mined areas and turf or fodder grasses, some of which have become naturalised. Several of these have become troublesome weeds, such as *Mimosa invisa* and *M. pudica*, which were first recorded on the island during the 1960s and have already formed extensive, impenetrable tangles of thorny stems in most cleared areas.

ENDEMIC TAXA

Sixteen taxa are endemic on Christmas Is. They are listed below with a note of their habitat and frequency.

Abutilon listeri – shrub, occurring mainly on the coast and shore terraces (frequent).

Arenga listeri – tree palm scattered throughout the island, forming dense populations on basaltic outcrops with higher soil moisture (frequent).

Asplenium listeri – lithophytic fern only known from a single limestone outcrop on Gannet Hill (rare).

Asystasia alba – herb, preferring open sites in the terrace forest (occasional).

Brachypeza archytas – epiphytic orchid, especially on boles in the terrace forest (frequent).

Colubrina pedunculata – spiny shrub in stunted, scrubby vegetation and vine thicket on the terraces (occasional).

Dicliptera maclearii – herb in marginal forest on the lower terraces (rare).

Dendrocnide peltata var. *murrayana* - small tree, mainly in exposed situations around the tops of the inland cliffs (occasional).

Flickingeria nativitatis – epiphytic orchid in the canopy of tall rainforest on the plateau (occasional).

Hoya aldrichii – epiphytic vine, especially in the plateau canopy (abundant).

Ischaemum nativitatis – tufted grass among the limestone pinnacles immediately behind the sea cliffs (occasional).

Pandanus christmatensis – shrub, mainly fringing the tops of the shore and inland cliffs (abundant).

Pandanus elatus – shrub or small tree, in the understorey of taller forest (frequent).

Phreatia listeri – small epiphytic orchid in the canopy of the rainforest on the plateau (occasional).

Peperomia rossii – herb, apparently extinct.

Zeuxine exilis – terrestrial orchid, apparently extinct.

USE OF FOREST BY SEA BIRDS

The forest on Christmas Is. provides sheltered nesting sites for a rich variety of sea birds, including several which breed nowhere else. They utilise several habitats within the forest.

The tall rainforest on the plateau is the habitat chosen by the endemic Abbott's Booby (*Sula abbotti* Ridgway). It used to be more widespread but now nests only on Christmas Is. This is a large species, superbly adapted for long-distance flight, ranging many thousands of miles from the island during its lifetime. Although it has sharp claws, which help it to grip branches, it is rather awkward when landing and needs a large, clear space with plenty of room for a preliminary dive off in order to take off again. This is particularly important for the fledglings, which have only one attempt at their first flight; if they fall through the canopy they do not survive. Abbott's Booby therefore prefers to nest in one of the tall, emergent trees, preferably one with an open branching structure, allowing access to the larger branches. *Planchonella nitida* and *Syzygium nervosum*are the most frequent nesting trees. A third common emergent species, *Hernandia ovigera*, is never used, perhaps because of its rather brittle branchlets or its large, pendulous leaves. Other tall forest species which may be used include *Tristiropsis acutangula*, *Celtis timorensis*, *Pongamia pinnata* and *Ficus microcarpa* f. *microcarpa* (Strangling Fig) which can eventually become one of the largest trees. About 35% of the plateau forest has already been cleared, much of this in areas which previously held breeding birds.

Two species of Frigate Bird nest on Christmas Is. The largest population is of the Greater Frigate Bird (*Fregata minor minor* (Gmelin)), which can be seen nesting all around the island's terraces, and the Christmas Island Frigate Bird (*Fregata andrewsi* Mathews), a

second species endemic on the island. This latter has its main colony in a broad, east-facing amphitheatre immediately behind the golf course. As nesting and display sites both species choose the deciduous trees in the marginal forest, which mainly occurs on the terraces. *Gyrocarpus americanus* and, in preference, *Terminalia catappa*, are the species most frequently chosen, both of which are deciduous during the nesting season. They also have thick twigs with an open branching structure, allowing easy access to the nests. Other species commonly used are a third deciduous species *Celtis timorensis*, and two other large trees, *Berrya cordifolia* and *Pongamia pinnata*. The shore terraces are shared by large numbers of the Red-Footed Booby (*Sula sula rubripes* Gould), these two species often nesting side-by-side.

Other seabirds which use the forest are the Brown Booby (*Sula leucogaster plotus* (Forster)), which nests in large numbers on the ground among the limestone pinnacles just behind the edge of the first inland and sea cliffs, from which position they can launch themselves into flight. The nest is a few twigs and leaves scraped together, usually partially sheltered by some shrubs or *Pandanus christmatensis*, but often open to the sunlight. The Red-Tailed Tropicbird or Silver Bosun (*Phaethon rubricauda westralis* Mathews) and the Noddy Tern (*Anous stolidus pileatus* (Scopoli)) nest mainly on ledges in the cliffs, but also on the main clefts of trees, especially on the edge of the shore terrace. These three species are widespread in the tropics and subtropics of the Indian and Pacific oceans. The White-Tailed Tropicbird (*Phaethon lepturus* Daudin) also occurs in tropical oceans around the world. The population on Christmas Is. is unusual in its golden colouration and is recognised as a distinct subspecies (*Phaethon lepturus fulvus* Brandt), known as the Golden Bosun. It nests all over the island, in holes in trees or hollow limbs, or on cliffs. This species has also been affected by mining, as any clearance of forest reduces the availability of nesting sites.

ENDEMIC LAND BIRDS AND FRUIT BATS

The primary forest also supports a variety of land birds. These have been isolated from other populations for so long that almost all are recognised as endemic species and subspecies. Six species of land bird inhabit the forest. These include two predators, the Christmas Island Hawk Owl (*Ninox squamipila natalis* Lister) and the Christmas Island Goshawk (*Accipiter fasciatus natalis* Lister).

The two endemic pigeons on the island live on a diet of fruit of trees such as *Ficus microcarpa* f. *microcarpa*, *Celtis timorensis* and *Planchonella nitida*. The large, dark grey Christmas Island Imperial Pigeon (*Ducula whartoni* (Sharpe)) feeds mainly in the canopy, while the Christmas Island Emerald Dove (*Chalcophaps indica natalis* Lister) prefers to forage in the shadows of the forest floor. Both are important in seed dispersal around the island. Small flocks of the Christmas Island White-Eye (*Zosterops natalis* Lister) are common, especially in areas of low, more open forest on the terraces. Their diet is varied but includes fruit such as that of *Pipturus argenteus*, and they also feed on nectar and may help to pollinate some species. The Christmas Island Thrush (*Turdus poliocephalus erythropleurus* Sharpe) is commonly seen throughout the forest. Its diet also includes fruits and seeds.

An endemic Fruit Bat, *Pteropus melanotus* Blyth, also occurs in large numbers, and plays an important part in seed dispersal on the island. It may also serve in the pollination of some species.

NATIONAL PARK

Christmas Island National Park was established in February 1980. It now covers some 9140 hectares (91.4 sq km), or 64% of the island. The shore terrace contains some fine stretches of terrace forest, including pure stands of *Pisonia grandis* and *Barringtonia racemosa*, and is the habitat of the island's population of giant *Erythrina variegata* trees, along with some

magnificent specimens of *Gyrocarpus americanus*. Almost all of the surviving endemic species of plants have been recorded from the park.

The large central plateau area to the south and south-west of Hanitch Hill consists of a virtually unbroken stretch of primary rainforest. Its value lies not only in the unusual species composition of the forest, but also in its size and undisturbed nature. It forms a viable, self-sustaining example of this unique forest. The area towards the eastern edge of the plateau is particularly fine. It is adjacent to the eastern terraces and has added importance as a buffer zone for this area, preventing erosion damage.

The eastern terraces of the island, from Waterfall to South Point, contain some of the most interesting plant communities on the island, including the unique freshwater mangrove stand at Hosnies Spring and the associated occurrences of mangrove-type species described above. They also contain the only known site of the endemic fern *Asplenium listeri*, on Gannet Hill.

A further important region is that of the terraces along the north coast, an area of almost impassable terrain, which has been practically free from disturbance.

The recent curtailment of forest clearance for phosphate mining activities, and the future reliance of the island on a wildlife-based tourist industry, give new opportunities for protecting the natural resources of the island upon which a lucrative tourist industry could be based.

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CHRISTMAS ISLAND SPECIES LIST

The flora of Christmas Island is made up as follows:

Dicotyledons: 69 families (13 naturalised only), 214 genera (91 naturalised only) and 314 species (140 naturalised, 8 endemic)

Monocotyledons: 10 families (2 naturalised only), 53 genera (26 naturalised only) and 66 species (33 naturalised, 7 endemic)

Cycad: 1 species

Ferns and Fern Allies: 15 families, 21 genera (2 naturalised only) and 30 species (1 endemic, 1 naturalised).

(A = taxon recorded by C.W.Andrews, *Monogr. Christmas Is.* (1900); R = taxon recorded by H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 138–271 (1906); e = endemic taxon; * = naturalised taxon).

MAGNOLIOPHYTA (flowering plants)

DICOTYLEDONAE

ACANTHACEAE
- * *Andrographis paniculata* (Burm.f.) Wall. ex Nees
- A R e *Asystasia alba* Ridl.
- * *Asystasia* cf. *chelonoides* Nees
- * *Asystasia gangetica* (L.) T.Anderson
- * *Asystasia* sp.
- * *Barleria cristata* L.
- * *Barleria lupulina* Lindl.
- A R e *Dicliptera maclearii* Hemsl.
- * *Justicia gendarussa* Burm.f.
- * *Peristrophe bivalvis* (L.) Merr.
- A R *Ruellia prostrata* Poir.

AIZOACEAE
- R *Sesuvium portulacastrum* (L.) L.

AMARANTHACEAE
- A R *Achyranthes aspera* L.
- * *Alternanthera bettzichiana* (Regel) Voss
- * *Alternanthera pungens* Kunth
- * *Alternanthera sessilis* (L.) DC.
- R * *Amaranthus cruentus* L.
- * *Amaranthus dubius* Mart. ex Thell.
- * *Amaranthus spinosus* L.
- * *Amaranthus tricolor* L.
- R *Amaranthus viridis* L.
- A R * *Celosia argentea* L.
- A R *Deeringia amaranthoides* (Lam.) Merr.
- * *Gomphrena celosioides* Mart.

ANACARDIACEAE
- * *Mangifera odorata* Griff.
- R *Spondias cytherea* Sonn.

ANNONACEAE
- * *Annona muricata* L.
- * *Annona reticulata* L.

APOCYNACEAE
- * *Catharanthus roseus* (L.) G.Don
- A R *Cerbera manghas* L.
- A R *Ochrosia ackeringae* (Teijsm. & Binn.) Miq.
- * *Vallaris glabra* (L.) Kuntze

ARALIACEAE
- * *Polyscias fruticosa* (L.) Harms

* *Schefflera actinophylla* (Endl.) Harms
A R *Schefflera elliptica* (Blume) Harms
ARISTOLOCHIACEAE
* *Aristolochia littoralis* Parodi
ASCLEPIADACEAE
A R e *Hoya aldrichii* Hemsl.
ASTERACEAE
A R * *Ageratum conyzoides* L.
* *Artemisia vulgaris* L.
* *Aster subulatus* Michx.
* *Bidens pilosa* var. *minor* (Blume) Sherff
Blumea balsamifera (L.) DC.
A R *Blumea lanceolaria* (Roxb.) Druce
* *Conyza bonariensis* (L.) Cronquist
* *Crassocephalum crepidioides* (Benth.) S.Moore
* *Eclipta prostrata* (L.) L.
* *Eleutheranthera ruderalis* (Sw.) Sch.Bip.
A R *Melanthera biflora* (L.) Wild
* *Mikania micrantha* Kunth
* *Pluchea indica* (L.) Less.
* *Sonchus oleraceus* L.
A R * *Synedrella nodiflora* (L.) Gaertn.
* *Tithonia diversifolia* (Hemsl.) A.Gray
* *Tridax procumbens* L.
* *Vernonia cinerea* (L.) Less.
* *Wedelia trilobata* (L.) Hitchc.
BALANOPHORACEAE
R *Balanophora abbreviata* Blume
BASELLACEAE
* *Basella alba* L.
BIGNONIACEAE
* *Tecoma stans* (L.) Juss. ex Kunth
BIXACEAE
* *Bixa orellana* L.
BORAGINACEAE
A R *Argusia argentea* (L.f.) Heine
Carmona retusa (Vahl) Masam.
* *Cordia curassavica* (Jacq.) Roem. & Schult.
A R *Cordia subcordata* Lam.
Ehretia javanica Blume
* *Heliotropium indicum* L.
BRASSICACEAE
* *Cardamine hirsuta* L.
CAESALPINIACEAE
Bauhinia binata Blanco
* *Bauhinia monandra* Kurz
A R *Caesalpinia bonduc* (L.) Roxb.
Caesalpinia crista L.
* *Caesalpinia pulcherrima* (L.) Sw.
Cynometra ramiflora L.
* *Delonix regia* (Bojer ex Hook.) Raf.
* *Senna occidentalis* (L.) Link
* *Senna sulphurea* (Collad.) Irwin & Barneby
Tamarindus indica L.
CAPPARACEAE
A R *Cleome gynandra* L.
* *Cleome rutidosperma* DC.
R *Cleome viscosa* L.
CARICACEAE
* *Carica papaya* L.
CELASTRACEAE
A R *Celastrus paniculatus* Willd.
CLUSIACEAE
A R *Calophyllum inophyllum* L.
A R *Mammea odorata* (Raf.) Kosterm.
COMBRETACEAE
A R *Combretum acuminatum* Roxb.
A R *Quisqualis indica* L.
A R *Terminalia catappa* L.
CONVOLVULACEAE
* *Ipomoea aquatica* Forssk.
* *Ipomoea batatas* (L.) Lam.
* *Ipomoea cairica* (L.) Sweet
* *Ipomoea hederifolia* L.
A R *Ipomoea macrantha* Roem. & Schult.
A R *Ipomoea mauritiana* Jacq.
* *Ipomoea nil* (L.) Roth
Ipomoea obscura (L.) Ker Gawl.
A R *Ipomoea pes-caprae* subsp. *brasiliensis* (L.) Ooststr.
* *Ipomoea quamoclit* L.
* *Ipomoea triloba* L.
A R *Jacquemontia paniculata* (Burm.f.) Hallier f.
R *Merremia hederacea* (Burm.f.) Hallier f.
A R *Merremia peltata* (L.) Merr.
* *Porana volubilis* Burm.f.
R *Stictocardia tiliifolia* (Desr.) Hallier f.
Xenostegia tridentata (L.) Austin & Staples
CUCURBITACEAE
* *Lagenaria siceraria* (Molina) Standl.
A R *Momordica charantia* L.
Muellerargia timorensis Cogn.
A R e *Zehneria alba* Ridl.
EUPHORBIACEAE
* *Acalypha indica* L.
A R * *Acalypha lanceolata* Willd.
A R *Alchornea rugosa* (Lour.) Müll.Arg.
* *Aleurites moluccana* (L.) Willd. var. *moluccana*
A R *Claoxylon indicum* (Reinw. ex Blume) Hassk.
A R *Croton caudatus* Geiseler

A R *Euphorbia atoto* G.Forst.
* *Euphorbia cyathophora* Murray
* *Euphorbia heterophylla* L.
A R * *Euphorbia hirta* L.
R * *Euphorbia prostrata* Aiton
Euphorbia rubicunda Steud.
* *Euphorbia thymifolia* L.
A R *Macaranga tanarius* (L.) Müll.Arg.
* *Manihot esculenta* Crantz
* *Manihot glaziovii* Müll.Arg.
* *Phyllanthus acidus* (L.) Skeels
A R * *Phyllanthus amarus* Schumach. & Thonn.
* *Ricinus communis* L.
* *Sauropus androgynus* (L.) Merr.
FABACEAE
* *Alysicarpus vaginalis* (L.) DC.
* *Calopogonium caeruleum* (Benth.) Sauvalle
* *Calopogonium mucunoides* Desv.
A R *Canavalia cathartica* Thouars
* *Centrosema pubescens* Benth.
* *Clitoria ternatea* L.
Crotalaria pallida var. *obovata* G.Don
Derris elliptica (Wall.) Benth.
* *Desmodium triflorum* (L.) DC.
A R *Erythrina variegata* L.
A R *Galactia tenuiflora* (Willd.) Wight & Arn.
Indigofera hirsuta L.
A R *Inocarpus fagifer* (Parkinson) Fosberg
A * *Lablab purpureus* (L.) Sweet
* *Macroptilium atropurpureum* (DC.) Urb.
* *Mucuna albertisii* F.Muell.
Mucuna pruriens (L.) DC.
* *Pachyrhizus erosus* (L.) Urb.
* *Phaseolus lunatus* L.
A R *Pongamia pinnata* (L.) Pierre
* *Psophocarpus tetragonolobus* (L.) DC.
* *Pueraria phaseoloides* var. *javanica* (Benth.) Baker
* *Sesbania bispinosa* (Jacq.) W.F.Wright var. *bispinosa*
A R *Strongylodon lucidus* (G.Forst.) Seem.
* *Stylosanthes humilis* Kunth
* *Vigna mungo* (L.) Hepper
* *Vigna radiata* (L.) R.Wilczek
FLACOURTIACEAE
* *Muntingia calabura* L.
GOODENIACEAE
A R *Scaevola taccada* (Gaertn.) Roxb.
HERNANDIACEAE
A R *Gyrocarpus americanus* Jacq. subsp. *americanus*
A R *Hernandia ovigera* L.
Illigera appendiculata subsp. *stenoptera* Kubitzki
LAMIACEAE
A R *Anisomeles indica* (L.) Kuntze
* *Hyptis capitata* Jacq.
A R *Leucas flaccida* R.Br.
Leucas zeylanica (L.) R.Br.
* *Ocimum americanum* L.
LAURACEAE
Cinnamomum iners Reinw. ex Blume
A R *Cryptocarya nitens* (Blume) Koord. & Valeton
LECYTHIDACEAE
A R *Barringtonia racemosa* (L.) Spreng.
LEEACEAE
A R *Leea angulata* Korth. ex Miq.
LYTHRACEAE
A R *Pemphis acidula* J.R.Forst. & G.Forst.
MALVACEAE
R *Abelmoschus manihot* var. *pungens* (Roxb.) Hochr.
A R *Abutilon auritum* (Wall. ex Link) Sweet
A R e *Abutilon listeri* Baker f.
* *Gossypium barbadense* var. *acuminatum* (Roxb.) Mast.
A R *Hibiscus tiliaceus* L. subsp. *tiliaceus*
A R *Hibiscus vitifolius* L.
A R * *Malvastrum coromandelianum* (L.) Garcke
R *Sida acuta* Burm.f.
Sida rhombifolia L. subsp. *rhombifolia*
Urena lobata var. *sinuata* (L.) Borss.Waalk.
MELIACEAE
A R *Dysoxylum gaudichaudianum* (A.Juss.) Miq.
A R * *Melia azedarach* L.
MENISPERMACEAE
Pachygone ovata (Poir.) Hook.f. & Thomson
* *Tinospora baenzigeri* Forman
* *Tinospora crispa* (L.) Hook.f. & Thomson
MIMOSACEAE
A R *Entada rheedii* Spreng.
* *Leucaena leucocephala* (Lam.) de Wit
* *Mimosa invisa* Mart. ex Colla
* *Mimosa pudica* L.

MORACEAE
A R *Ficus microcarpa* L.f. f. *microcarpa*
A R *Ficus saxophila* Blume
A R *Maclura cochinchinensis* (Lour.) Corner var. *cochinchinensis*
MORINGACEAE
* *Moringa oleifera* Lam.
MYRSINACEAE
A R *Ardisia colorata* Roxb.
MYRTACEAE
* *Psidium guajava* L.
* *Psidium cattleianum* Sabine
A R *Syzygium nervosum* DC.
NYCTAGINACEAE
A R *Boerhavia diffusa* L.
Commicarpus chinensis (L.) Heimerl subsp. *chinensis*
* *Mirabilis jalapa* L.
A R *Pisonia grandis* R.Br.
A R *Pisonia umbellifera* (J.R.Forst. & G.Forst.) Seem.
OLACACEAE
Ximenia americana L.
OLEACEAE
A R * *Jasminum sambac* (L.) Aiton
Ligustrum glomeratum Blume
ONAGRACEAE
R * *Ludwigia hyssopifolia* (G.Don) Exell
OXALIDACEAE
* *Oxalis barrelieri* L.
* *Oxalis corniculata* L. subsp. *corniculata*
PASSIFLORACEAE
* *Passiflora foetida* L.
PIPERACEAE
A R *Peperomia laevifolia* (Blume) Miq.
R * *Peperomia pellucida* (L.) Kunth
A R e *Peperomia rossii* Rendle ex Baker f.
* *Piper aduncum* L.
* *Piper betle* L.
PITTOSPORACEAE
A R *Pittosporum ferrugineum* W.T.Aiton
PLANTAGINACEAE
* *Plantago major* L.
PLUMBAGINACEAE
Plumbago zeylanica L.
POLYGONACEAE
* *Antigonon leptopus* Hook. & Arn.
PORTULACACEAE
R * *Portulaca oleracea* L.
* *Portulaca pilosa* L.
Portulaca tuberosa Roxb.
RHAMNACEAE
A R e *Colubrina pedunculata* Baker f.
RHIZOPHORACEAE
Bruguiera gymnorhiza (L.) Savigny
Bruguiera sexangula (Lour.) Poir.
RUBIACEAE
A R *Aidia* aff. *racemosa* (Cav.) Tirveng.
A R *Amaracarpus pubescens* Blume
A R *Guettarda speciosa* L.
A R *Morinda citrifolia* L.
* *Oldenlandia corymbosa* L.
* *Oldenlandia pumila* (L.f.) DC.
* *Paederia foetida* L.
* *Spermacoce assurgens* Ruiz & Pav.
Spermacoce mauritiana Gideon
RUTACEAE
A R *Acronychia trifoliolata* Zoll. & Moritzi var. *trifoliolata*
* *Citrus aurantifolia* (Christm.) Swingle
* *Citrus maxima* (Burm.) Merr.
* *Citrus microcarpa* Bunge
* *Clausena excavata* Burm.f.
* *Clausena lansium* (Lour.) Skeels
* *Murraya koenigii* (L.) Spreng.
Murraya paniculata (L.) Jack
Triphasia trifolia (Burm.f.) P.Wilson
SAPINDACEAE
A R *Allophylus cobbe* (L.) Blume
R * *Cardiospermum halicacabum* L.
Dodonaea viscosa Jacq. subsp. *viscosa*
R *Tristiropsis acutangula* Radlk.
SAPOTACEAE
A R *Planchonella nitida* (Blume) Dubard
SCROPHULARIACEAE
Lindernia crustacea (L.) F.Muell.
* *Scoparia dulcis* L.
SOLANACEAE
* *Capsicum frutescens* L.
A R *Datura metel* L.
A R *Lycianthes biflora* (Lour.) Bitter
* *Lycopersicon esculentum* Mill.
* *Nicotiana tabacum* L.
A R *Physalis minima* L.
Physalis pubescens L.
A R *Solanum* aff. *ferox* L.
Solanum americanum Mill.
STERCULIACEAE
Heritiera littoralis Aiton
A R *Kleinhovia hospita* L.
Melochia umbellata (Houtt.) Stapf
TILIACEAE
A R *Berrya cordifolia* (Willd.) Burret
Corchorus aestuans L.
Grewia acuminata Juss.
A R *Grewia glabra* Blume
R e *Grewia insularis* Ridl.
R *Triumfetta suffruticosa* Blume
TURNERACEAE
* *Turnera ulmifolia* L.

ULMACEAE
A R *Celtis timorensis* Span.
A R * *Trema tomentosa* (Roxb.) Hara
URTICACEAE
A R e *Dendrocnide peltata* var. *murrayana* (Rendle) Chew
Dendrocnide peltata (Blume) Miq. var. *peltata*
A R *Dendrocnide sinuata* (Blume) Chew
A R *Laportea ruderalis* (G.Forst.) Chew
Pilea peploides (Gaudich.) Hook. & Arn.
A R *Pipturus argenteus* var. *lanosus* Skottsb.
A R *Procris pedunculata* (J.R.Forst. & G.Forst.) Wedd. var. *pedunculata*
VERBENACEAE
A R *Callicarpa longifolia* Lam.
* *Clerodendrum calamitosum* L.
Clerodendrum inerme (L.) Gaertn.
A R *Premna lucidula* Miq.
Premna odorata Blanco
Premna serratifolia L.
A R * *Stachytarpheta jamaicensis* (L.) J.Vahl
* *Vitex trifolia* L.
VITACEAE
R *Cayratia japonica* (Thunb.) Gagnep.
A R *Cayratia pedata* (Lam.) Gagnep.
Cayratia trifolia (L.) Domin
A R *Cissus repens* Lam.
Vitis flexuosa Thunb.

MONOCOTYLEDONAE
ARACEAE
* *Colocasia esculenta* (L.) Schott
A R *Remusatia vivipara* (Roxb.) Schott
* *Xanthosoma sagittifolium* (L.) Schott
ARECACEAE
A R e *Arenga listeri* Becc.
* *Cocos nucifera* L.
CANNACEAE
* *Canna indica* L.
COMMELINACEAE
* *Commelina benghalensis* L.
* *Rhoeo spathacea* (Sw.) Stearn
CYPERACEAE
* *Cyperus compressus* L.
* *Cyperus rotundus* L.
A R *Fimbristylis cymosa* R.Br.
* *Kyllinga nemoralis* (J.R.Forst. & G.Forst.) Dandy ex Hutch. & Dalziel
* *Kyllinga polyphylla* Willd. ex Kunth
R *Mariscus javanicus* (Houtt.) Merr. & F.P.Metcalf
* *Mariscus macrocarpus* Kunth
DIOSCOREACEAE
Dioscorea alata L.
Dioscorea bulbifera L. var. *bulbifera*
LILIACEAE
A R *Crinum asiaticum* L.
ORCHIDACEAE
A R e *Brachypeza archytas* (Ridl.) Garay
A R *Corymborkis veratrifolia* (Reinw.) Blume var. *veratrifolia*
A R *Dendrobium crumenatum* Sw.
R *Didymoplexis pallens* Griff.
A R *Eria retusa* (Blume) Rchb.f.
A R *Flickingeria nativitatis* (Ridl.) J.J.Wood
A R e *Phreatia listeri* Rolfe
Taeniophyllum hasseltii Rchb.f.
R *Thelasis capitata* Blume
A R *Thrixspermum carinatifolium* (Ridl.) Schltr.
R e *Zeuxine exilis* Ridl.
PANDANACEAE
R e *Pandanus christmatensis* Martelli
R e *Pandanus elatus* Ridl.
POACEAE
* *Arundo donax* L.
* *Axonopus compressus* (Sw.) P.Beauv.
* *Bothriochloa bladhii* (Retz.) S.T.Blake
* *Brachiaria mutica* (Forssk.) Stapf
* *Brachiaria ramosa* (L.) Stapf
* *Brachiaria reptans* (L.) C.Gardner & C.E.Hubb.
* *Brachiaria subquadripara* (Trin.) Hitchc.
* *Cenchrus brownii* Roem. & Schult.
* *Chloris barbata* Sw.
* *Chrysopogon aciculatus* (Retz.) Trin.
* *Cynodon dactylon* (L.) Pers.
* *Dactyloctenium aegyptium* (L.) Willd.
Digitaria radicosa (C.Presl) Miq.
A R *Digitaria setigera* Roth
R * *Echinocloa colona* (L.) Link
A R * *Eleusine indica* (L.) Gaertn.
A R *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult.
* *Eragrostis pilosa* (L.) P.Beauv.
* *Imperata cylindrica* (L.) P.Beauv.
Ischaemum muticum L.
R e *Ischaemum nativitatis* Jansen ex Renvoize
R *Lepturus repens* (G.Forst.) R.Br.

A R *Oplismenus compositus* (L.) P.Beauv.
A R * *Panicum trichoides* Sw.
R * *Paspalum conjugatum* Bergius
* *Rhynchelytrum repens* (Willd.) C.E.Hubb.
Rottboellia cochinchinensis (Lour.) Clayton
* *Saccharum spontaneum* L.
R *Setaria clivalis* (Ridl.) Veldkamp
* *Sorghum bicolor* (L.) Moench
Sorghum propinquum (Kunth) Hitchc.
Sporobolus fertilis (Steud.) Clayton
Sporobolus virginicus (L.) Kunth
* *Urochloa mosambicensis* (Hack.) Dandy
* *Zoysia matrella* (L.) Merr. subsp. *matrella*

PINOPHYTA
CYCADACEAE
A R *Cycas rumphii* Miq.

PTERIDOPHYTA & ALLIES
ADIANTACEAE
* *Pityrogramma calomelanos* (L.) Link var. *calomelanos*
ASPLENIACEAE
A R e *Asplenium listeri* C.Chr.
A R *Asplenium nidus* L.
A R *Asplenium polyodon* G.Forst.
DAVALLIACEAE
A R *Arthropteris palisotii* (Desv.) Alston
A R *Davallia denticulata* (Burm.f.) Mett. ex Kuhn
A R *Davallia solida* (G.Forst.) Sw.
A R *Nephrolepis biserrata* (Sw.) Schott
A R *Nephrolepis multiflora* (Roxb.) F.M.Jarett ex C.V.Morton
DENNSTAEDTIACEAE
A R *Microlepia speluncae* (L.) T.Moore
DRYOPTERIDACEAE
A R *Pteridrys syrmatica* (Willd.) C.Chr. & Ching
Tectaria devexa var. *minor* (Hook.) Holttum
A R *Tectaria dissecta* (G.Forst.) Lellinger
A R *Tectaria siifolia* (Willd.) Copel.
HYMENOPHYLLACEAE
A R *Gonocormus saxifragoides* (C.Presl) Bosch
LOMARIOPSIDACEAE
A R *Bolbitis heteroclita* (C.Presl) Ching
LYCOPODIACEAE
A R *Huperzia phlegmaria* (L.) Rothm.
OPHIOGLOSSACEAE
Ophioglossum pendulum L.
Ophioglossum reticulatum L. f. *reticulatum*
POLYPODIACEAE
A R *Leptochilus decurrens* Blume
A R *Microsorum punctatum* (L.) Copel.
R *Microsorum scolopendria* (Burm.f.) Copel.
A R *Pyrrosia lanceolata* (L.) Farw.
PSILOTACEAE
Psilotum nudum (L.) P.Beauv.
PTERIDACEAE
R *Pteris tripartita* Sw.
Pteris vittata L.
SELAGINELLACEAE
R *Selaginella alutacia* Spring
THELYPTERIDACEAE
* *Amphineuron opulentum* (Kaulf.) Holttum
A R *Pneumatopteris truncata* (Poir.) Holttum
VITTARIACEAE
A R *Vittaria elongata* Sw.

KEY TO FAMILIES

DICOTYLEDONAE

1 Leaves alternate (to p. 25)

2 Leaves reduced to scales; parasitic climbers (*Cassytha*) **2. LAURACEAE**

2: Leaves well developed; not parasitic climbers

3 Leaves simple or lobed (to p. 24)

4 Plant with tendrils

5 Flowers in panicles; seeds 1–4

6 Tendrils leaf-opposed; fruit a berry **56. VITACEAE**

6: Tendrils axillary or terminating inflorescence; fruit nut-like, enclosed by enlarged calyx (*Antigonon*) **19. POLYGONACEAE**

5: Flowers solitary or clustered; seeds usually many

7 Tendrils in stipular position; calyx simply lobed; corona absent **31. CUCURBITACEAE**

7: Tendrils axillary; calyx much divided; corona present **29. PASSIFLORACEAE**

4: Plant without tendrils

8 Fruit a fig or mulberry-like; latex present **9. MORACEAE**

8: Fruit otherwise

9 Ovary inferior

10 Flowers in a head surrounded by an involucre **82. ASTERACEAE**

10: Not as above

11 Leaves with oil glands; corolla a cap **48. MYRTACEAE**

11: Leaves without oil glands

12 Flowers solitary

13 Perianth of 1 whorl, tubular with broad limb; climbers **5. ARISTOLOCHIACEAE**

13: Perianth of 2 whorls; petals free; erect herbs **46. ONAGRACEAE**

12: Flowers several to many in an inflorescence

14 Flower with zygomorphic corolla **80. GOODENIACEAE**

14: Flowers actinomorphic

15 Stamens many, in several whorls **25. LECYTHIDACEAE**

15: Stamens up to 10, in 1 or 2 whorls

16 Stamens 8 or 10, in 2 whorls; inflorescence a spike (*Terminalia*) **47. COMBRETACEAE**

16: Stamens 2–7, in 1 whorl, alternating with staminodes; inflorescence a compound cyme **3. HERNANDIACEAE**

9: Ovary superior

17 Perianth parts or lobes up to 6 or absent

18 Leaves gland-dotted (*Triphasia*) **60. RUTACEAE**

18: Leaves without oil glands

19 Perianth parts scarious

20 Flowers apetalous, usually 3- or 5-merous **15. AMARANTHACEAE**

20: Flowers with calyx and corolla, usually 4-merous **74. PLANTAGINACEAE**

19: Perianth not scarious or absent

21 Flowers 2 or 3 per axil (*Capsicum*) **68. SOLANACEAE**

21: Flowers in panicles, racemes or spikes

22 Flowers and fruit with sticky glands (*Pisonia*) **13. NYCTAGINACEAE**

22: Not as above

23 Perianth absent **4. PIPERACEAE**

23: Perianth present

24 Number of stamens more than number of perianth parts

25 Fruit a capsule

26 Capsule winged with glandular surface; seeds 4, black (*Dodonaea*) **57. SAPINDACEAE**

26: Capsule unwinged, bristly; seeds many, red **27. BIXACEAE**

25: Fruit a berry

27 Fruit less than 2 cm diam; seed 1 (*Cryptocarya*) **2. LAURACEAE**

27: Fruit 7–15 cm diam; seeds many **30. CARICACEAE**

24: Number of stamens as many as number of perianth parts

28 Climbing herbs; stipules absent **17. BASELLACEAE**

28: Trees, shrubs or non-climbing herbs; stipules often present

29 Styles 4 or 5, free; peltate scales on vegetative parts (*Heritiera*) **23. STERCULIACEAE**

29: Style 1; scales absent

30 Style bifid or styles free **8. ULMACEAE**

30: Style simple or stigma sessile **10. URTICACEAE**

17: Perianth parts or lobes more than 6

31 Petals united or connate

32 Sepals 2; leaves and stems fleshy **16. PORTULACACEAE**

32: Sepals more than 2; leaves and stems usually not fleshy

33 Corolla tubular, shallowly lobed; stipules absent

34 Corolla lobes 4

35 Branchlets glabrous; corolla bearded inside (*Ximenia*) **50. OLACACEAE**

35: Branchlets pubescent; corolla glabrous (*Ligustrum*) **75. OLEACEAE**

34: Corolla lobes 5

36 Calyx prominently tubular with sticky glands; corolla tube long, white or blue (*Plumbago*) **20. PLUMBAGINACEAE**

36: Calyx shortly tubular, without glands; corolla tube short, pink (*Ardisia*) **36. MYRSINACEAE**

33: Not as above

37 Fruit a capsule

38 Seeds 1–4 **69. CONVOLVULACEAE**

38: Seeds many (*Datura*, *Nicotiana*) **68. SOLANACEAE**

37: Fruit a drupe, berry, follicle or of nutlets

39 Inflorescence scorpioid; fruit of nutlets **70. BORAGINACEAE**

39: Otherwise

40 Fruit a follicle; stems much thickened (*Plumeria*) **66. APOCYNACEAE**

40: Fruit and stems otherwise

41 Latex present (*Cerbera*) **66. APOCYNACEAE**

41: Latex absent

42 Fruit a drupe; style bifid **70. BORAGINACEAE**

42: Fruit a berry; style simple, with capitate stigma **68. SOLANACEAE**

31: Petals free

43 Sepals 4; petals 4; stamens 2, 4 or 6; fruit a siliqua or silicula **33. BRASSICACEAE**

43: Not as above

44 Petals absent; latex present **53. EUPHORBIACEAE**

44: Petals present; latex usually absent

45 Sepals 2; stems and leaves fleshy — **16. PORTULACACEAE**

45: Sepals 3–7; stems and leaves not fleshy

46 Leaves with prominent basal sheath encircling stem — **19. POLYGONACEAE**

46: Leaves without basal sheath

47 Leaves with stellate hairs or peltate scales, sometimes also with simple hairs; stamens united

48 Stamens along upper part of a narrow column — **24. MALVACEAE**

48: Stamens united in a short cup or terminating the cup-like apex of a tube

49 Petals with glandular hairs at base; flowers 1–few in a short inflorescence (*Corchorus*, *Grewia*) — **22. TILIACEAE**

49: Petals without glandular hairs; flowers many in a large panicle or compound inflorescence — **23. STERCULIACEAE**

47: Not as above

50 Leaves gland-dotted; axillary spines often present (*Citrus*, *Triphasia*) — **60. RUTACEAE**

50: Not as above

51 Sepals 3, connate; petals in 2 whorls of 3 — **1. ANNONACEAE**

51: Not as above

52 Sepals 6 or 12, free; petals 3 or 6; stamens 3 or 6; woody climber — **7. MENISPERMACEAE**

52: Not as above; sepals and petals usually 5, free or united

53 Calyx tubular, 5-lobed; styles 3 — **28. TURNERACEAE**

53: Not as above; styles simple, sometimes lobed

54 Stamens 10 — **43. FABACEAE**

54: Stamens 4 or 5

55 Hairs stellate

56 Style present; placentas axile — **22. TILIACEAE**

56: Stigma sessile; placentas parietal (*Muntingia*) — **26. FLACOURTIACEAE**

55: Hairs if present not stellate

57 Sepals free

58 Style simple — **37. PITTOSPORACEAE**

58: Style 3-lobed — **54. RHAMNACEAE**

57: Sepals united into a lobed calyx

59 Flowers in cymose clusters — **35. SAPOTACEAE**

59: Flowers paniculate

60 Fruit a capsule — **52. CELASTRACEAE**

60: Fruit a drupe — **58. ANACARDIACEAE**

3: Leaves compound

61 Leaves bi- or tri-pinnate

62 Leaflets entire

63 Leaves bipinnate

64 Fruit indehiscent, 3-angled; ovary 3- or 4-locular (*Tristiropsis*) **57. SAPINDACEAE**

64: Fruit dehiscent, variously shaped; ovary 1-locular

65 Flowers in heads or spikes; petals small; stamens well exserted **41. MIMOSACEAE**

65: Flowers in racemes; petals prominent; stamens not exserted **42. CAESALPINIACEAE**

63: Leaves tripinnate; fruit 3-valved **34. MORINGACEAE**

62: Leaflets serrate

66 Petiole ±terete; flowers purple-pink; stamens 10, fused, exserted; fruit orange (*Melia*) **59. MELIACEAE**

66: Petiole winged; flowers greenish; stamens 5, free, ±appressed to carpels; fruit almost black **55. LEEACEAE**

61: Leaves simply pinnate or 3–many-foliolate

67 Plant with tendrils **56. VITACEAE**

67: Plant without tendrils

68 Leaves gland-dotted, aromatic when crushed; spines usually present **60. RUTACEAE**

68: Leaves not gland-dotted or aromatic; spines absent

69 Petiole with sheathing base (*Polyscias*) **63. ARALIACEAE**

69: Petiole without sheathing base

70 Petiole winged throughout **55. LEEACEAE**

70: Petiole ±terete, not winged

71 Plant a herb **32. CAPPARACEAE**

71: Plant a tree

72 Intramarginal vein prominent on both sides of leaflet lamina; leaves glabrous; petals c. 4 mm long, white; fruit 2.5–4 cm long (*Spondias*) **58. ANACARDIACEAE**

72: Intramarginal vein obscure on lower lamina surface, not evident on upper; leaf rachis pubescent, glabrescent; petals 6–8 mm long, violet; fruit 8–12 mm long **59. MELIACEAE**

1: Leaves opposite or whorled

73 Plants parasitic, yellow, fungus-like **51. BALANOPHORACEAE**

73: Plants photosynthetic, not fungus-like

74 Leaves compound

75 Leaves 3-foliolate

76 Leaves with translucent oil glands (*Acronychia*) **60. RUTACEAE**

76: Leaves without oil glands

77 Plant a herb **62. OXALIDACEAE**

77: Plant a shrub or tree

78 Flowers less than 1 cm long; fruit globular, indehiscent, less than 1 cm diam.(*Vitex*) **71. VERBENACEAE**

78: Flowers more than 1 cm long; fruit an elongate capsule more than 5 cm long (*Tecoma*) **78. BIGNONIACEAE**

75: Leaves pinnate

79 Leaves with translucent oil glands; flowers white (*Murraya*, *Clausena*) **60. RUTACEAE**

79: Leaves without oil glands; flowers yellow or orange **78. BIGNONIACEAE**

74: Leaves simple

80 Perianth segments or lobes, or sepals and petals 5 or fewer

81 Flowers in an involucrate head **82. ASTERACEAE**

81: Flowers otherwise, if in heads then not involucrate

82 Perianth absent

83 Plant a tree with buttresses (*Syzygium*) **48. MYRTACEAE**

83: Plant a herb (*Peperomia*) **4. PIPERACEAE**

82: Perianth, or calyx and corolla, or corolla present

84 Flowers solitary; stamens many **14. AIZOACEAE**

84: Inflorescence otherwise; stamens 2–5

85 Perianth base and fruit ribbed, usually with sticky glands or glandular hairs, if not glandular then each enclosed in an involucre of fused bracts **13. NYCTAGINACEAE**

85: Perianth base and fruit not as above

86 Stipules present; cystoliths present (*Procris*, *Pilea*) **10. URTICACEAE**

86: Stipules absent; cystoliths absent (*Achyranthes*, *Alternanthera*) **15. AMARANTHACEAE**

80: Perianth segments or lobes (including petals and sepals) 6 or more

87 Ovary inferior

88 Flowers in heads

89 Stems without interpetiolar stipule; fruit a dry indehiscent achene **82. ASTERACEAE**

89: Stems with interpetiolar stipule; fruit a fleshy syncarp (*Morinda*) **81. RUBIACEAE**

88: Inflorescence otherwise

90 Stamens 20 or more

91 Calyx 10–14-toothed (*Bruguiera*) **49. RHIZOPHORACEAE**

91: Calyx 4- or 5-partite or an operculum (*Eugenia*, *Syzygium*) **48. MYRTACEAE**

90: Stamens up to 10

92 Corolla tube present **81. RUBIACEAE**

92: Petals free

93 Hypanthium extended into a limb (Combretum, Quisqualis) **47. COMBRETACEAE**

93: Hypanthium not extended beyond ovary (*Ludwigia*) **46. ONAGRACEAE**

87: Ovary superior

94 Stamens more than 5

95 Perianth of 2 whorls of 3 segments (*Cinnamomum*) **2. LAURACEAE**

95: Calyx of 1 whorl of 2, 4 or 6 sepals

96 Plant a shrub; stamens 12, free (*Pemphis*) **45. LYTHRACEAE**

96: Plant a tree; stamens numerous or united in 4–6 clusters **21. CLUSIACEAE**

94: Stamens up to 5

97 Flowers actinomorphic

98 Flowers with a corona **67. ASCLEPIADACEAE**

98: Flowers without a corona

99 Stigma with a collar (*Catharanthus, Ochrosia, Vallaris*) **66. APOCYNACEAE**

99: Stigma without a collar

100 Corolla fused at base but not tubular

101 Flowers solitary in axils **36. MYRSINACEAE**

101: Flowers in umbels (*Scoparia*) **76. SCROPHULARIACEAE**

100: Corolla distinctly tubular

102 Leaves with acrodomatia in the axils of the main nerves and midrib abaxially (*Jasminum*) **75. OLEACEAE**

102: Leaves without acrodomatia (*Stachytarpheta, Callicarpa*) **71. VERBENACEAE**

97: Flowers zygomorphic

103 Plant with cystoliths **77. ACANTHACEAE**

103: Plant without cystoliths

104 Fruit a drupe **71. VERBENACEAE**

104: Fruit a capsule or 4 dry 1-seeded nutlets

105 Stamens with a basal spur; fruit a capsule (*Lindernia*) **76. SCROPHULARIACEAE**

105: Stamens not spurred; fruit 4 dry 1-seeded nutlets **72. LAMIACEAE**

MONOCOTYLEDONAE

1 Plant palm-like

2 Plant a true palm with alternate, compound, pinnate leaves **85. ARECACEAE**

2: Plant a screw-palm with simple leaves arising in a spiral **86. PANDANACEAE**

1: Plant not palm-like

3 Plant scandent; leaves distinctly petiolate without a sheathing base **94. DIOSCOREACEAE**

3: Plant not scandent; if leaves distinctly petiolate then with a sheathing base

4 Leaf lamina with venation parallel from marked midrib

5 Inflorescence a spathe and spadix **87. ARACEAE**

5: Inflorescence a spike of 1- or 2-flowered cymules **92. CANNACEAE**

4: Leaf lamina with venation parallel from the base or venation obscure

6 Leaves with an open cylindrical sheath and a ligule **91. POACEAE**

6: Leaf bases various but lacking a ligule

7 Plant grasslike; leaf sheath closed; flowers not showy, wind pollinated **90. CYPERACEAE**

7: Plant not grasslike; leaf sheath various; flowers showy

8 Flowers actinomorphic

9 Leaves basal, green **93. LILIACEAE**

9: Leaves basal and purple or cauline and green **88. COMMELINACEAE**

8: Flowers zygomorphic **95. ORCHIDACEAE**

PINOPHYTA

Cycas rumphii Miq. is the only representative of the Pinophyta, see page 530.

PTERIDOPHYTA & ALLIES

1 Plant slender, creeping, with flattened, branching stems c. 2.5–4 mm wide (including leaves); leaves 1–2 mm long, closely spread in 2 rows along stems, alternate, distichous (with 2 rows of reduced, inconspicuous leaves above); sporangia in compressed, terminal strobili c. 3–6 mm long, consisting of numerous overlapping, keeled sporophylls ±similar to leaves (Selaginella) **98. SELAGINELLACEAE**

1: Plants not as above

2 Minute fern; fronds dark green, membranous, c. 2.5–7 cm long, c. 4–11 mm wide, fan-shaped, palmately lobed (*Gonocormus*) **101. HYMENOPHYLLACEAE**

2: Plant larger, not as above

3 Terrestrial herb c. 20–40 cm tall, with erect, wiry, much-branched stems, naked except scattered, minute, triangular scales up to 3 mm long; sporangia fused into 3-lobed synangia c. 2 mm diam. (*Psilotum*) **99. PSILOTACEAE**

3: Plant not as above

4 Stems pendulous, densely covered by coriaceous, triangular, acute leaves 6–15 mm long; fertile portion at stem apex, much narrower than sterile shoot, 1–1.5 mm diam., covered by small scales, 4-angled, dichotomously branched (*Huperzia*) **97. LYCOPODIACEAE**

4: Plant not as above

5 Fertile fronds in 2 distinct parts, sterile lamina, and a stalked fertile spike inserted near base of sterile lamina, with sporangia arranged in 2 rows in a linear, thick walled synangium; plant either small, erect, terrestrial with a rhomboid to ovate, sterile lamina 1–3 cm long, or large, pendulous, epiphytic, with a strap-shaped, sparingly dichotomously branched, undulating, sterile lamina up to 200 cm long (Ophioglossum) **100. OPHIOGLOSSACEAE**

5: Sporangia not arranged in 2 rows in a stalked synangium; plant not as above

6 Fronds simple, entire

7 Fronds 25–90 cm long, 0.5–1 cm wide, linear, pendulous; sori linear, in narrow grooves extending along margins of frond (*Vittaria*) **103. VITTARIACEAE**

7: Fronds and sori not as above

8 Fronds up to 100–150 cm long, c. 1.5–25 cm wide, radiating from a central crown and forming a large rosette; sori linear, along lateral veins in apical portion of frond (*Asplenium*) **109. ASPLENIACEAE**

8: Fronds not forming a rosette; sori not linear

9 Fronds c. 60–120 cm long, c. 6–11 cm wide, erect to arching, often forming large clumps; sori small, circular, scattered in apical half of frond (Microsorum) **105. POLYPODIACEAE**

9: Fronds much smaller; sori completely covering all or part of fertile frond

10 Terrestrial fern forming small clumps; sterile fronds 20–40 cm long, narrowly ovate to narrowly elliptic, not coriaceous; fertile fronds linear, ±completely covered by sporangia beneath (Leptochilus) **105. POLYPODIACEAE**

10: Epiphytic fern often forming extensive colonies; fronds c. 5–20 cm long, linear to elliptic, coriaceous; fertile fronds longer and narrower than sterile ones, densely covered beneath by sori in apical portion (*Pyrrosia*) **105. POLYPODIACEAE**

6: Fronds pinnatisect, pinnate, or more finely dissected

11 Fronds pinnatisect to simply pinnate, the lobes or pinnae entire or with toothed margins (the lower pair of pinnae rarely lobed – see *Tectaria siifolia*)

12 Fronds pinnatisect with 1–9 pairs of acuminate lobes, the lobes deeply divided by broad sinuses (but never divided to midrib), coriaceous; sori usually in single rows on either side of midveins of lobes (Microsorum) **105. POLYPODIACEAE**

12: Fonds pinnate with 1–numerous pairs of pinnae; sori smaller, sometimes linear, sometimes covering undersurface of fertile fronds

13 Fronds with 3–9 pinnae, dimorphic, the fertile fronds reduced in size but on long stipes, usually held above sterile fronds

14 Apical pinna frequently with an elongated, slender apex up to 30 cm long, often bearing a subapical plantlet; fertile fronds ±entirely covered beneath by sporangia (*Bolbitis*) **111. LOMARIOPSIDACEAE**

14: Apical pinna lacking an elongated apex, sometimes with plantlets in pinna-axils of old fronds; sori circular, scattered over undersurface of fertile fronds, in paired rows between lateral veins of pinnae (Tectaria) **110. DRYOPTERIDACEAE**

13: Pinnae usually much more numerous; fronds not dimorphic, the fertile fronds ±identical to the sterile ones

15 Epiphytic fern, not climbing; pinna margins coarsely serrate, the serrations often with secondary teeth; sori narrow, linear, along lateral viens on undersurface of lamina (Asplenium) **109. ASPLENIACEAE**

15: Terrestrial or climbing ferns; pinna margins entire, very shallowly toothed or crenate; sori circular, or linear along pinna margins

16 Climbing fern on tree trunks and buttresses; fronds spaced along a slender, wiry rhizome, held ±horizontal (Arthropteris) **112. DAVALLIACEAE**

16: Terrestrial ferns; fronds appearing to radiate from a central crown, arching

17 Pinnae narrow, linear, finely tapering; pinnae largest towards the frond apex, the terminal pinna similar to, or longer than, the lateral pinnae; sori linear, along pinnae-margins, the indusium a flap recurved from margins (*Pteris*) **104. PTERIDACEAE**

17: Pinnae oblong to narrowly oblong, blunt or tapering; pinnae becoming gradually reduced towards apex, the terminal pinna very reduced or absent; sori small, circular, with a reniform indusium (*Nephrolepis*) **112. DAVALLIACEAE**

11: Fronds bipinnatifid (pinnate, with lobed pinnae) or more finely dissected

18: Fronds densely white-floury beneath (*Pityrogramma*) **102. ADIANTACEAE**

18: Fronds not floury beneath

19 Fronds very small, the lamina c. 7–12 cm long; sori linear, along lateral veins on undersurface of fronds; a small, lithophytic fern (*Asplenium*) **109. ASPLENIACEAE**

19: Fronds much larger, the lamina at least 25 cm long; sori circular, oblong or cup-shaped, or linear along margins of pinna lobes

20 Fronds very large, divided into 5–9 similar, radiating laminas at top of a long, robust stipe; sori linear, along margins of pinna lobes (*Pteris*) **104. PTERIDACEAE**

20: Fronds not as above; sori circular or cup-shaped

21 Pinnae all pinnately lobed (pinnatifid to pinnatisect); terminal pinna ±resembling lateral pinnae

22 Fronds with c. 13–21 pinnae; pinnae with stalks c. 4–12 mm long; sinuses between pinna lobes with a small, prominent tooth at base (*Pterydris*) **110. DRYOPTERIDACEAE**

22: Fronds with more numerous pinnae; pinnae sessile or subsessile with stalks up to c. 1 mm long; sinuses without a distinct tooth at base (Pneumatopteris, Amphineuron) **107. THELYPTERIDACEAE**

21: Pinnae, or at least the basal pair of pinnae, pinnate with lobed pinnules (bipinnatifid) or more deeply divided (to 4-pinnatisect)

23 Sori positioned on undersurface of lamina, not at base; fronds with basal pair of pinnae more finely divided than others; fronds in an apical crown (Tectaria) **110. DRYOPTERIDACEAE**

23: Sori ±marginal; indusia cup-shaped or pouch-shaped, attached (to frond lamina) at base and sides, opening towards margin of lamina; basal pair of pinnae not more finely divided than others; fronds scattered along a creeping rhizome

24 Fronds with a finely hairy rachis and lamina, deeply 3-pinnatisect to 3-pinnate; indusia cup-shaped, sealed only in basal portion; rhizome ±glabrous, the young parts shortly hairy (*Microlepia*) **108. DENNSTAEDTIACEAE**

24: Fronds glabrous, finely 4-pinnatisect; indusia semicircular to narrowly oblong, the margins entirely sealed except a narrow, apical opening at lamina margin (pouch-shaped); rhizome densely covered in long, soft, red-brown scales (*Davallia*) **112. DAVALLIACEAE**

COCOS (KEELING) ISLANDS

I.R.H.Telford

GEOGRAPHIC LOCATION

The Cocos (Keeling) Islands lie in the northern Indian Ocean between latitudes 11°49' and 12°13'S and longitudes 96°49' and 96°56'E, 1000 km SW of the Sunda Strait between Sumatra and Java. Sumatra, 900 km to the NNE, is the closest land mass. Christmas Is. lies 920 km to the ENE. The nearest point of continental Australia, North West Cape, is c. 2100 km to the SE.

PHYSIOGRAPHY AND GEOLOGY

These deep sea atolls sit atop the Cocos Rise on two summits of the volcanic Vening Meinesz Seamounts which run NE from the Ninetyeast Ridge to Christmas Is. This chain of guyots suggests their volcanic origin as the Indo-Australian Plate moved northwards over a hot-spot to be subducted in the Java Trench. Subsidence of the seamounts and upward reef-building have accummulated coral rock to a depth of 500–1000 m.

Cocos (Keeling) Islands consist of 2 atolls. The main group of islands comprises the larger (southern) atoll with the smaller, North Keeling Is., lying 25 km to the north.

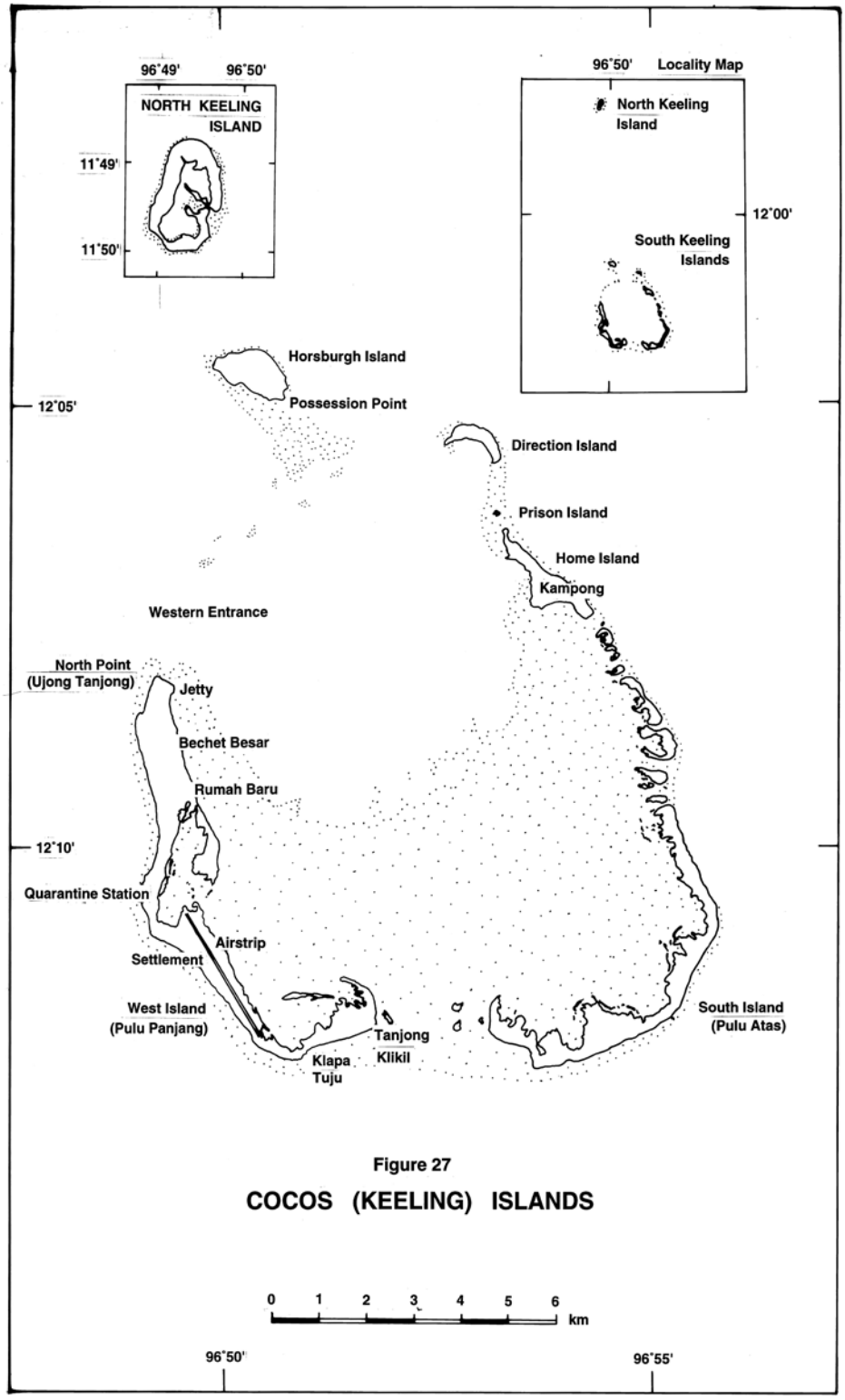

Figure 27

COCOS (KEELING) ISLANDS

The larger atoll consists of a roughly horse-shoe-shaped group of some 30 islands around a lagoon 15 km long and 9 km wide, the longer axis lying north-south. The highest point is 9 m above sea level on a stablised sand dune at the south-western end of South Is. (Pulu Atas).

North Keeling Is. is more accurately described as an atoll-like platform reef and consists of a single island 2 km long. Its shallow central lagoon has a narrow opening to the E.

Both atolls consist almost entirely of coralline sand and rubble on coralline and algal limestone. Pumice has accumulated after Indian Ocean volcanic eruptions such as that of Krakatoa in 1883. Reef building continues as a fringing platform around the atolls. Shallow flats occur between the outer reef edges and the ocean beaches.

Charles Darwin visited the islands in 1836 during the voyage of H.M.S. *Beagle*. His studies of the reefs and atolls provided data for his work on the structure and distribution of reefs (1842) in which his theory of atoll formation was presented.

SOILS

Unlike the older and uplifted Christmas Is., where basalt outcrops, the Cocos Islands soils have developed purely from coralline material. Accumulation of pumice and guano may have localised effects. A humic upper horizon has developed under forest vegetation.

No permanent surface fresh water occurs on the islands. Fresh groundwater lenses occur in the larger islands of the main atoll.

CLIMATE

Lying in the low latitudes in the Tropical Zone, the islands experience little diurnal or seasonal variation in temperature. The mean summer maximum is 30°C with February and March the hottest months; the mean winter minimum is 23°C in September. Day–night variation is c. 5°C.

The prevailing winds are the south-east trades. Windy squalls, gusting to 70 km per hour, may bring heavy showers. Summer is the doldrum season but the lowering of the intertropical front to this latitude may produce cyclones from December to April. Annual rainfall is c. 2000 mm, with a peak between April and June.

VEGETATION

On the main or southern atoll much of the terrestrial vegetation has been cleared and monoculture plantations of *Cocos nucifera* (coconut) established. Understorey species are rare but in some more open plantations the shrubs *Scaevola taccada* and *Morinda citrifolia* have regenerated thickly. In 1890 H.B.Guppy reported that the interiors of South and West Islands were largely occupied by tall forests of *Hernandia nymphaeifolia* and *Pisonia grandis*. Surviving vegetation occurs as a narrow girdle at beach tops and in swamp or lagoon environs.

The vegetation of North Keeling Is., although somewhat disturbed, remains as an example of what that of the main atoll must have been before settlement. On North Keeling Is. *Pisonia grandis* dominates the forest whereas few trees of this species remain on the southern islands. Other species, such as *Laportea aestuans*, *Acalypha lanceolata*, *Canavalia cathartica* and *Erythrina variegata*, persist here but are absent from or extinct on the southern islands. The numbers of weed species present is low compared with that of the southern atoll. A grove of *Carica papaya* is naturalised near the landing place on the leeward side.

STRAND COMMUNITIES

Cocos nucifera, *Calophyllum inophyllum* and *Argusia argentea* are the dominant tree or larger shrub species on ocean beach strands in an open forest or tall shrub community. *Cordia subcordata* occurs more commonly on lagoon strands occasionally just behind the *Pemphis acidula* shrubbery. *Pandanus tectorius* var. *cocosensis* occurs in scattered groves around the lagoon shore of the southern atoll, still extant on Home Is. and West Is. and reported by H.B.Guppy (1890) as previously common on the south and east ocean coasts, but then surviving only on South-East Cape. *Scaevola taccada* and *Suriana maritima* are shrub components. In swampy depressions bordering lagoons, *Hibiscus tiliaceus* may form thickets. *Pemphis acidula* occurs in pure stands as shrub thickets on sand spits and bars of the lagoon.

HERBFIELDS

Strand herbfield on coralline sand, mainly at the tops of ocean beaches, is dominated by *Stenotaphrum micranthum*, *Lepturus repens* and *Ipomoea pes-caprae*.

Herbfield of *Paspalum vaginatum* and *Sesuvium portulacastrum* occurs in depressions inundated at high water and on coral rubble and sand spits bordering the lagoon on North Keeling Is. Neither species has been recorded for the southern atoll.

FOREST COMMUNITIES

Pisonia grandis is dominant in the closed forest community behind the strand shelter belt. Trees may grow to 25 m tall with large fluted trunks to 2.5 m diam. The canopy is dense and understorey species are sparse. Lianes such as *Canavalia cathartica* are rare. Virtually none of this forest community remains on the southern atoll because of the *Cocos* monoculture.

MANGROVE COMMUNITY

A stand of *Rhizophora apiculata* fringes the brackish lagoon on Horsburgh Is. Although apparently part of the natural vegetation, the establishment of these mangroves was assisted by man. H.B.Guppy, *J. Trans. Victoria Inst.* (*London*) 267–301 (1890) reported:

'Mr Ross has sometimes endeavoured to give the ocean waifs a chance. His father tried to introduce the mangrove into Horsburgh Is., the germinated seeds of which often occur amongst the vegetable drift. But the crabs frustrated his efforts in all parts of the island except around the shores of the enclosed lagoonlet, where the mangrove survived and is still thriving.'

MARINE COMMUNITIES

Seagrass community of *Thalassia hemprichii* occurs on the flats between ocean beaches and reefs, often on the sandy lagoon floors to a depth of c. 2 m.

In the north-western corner of the lagoon of the southern atoll, populations of the marine angiosperms *Syringodium isoetifolium* and *Thalassodendron ciliatum* occur. *Thalassodendron* occurs in large patches in water c. 8 m deep between North Point, West Is. and Horsburgh Is. Individual plants form 'fairy rings' several metres in diameter. Two populations of *Syringodium* have been recorded – one off North Point, West Is. at a depth of c. 1.5 m, the other off Direction Is.

FLORISTICS

Low endemism is to be expected on a purely coralline oceanic island group providing little variation in terrestrial habitats. The only taxon regarded as endemic is *Pandanus tectorius* var. *cocosensis*. Surprisingly, the *Pandanus* was not collected by Darwin in 1836. H.B.Guppy, *loc. cit.*, reported that it had been recorded by the earlier visitors Keating in 1829 and Jagt in 1832, and had previously been frequent on the southern and eastern coasts, but through clearing was then restricted to South-East Point. Of special interest is the problematic grass genus *Lepturopetium*. The genus was previously known only from the type collections of its 2 named species – *L. kuniense* from Isle of Pines, New Caledonia, and *L. marshallense* from Eniwetok Atoll, Marshall Is. The recent (1986) collection from West Is. remains specifically unplaced.

Phytogeographic relationships clearly lie with the strand floras of the tropical Indian and Pacific Oceans. At least 32 of the woody species belong to the suite of species widespread through this zone, including the dominant forest tree *Pisonia grandis* and the littoral species *Argusia argentea*, *Calophyllum inophyllum*, *Cordia subcordata*, *Hernandia nymphaeifolia*, *Suriana maritima*, *Hibiscus tiliaceus*, *Pemphis acidula*, *Scaevola taccada*, *Guettarda speciosa*, *Morinda citrifolia* and *Terminalia catappa*. *Suriana maritima* appears to be a relatively recent arrival. H.B.Guppy (1890) wrote:

'[Suriana maritima] within the last 20 years [i.e. after 1870] has established itself through natural agencies on the weather margin of Gooseberry Is. ...It is not included in the lists of Darwin and Forbes, and the Cocos Islanders take such an interest in the plants of their atoll that there is no reason to doubt the recent appearance of the shrub...'

Some common tropical strand species are surprisingly absent, as was observed by H.B.Guppy (1890). Athough viable seeds of *Entada phaseoloides*, *Heritiera littoralis*, *Cerbera manghas* and *Carapa moluccensis* are frequently found in drift, none has become established, probably because of attack by crabs.

USAGE

The prevalance of coconut palms (*Cocos nucifera*) induced the settlement of the islands in 1826 to establish a trade in copra and coconut oil. The coconut is still used on the islands for food. Two variants are recognised locally - one producing superior water, the other superior flesh. *Cocos* flower nectar is collected for use as liquid sugar.

Of other indigenous trees, Ironwood (*Cordia subcordata*) was used for house and boat construction, wood carving and firewood. No large trees survive. The naturalised *Muntingia calabura* (Panama Cherry) and *Carica papaya* (Pawpaw) provide fruit.

Robber crabs (*Birgus latro* Linnaeus) eat coconuts, climbing the trunks and severing the fruit stalks with their claws.

Land crabs (*Cardisoma* spp.) and (on North Keeling Is.) red crabs (*Gecarcoidea* spp.) devour much of the edible plant material that falls or washes ashore. H.B.Guppy (1890) claimed that viable seeds arriving in drift were quickly attacked by crabs, limiting the number of successful colonising species.

Large numbers of sea-birds breed on North Keeling Is., the vegetation providing nesting sites and building material. *Pisonia grandis* provide nesting sites for Red-footed Boobies (*Sula sula rubripes* Gould). White terns (*Gygis alba* (Sparrman)) favour the branches of *Argusia argentea*. Thickets of *Pemphis acidula* are used by Frigate birds (*Fregata* spp.) and Red-footed Boobies.

HISTORY

These islands were supposedly discovered by Captain William Keeling between 1607 and 1610. In early Dutch maps and French atlases of the 17th century, they appear as the Cocos Islands. The major atoll has a long history of habitation. Permanent settlement began in May 1826, when Alexander Hare and a party of some 100 people, predominantly Malay, established a settlement on Home Is. Subsidiary garden settlements followed on Horsburgh, South and West Islands. Fruit and vegetables were cultivated and coconut oil extracted for export. John Clunies Ross, with family and tradesmen included in his party of some 20 members, migrated to the islands to establish a trading depot. They initially settled on Goose Is., later moving to South Is. and finally to Home Is. in 1834. Coconuts, coconut oil and copra were exported and the vegetation of the main atoll was replaced by *Cocos* plantations. The coconut industry continues today, but in 1987 was declared unprofitable (P.Bunce, *The Cocos* (*Keeling*) *Islands, Australian Atolls in the Indian Ocean*, 1988).

A repeater station for the undersea telegraphic cable linking Australia to Singapore was erected on Direction Is. in 1901. During the First World War, in November 1914, this station was the target for a German raiding party from the cruiser S.M.S. *Emden*. The *Emden* was engaged in battle by the H.M.A.S. *Sydney*, overpowered and beached on North Keeling Is.

North Keeling Is. has never been permanently settled. During the 1950s, a transitory camp was set up by the Japanese for the salvage of scrap iron from the wreck of the *Emden*.

During the Second World War, in 1944, an airfield was constructed on West Is. as a base for a Spitfire squadron and Mosquito and Liberator bombers for sorties to Singapore, Malaya and Java. The newly completed airfield was closed in 1945 but re-opened in 1951 for the Australia–South Africa air route.

A supporting settlement was established and this has grown to become the site of the Territory Administration. In 1978 the islands were purchased from the Clunies-Ross Family by the Australian Government. An Animal Quarantine Station for staging cattle, sheep and goats from overseas to mainland Australia was set up in 1981 on West Is. Fodder is cultivated on site.

COLLECTORS

The first collections made on the atoll were by Charles Darwin in 1836 during his voyage on H.M.S. *Beagle*. A species list and descriptions were published by J.S.Henslow (1838), Professor of Botany at Cambridge. Twenty-one indigenous and 3 introduced vascular plants were recorded. The settlers had:

'Readily pointed out to Mr Darwin the different species of plants, and assured him that he had seen them all except one, of which there was only a single tree, bearing a large square and very hard nut [Barringtonia asiatica] growing on one of the islands which he did not visit. Excepting the cocoa-nut, and one other tree which was not in flower, and which attains a diameter of five or six feet, with particularly soft wood [Pisonia grandis], Mr Darwin brought away specimens of all the species he saw...' (J.S.Henslow, *Ann. Nat. Hist.* 1: 337–347, 1838).

Naturalised plants listed were the grasses *Eleusine indica*, *Eragrostis tenella* (as *Poa plumosa* Retz) and *Panicum* sp. Darwin's collections are housed at CGE.

Henry O.Forbes, who studied botany and ethnology, collected on the islands in 1879, publishing his species list in 1885 and comparing it with Darwin's collections. An additional 38 indigenous or naturalised species were recorded.

Henry B.Guppy, formerly a naval surgeon but commissioned for survey work and the study of natural history with a special interest in plant dispersal, collected on the islands in

1888. The first naturalist to visit North Keeling Island, Guppy (1890) recorded 14 additional species. Guppy's collections are housed at K.

Major recent collections are those made by Harold St. John in 1961 (BISH), F.W. & M.Jowett in 1978 (K), Ian R.Telford and Christopher Howard in 1985 (CBG) and David G.Williams from 1986–1987 (CBG).

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COCOS (KEELING) ISLANDS SPECIES LISTS

MAIN ATOLL

The flora of the main atoll of Cocos (Keeling) Island is made up as follows:

Dicotyledons: 41 families (12 naturalised only), 76 genera (35 naturalised only) and 83 species (40 naturalised)

Monocotyledons: 8 families (1 naturalised only), 36 genera (15 naturalised only) and 38 species (1 endemic, 17 naturalised).

(! indicates species recorded by H.Forbes, *Naturalist's Wanderings Eastern Archipelago* (1885) and F.Wood-Jones, *Corals and Atolls.* (1912) but not collected since; e = endemic taxon; * = naturalised taxon).

MAGNOLIOPHYTA (flowering plants)

DICOTYLEDONAE

ACANTHACEAE

! *Asystasia gangetica* (L.) T.Anderson
Dicliptera ciliata Decne.

AMARANTHACEAE

Achyranthes aspera L.
Aerva lanata (L.) Schult.
! *Amaranthus retroflexus* L. sphalm. '*schoflexus*'

ANNONACEAE

!*Annona reticulata* L.

APOCYNACEAE

Neisosperma oppositifolium (Lam.) Fosberg & Sachet

ASCLEPIADACEAE

! *Asclepias curassavica* L.

ASTERACEAE
* *Conyza bonariensis* (L.) Cronquist
* *Eleutheranthera ruderalis* (Sw.) Sch.Bip.
Emilia sonchifolia (L.) DC.
Melanthera biflora (L.) Wild
! *Sonchus oleraceus* L.
* *Synedrella nodiflora* (L.) Gaertn.
* *Tridax procumbens* L.
* *Vernonia cinerea* (L.) Less.
BORAGINACEAE
Argusia argentea (L.f.) Heine
Cordia subcordata Lam.
BRASSICACEAE
! *Brassica juncea* (L.) Czern.
* *Lepidium virginicum* L.
CAESALPINIACEAE
Caesalpinia bonduc (L.) Roxb.
* *Senna occidentalis* (L.) Link
CAMPANULACEAE
* *Hippobroma longiflora* (L.) G.Don
CASUARINACEAE
* *Casuarina equisetifolia* L. subsp. *equisetifolia*
CLUSIACEAE
Calophyllum inophyllum L.
COMBRETACEAE
Terminalia catappa L.
CONVOLVULACEAE
Ipomoea macrantha Roem. & Schult.
Ipomoea pes-caprae subsp. *brasiliensis* (L.) Ooststr.
CRASSULACEAE
* *Bryophyllum pinnatum* (Lam.) Oken
EUPHORBIACEAE
* *Acalypha indica* L.
* *Acalypha lanceolata* Willd.
Euphorbia atoto G.Forst.
* *Euphorbia cyathophora* Murray
* *Euphorbia hirta* L.
* *Euphorbia prostrata* Aiton
* *Phyllanthus amarus* Schumach & Thonn.
* *Ricinus communis* L.
* *Sauropus androgynus* (L.) Merr.
FABACEAE
* *Alysicarpus vaginalis* (L.) DC.
* *Crotalaria retusa* L. var. *retusa*
* *Desmodium triflorum* (L.) DC.
Indigofera hirsuta L.
* *Macroptilium atropurpureum* (DC.) Urb.
* *Sesbania cannabina* (Retz.) Poir. var. *cannabina*
Vigna marina (Burm.f.) Merr.
FLACOURTIACEAE
* *Muntingia calabura* L.
GENTIANACEAE
Enicostema axillare subsp. *littorale* (Blume) A.Raynal
GOODENIACEAE
Scaevola taccada (Gaertn.) Roxb.
HERNANDIACEAE
Hernandia nymphaeifolia (C.Presl) Kubitzki
LAURACEAE
Cassytha filiformis L.
LECYTHIDACEAE
Barringtonia asiatica (L.) Kurz
LYTHRACEAE
Pemphis acidula J.R.Forst. & G.Forst.
MALVACEAE
Hibiscus tiliaceus L. subsp. *tiliaceus*
Thespesia populnea (L.) Sol. ex Corrêa
MIMOSACEAE
*! *Acacia farnesiana* (L.) Willd.
* *Leucaena leucocephala* (Lam.) de Wit
NYCTAGINACEAE
Boerhavia albiflora Fosberg
* *Boerhavia diffusa* L.
Boerhavia repens L.
Pisonia grandis R.Br.
OLACACEAE
Ximenia americana L.
PASSIFLORACEAE
* *Passiflora foetida* L.
PHYTOLACCACEAE
* *Rivina humilis* L.
PORTULACACEAE
* *Portulaca oleracea* L.
RHIZOPHORACEAE
Rhizophora apiculata Blume
RUBIACEAE
Guettarda speciosa L.
Morinda citrifolia L.
* *Oldenlandia corymbosa* L.
* *Spermacoce assurgens* Ruiz & Pav.
SAPINDACEAE
Dodonaea viscosa Jacq. subsp. *viscosa*
SAPOTACEAE
! *Planchonella nitida* (Blume) Dubard
SCROPHULARIACEAE
* *Scoparia dulcis* L.
* *Striga angustifolia* (D.Don) Saldanha
SOLANACEAE
* *Physalis minima* L.
* *Solanum americanum* Mill.
SURIANACEAE
Suriana maritima L.
TILIACEAE
Triumfetta repens (Blume) Merr. & Rolfe
TURNERACEAE
* *Turnera ulmifolia* L.
VERBENACEAE
Clerodendrum inerme (L.) Gaertn.
* *Phyla nodiflora* (L.) Greene
Premna serratifolia L.

* *Stachytarpheta jamaicensis* (L.) J.Vahl
* *Vitex trifolia* L.

MONOCOTYLEDONAE
ARECACEAE
Cocos nucifera L.
COMMELINACEAE
* *Rhoeo spathacea* (Sw.) Stearn
CYMODOCEACEAE
Syringodium isoetifolium (Asch.) Dandy
Thalassodendron ciliatum (Forssk.) Hartog
CYPERACEAE
Cyperus stolonifer Willd. ex Kunth
Fimbristylis cymosa R.Br.
Mariscus javanicus (Houtt.) Merr. & F.P.Metcalf
Pycreus polystachyos (Rottb.) P.Beauv.
Queenslandiella hyalina (Vahl) F.Ballard
HYDROCHARITACEAE
Thalassia hemprichii (Ehrenb.) Asch.
LILIACEAE
Crinum asiaticum L.
* *Zephyranthes rosea* (Spreng.) Lindl.
PANDANACEAE
e *Pandanus tectorius* var. *cocosensis* B.C.Stone
POACEAE
Apluda mutica L.
* *Bothriochloa bladhii* (Retz.) S.T.Blake
* *Brachiaria brizantha* (Hochst. ex A.Rich.) Stapf
* *Cenchrus ciliaris* L.
* *Cenchrus echinatus* L.
* *Chloris barbata* Sw.
* *Chrysopogon aciculatus* (Retz.) Trin.
* *Cynodon arcuatus* J.Presl & C.Presl
* *Cynodon dactylon* (L.) Pers.
* *Dactyloctenium aegyptium* (L.) Willd.
* *Desmostachya bipinnata* (L.) Stapf
Digitaria setigera Roth
* *Eleusine indica* (L.) Gaertn.
Eragrostis tenella (L.) P.Beauv. ex Roem. & Schult.
* *Eriochloa meyeriana* (Nees) Pilg.
* *Imperata cylindrica* (L.) P.Beauv.
Ischaemum muticum L.
Lepturopetium sp.
Lepturus repens (G.Forst.) R.Br.
Panicum repens L.
* *Sorghum bicolor* (L.) Moench
Sporobolus fertilis (Steud.) Clayton
Stenotaphrum micranthum (Desv.) C.E.Hubb.
Thuarea involuta (G.Forst.) R.Br. ex Roem. & Schult.
Zoysia matrella (L.) Merr. subsp. *matrella*

NORTH KEELING ISLAND

The flora of North Keeling Island is made up as follows:

Dicotyledons: 21 families (5 naturalised only), 23 genera (5 naturalised only) and 24 species (5 naturalised)

Monocotyledons: 3 families, 5 genera and 5 species.

MAGNOLIOPHYTA (flowering plants)

DICOTYLEDONAE
ACANTHACEAE
Dicliptera ciliata Decne.
AIZOACEAE
Sesuvium portulacastrum (L.) L.
AMARANTHACEAE
Achyranthes aspera L.
BORAGINACEAE
Argusia argentea (L.f.) Heine
Cordia subcordata Lam.
CAESALPINIACEAE
Caesalpinia bonduc (L.) Roxb.
CAPPARACEAE
Cleome gynandra L.
CARICACEAE
* *Carica papaya* L.
CLUSIACEAE
Calophyllum inophyllum L.
EUPHORBIACEAE
* *Acalypha lanceolata* Willd.
FABACEAE
Canavalia cathartica Thouars
Erythrina variegata L.
GOODENIACEAE
Scaevola taccada (Gaertn.) Roxb.
HERNANDIACEAE
Hernandia nymphaeifolia (C.Presl) Kubitzki
LYTHRACEAE
Pemphis acidula J.R.Forst. & G.Forst.
MALVACEAE
Sida acuta Burm.f.
NYCTAGINACEAE
Boerhavia albiflora Fosberg

Boerhavia repens L.
Pisonia grandis R.Br.
PHYTOLACCACEAE
* *Rivina humilis* L.
PORTULACACEAE
* *Portulaca oleracea* L.
RUTACEAE
* *Triphasia trifolia* (Burm.f.) P.Wilson
SAPINDACEAE
Allophylus cobbe (L.) Blume
SOLANACEAE
* *Physalis minima* L.
URTICACEAE
Laportea aestuans (L.) Chew
VERBENACEAE
Premna serratifolia L.

MONOCOTYLEDONAE
ARECACEAE
Cocos nucifera L.
HYDROCHARITACEAE
Thalassia hemprichii (Ehrenb.) Asch.
POACEAE
Lepturus repens (G.Forst.) R.Br.
Paspalum vaginatum Sw.
Stenotaphrum micranthum (Desv.) C.E.Hubb.

KEY TO FAMILIES

DICOTYLEDONAE

1 Leaves scale-like

2 Tree with whorled scale leaves; flowers unisexual; fruit compound, cone-like (Casuarina) **11. CASUARINACEAE**

2: Twiner with alternate scale leaves; flowers bisexual; fruit a berry (*Cassytha*) **2. LAURACEAE**

1: Leaf lamina developed

3 Leaves opposite or whorled

4 Leaves compound

5 Leaves 5–7-foliolate (sometimes 3-foliolate), digitate; ovary on a gynophore (*Cleome*) **32. CAPPARACEAE**

5: Leaves 3-foliolate (sometimes 1- or 2-foliolate); no gynophore present

6 Succulent herb (*Bryophyllum*) **38. CRASSULACEAE**

6: Shrub (*Vitex*) **71. VERBENACEAE**

4: Leaves simple or unifoliolate

7 Flowers solitary

8 Succulent herb (*Sesuvium*) **14. AIZOACEAE**

8: Shrub (*Pemphis*) **45. LYTHRACEAE**

7: Flowers not solitary, clustered or arranged in an inflorescence

9 Inflorescence a capitulum surrounded by involucral bracts **82. ASTERACEAE**

9: Inflorescence not as above (sometimes flowers in terminal clusters but then subtended by leaves, not bracts)

10 Milky latex present

11 Corolla with long tube; flowers white or pink (*Neisosperma*) **66. APOCYNACEAE**

11: Corolla lobes shortly united; flowers red and yellow (*Asclepias*) **67. ASCLEPIADACEAE**

10: Milky latex absent

12 Stipules interpetiolar, more than 1 cm long

13 Inflorescence of 2 flowers; fruit viviparous (*Rhizophora*) **49. RHIZOPHORACEAE**

13: Inflorescence of more than 2 flowers; fruit not viviparous **81. RUBIACEAE**

12: Stipules absent or if present less than 1 cm long

14 Flowers in racemes or panicles, sometimes reduced to glomerules but on peduncles more than 2 cm long

15 Petals free; stamens many (*Calophyllum*) **21. CLUSIACEAE**

15: Petals united; stamens 2–5

16 Calyx viscid; fruit an anthocarp (*Pisonia*) **13. NYCTAGINACEAE**

16: Calyx not viscid; fruit not viscid **71. VERBENACEAE**

14: Flowers in spikes, or in clusters, cymes or verticillasters on peduncles less than 2 cm long

17 Erect herb; lower leaves pinnatifid; upper leaves linear; flowers red (*Leonurus*)

17: Plant not as above

18 Flowers solitary in leaf or bract axil **76. SCROPHULARIACEAE**

18: Flowers not solitary in axils

19 Succulent herb; flowers yellow, in terminal clusters (*Portulaca*)

19: Non-succulent herb; flowers not as above

20 Leaves ±3-nerved; flowers ±regular (*Enicostemma*) **65. GENTIANACEAE**

20: Leaves not 3-nerved; flowers zygomorphic **77. ACANTHACEAE**

3: Leaves alternate

21 Leaves compound

22 Leaves 2-pinnate

23 Stamens 10 (*Caesalpinia*) **42. CAESALPINIACEAE**

23: Stamens many (*Acacia*) **41. MIMOSACEAE**

22: Leaves 1-pinnate or 3-foliolate (sometimes 1- or 2-foliolate leaves present)

24 Leaves glandular-dotted (*Triphasia*) **60. RUTACEAE**

24: Leaves not glandular-dotted

25 Leaves paripinnate (*Senna*) **42. CAESALPINIACEAE**

25: Leaves imparipinnate or 3-foliolate

26 Flowers unisexual; petals 4 (*Allophylus*) **57. SAPINDACEAE**

26: Flowers bisexual; petals 5 **43. FABACEAE**

21: Leaves simple or unifoliolate

27 Inflorescence of unisexual flowers in glandular cyathia (*Euphorbia*) **53. EUPHORBIACEAE**

27: Inflorescence not as above

28 Inflorescence a capitulum surrounded by involucral bracts **82. ASTERACEAE**

28: Inflorescence not as above (sometimes flowers interminal clusters but then subtended by leaves, not bracts)

29 Plant a tendril-bearing climber; calyx much divided (*Passiflora*) **29. PASSIFLORACEAE**

29: Plant not as above

30 Leaves glandular-dotted (*Triphasia*) **60. RUTACEAE**

30: Leaves not glandular-dotted

31 Flowers usually unisexual

32 Leaves more than 19 cm long

33 Leaves entire, peltate (*Hernandia*) **3. HERNANDIACEAE**

33: Leaves deeply lobed (*Carica*) **30. CARICACEAE**

32: Leaves less than 10 cm long

34 Fruit 3-winged (*Dodonaea*) **57. SAPINDACEAE**

34: Fruit not 3-winged

35 Inflorescence with flowers in glomerules along a zig-zag axis; stinging hairs present (*Laportea*)

35: Inflorescence not as above; stinging hairs absent **53. EUPHORBIACEAE**

31: Flowers bisexual

36 Ovary apocarpous, of 3 or more ±free carpels (sometimes coalescing in fruit)

37 Leaves grey, puberulous (*Suriana*) **40. SURIANACEAE**

37: Leaves green, glabrous (*Annona*) **1. ANNONACEAE**

36: Ovary syncarpous or carpel 1

38 Perianth segments of lobes 6 or fewer (counting both sepals and petals if present)

39 Inflorescence a dense woolly spike (*Aerva*) **15. AMARANTHACEAE**

39: Inflorescence not as above

40 Perianth base and fruit viscid **13. NYCTAGINACEAE**

40: Perianth base and fruit not viscid (*Terminalia*) **47. COMBRETACEAE**

38: Perianth segments or lobes more than 6

41 Corolla lobes fused or partly fused into a tube (sometimes only several mm long or slit on one side)

42 Corolla lobes 4 (*Ximenia*) **50. OLACACEAE**

42: Corolla lobes 5

43 Corolla tube narrowly cylindrical, at least 10 x as long as wide; herb with milky latex (*Hippobroma*)

43: Corolla tube not as above; latex absent, or if present plant woody

44 Flowers zygomorphic

45 Shrub; leaves broad; corolla tube slit on one side **(*Scaevola*)**

45: Herb; leaves linear; corolla tube 2-lipped (*Striga*) **76. SCROPHULARIACEAE**

44: Corolla ±regular

46 Stamens united into a staminal tube **24. MALVACEAE**

46: Stamens not united

47 Trees or shrubs

48 Inflorescence a terminal panicle or pedunculate axillary cyme

48: Inflorescence an axillary cyme, sometimes borne at a leaf scar (*Planchonella*)

47: Herbaceous plants

49 Plant long trailing or climbing; corolla more than 4 cm long (Ipomoea)

49: Plant ±erect, neither long trailing nor climbing; corolla less than 2 cm long

41: Corolla of free petals

50 Flowers strongly zygomorphic **43. FABACEAE**

50: Flowers ±regular

51 Petals 4

52 Fruit elongate, dry, dehiscent **33. BRASSICACEAE**

52: Fruit a ±globose berry (*Rivina*) **12. PHYTOLACCACEAE**

51: Petals 5

53 Stamens 5 (*Turnera*) **28. TURNERACEAE**

53: Stamens 7–many

54 Plant herbaceous; petals yellow

55 Succulent herb; leaves entire, glabrous (Portulaca) **16. PORTULACACEAE**

55: Trailing herb; leaves dentate, stellate-hairy (*Triumfetta*)

54: Shrub or tree; petals white

56 Leaves serrate; fruit a ±globose berry (*Muntingia*) **26. FLACOURTIACEAE**

56: Leaves entire; fruit angular, fibrous (Barringtonia) **25. LECYTHIDACEAE**

MONOCOTYLEDONAE

1 Palms or palm-like trees

2 Leaves simple, strap-like; margins sharply serrate or spiny (*Pandanus*) **86. PANDANACEAE**

2: Leaves pinnate (*Cocos*) **85. ARECACEAE**

1: Herbs

3 Plants of marine habitats

4 Leaf sheath auriculate **84. CYMODOCEACEAE**

4: Leaf sheath not auriculate (*Thalassia*) **83. HYDROCHARITACEAE**

3: Plants of land habitats

5 Perianth segments petaloid

6 Flowers enclosed in a boat-shaped spathe (*Rhoeo*) **88. COMMELINACEAE**

6: Flowers not in a boat-shaped spathe **93. LILIACEAE**

5: Perianth segments not petaloid

7 Leaves ligulate at sheath-lamina junction **91. POACEAE**

7: Leaves not ligulate **90. CYPERACEAE**

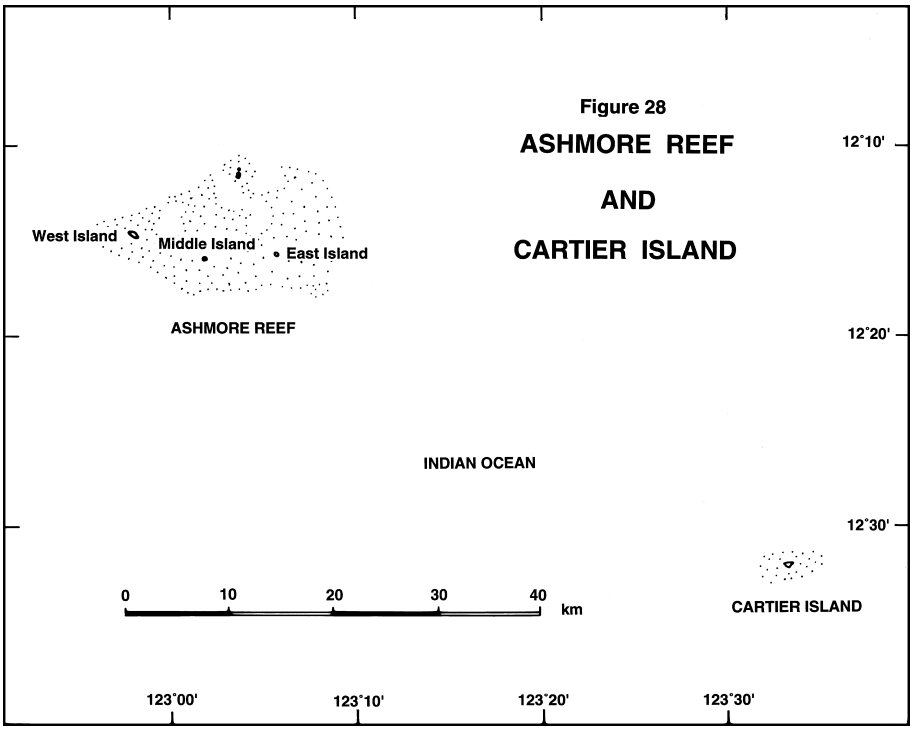
ASHMORE REEF AND CARTIER ISLAND

Kevin F.Kenneally

ASHMORE REEF

Ashmore Reef National Nature Reserve (12°17'S, 123°02'E), occupying an area of approximately 58 300 ha, lies on the outer edge of the Sahul Shelf in the Timor Sea approximately 500 km north of Derby, Western Australia. The Reef was first sighted in 1811 by Samuel Ashmore, commander of the ship *Hibernia,* and originally charted as Ashmore's Shoal. The reef consists of coral and sand, with three, low, vegetated, uninhabited islands and several sandbanks supporting seagrass meadows which are exposed at low tide. Great Britain took formal possession of Ashmore Reef in 1878, and Cartier Is. was annexed in 1909. By Imperial Order in Council of 23 July 1931, the islands were placed under the authority of the Commonwealth of Australia. They were accepted by the Commonwealth, through the Ashmore and Cartier Islands Acceptance Act 1933, under the name of the Territory of Ashmore and Cartier Islands. An amendment to the Act in July 1938 annexed the islands to the Northern Territory. They were declared a National Nature Reserve on 16 Aug. 1983.

The islands are important breeding colonies for a rich diversity of ocean-going seabirds such as the Brown Booby (*Sula leucogaster* (Boddaert)), Common Noddy (*Anous stolidus* (Linnaeus)) and Lesser Frigate Bird (*Fregata ariel* (Gray)). The seabirds have been responsible for the blanket of phosphate-rich soil that covers most of the islands. During the last century the islands were mined for their guano deposits but no records survive of the operations. Large flocks of migratory waders, including Whimbrels (*Numenius phaeopus* (Linnaeus) and Ruddy Turnstones (*Arenaria interpres* Linnaeus), have been recorded on reefs adjacent to the islands.



The islands may also be important breeding sites for Green Turtles (*Chelonia mydas* (Linnaeus)) and the occasional Hawksbill Turtle (*Eretmochelys imbricata* (Linnaeus)) although the Green Turtle population appears to have declined due to increased numbers being harvested by fishermen for food.

The Ashmore Reef has been a traditional fishing ground of Indonesians who operate seasonally and extensively along the northern Australian coastline. The activities of fisherman landing on the islands, exploiting the wildlife and utilising the larger shrubs as drying racks for fish and clam meat or for use as firewood has been monitored for some time by the Royal Australian Navy and Australian Fisheries officers. The planting on the islands of Coconut Palms (*Cocos nucifera*) and maize (*Zea mays*) is directly attributable to landings by the Indonesians. A Memorandum of Understanding between the Indonesian and Australian Governments has been signed restricting landings by fishermen except for the taking of water from the wells on the islands. Another human impact is the presence of offshore navigation and oil exploration personnel camping on the islands.

The disturbance associated with the past mining of guano, visits by Indonesian fisherman, the seasonal occurrence of cyclones (with their associated storm surges) and fire appear to be the major influences on the patterns of vegetation on the islands. Other influences impacting on the vegetation include birds nesting, turtles excavating egg laying chambers, burrowing by land crabs and the occurrence of feral rats (*Rattus rattus* (Linnaeus)) and mice (*Mus musculus* Linnaeus) which burrow and eat seeds.

The colonies of seabirds which nest on the island utilise different habitats. Reef Herons (*Egretta sacra* (Gmelin)) prefer the taller dried *Sesbania* thickets to build their substantial nests whilst Little Egrets (*Egretta garzetta* (Linnaeus)) build low platform nests on the *Tribulus* herbland. Brown Boobies tend to harvest *Amaranthus* and drift seaweed to construct a shallow nest on the limestone pavement. Lesser Frigate Birds build nests on *Spinifex* hummocks or on low shrubs of *Argusia*.

Rats were first recorded on the islands in 1949 and since that time both rats and mice have been recorded as either scarce or in plague proportions. When the author visited in 1977 the rodent population had almost been eliminated due to their predation by a large number of nomadic Letter-winged Kites (*Elanus scriptus* Gould) that had taken up residence on the islands.

The vegetation is extremely vagile with a high probability of seeds and other propagules being carried by the sea, wind and birds, or, as in the case of maize and coconuts, introduced by persons landing on the islands.

The three vegetated islands on the reef are East, Middle and West Islands.

East Island

East Is. is approximately 560 m long and 350 m wide and consists mainly of sand. Storm beaches and sand ridges fringe some of the rocky-shores above high tide level on the northern shore. Located in the centre of the island are two wells (one abandoned) and four graves. The vegetation is dominated by grasses and creepers. On the sand ridges fringing the island *Spinifex littoreus* and *Lepturus repens* occur, as do occasional shrubs of *Argusia argentea* and *Cordia subcordata*. The northern end of the island supports the woody herb *Sesbania cannabina* over a ground layer of the grasses *Digitaria mariannensis*, *Cenchrus ciliaris*, and *C. brownii*. At the southern end of the island *Sesbania cannabina* also occurs in association with *Tribulus cistoides*, *Boerhavia* spp., *Amaranthus interruptus* and patches of *Digitaria mariannensis*.

Middle Island

Middle Is. is approximately 480 m long and 350 m wide, sandy and gently undulating. On the island are a well and two graves, one at the eastern end, the other at the western end. Shrubs of *Guettarda speciosa*, *Scaevola taccada*, *Suriana maritima* and *Argusia argentea* occur behind the sand ridges fringing the shore. On high ground directly behind the dunes are patches of *Tribulus cistoides*. Dense thickets of *Sesbania cannabina* have been recorded

but *Amaranthus interruptus* dominates most of the island after fire. Discrete patches of the grasses *Cenchrus* spp., *Digitaria mariannensis* and *Lepturus repens* occur, often interspersed with the herbs *Sida pusilla*, *Boerhavia* spp. and *Tribulus cistoides*.

West Island

West Is. is the largest island, being approximately 1 km long and 450 m wide. There are extensive outcrops of beach rock along the shoreline, and sand ridges are common fringing the perimeter of the island. The surface is generally flat. There are remnants of an abandoned weather station, a grave, and a well where Indonesian fishermen obtain drinking water. Of the three islands the vegetation of West Is. is the most uniform. Behind the sand ridges is a fringe of the shrubs *Argusia argentea* and *Cordia subcordata* interspersed with clumps of *Spinifex littoreus* and *Portulaca pilosa*. The creepers *Ipomoea pes-caprae* subsp. *brasiliensis* and *I. macrantha* form dense swards directly behind the sand ridges, often scrambling over the fringing shrub species. The centre of the island supports dense stands of *Sida pusilla* with *Digitaria mariannensis* and *Boerhavia* spp.

CARTIER ISLAND

Cartier Is. (12°32'S, 123°33'E) was named in 1800 after the ship *Cartier* and lies 46 km south-east of Ashmore Reef. Its charted position was amended after hydrographic survey in 1878 by Lieutenant William Tooker in the schooner *Airlie*, and published in the Western Australian Government Gazette of 4 November 1879. It is a platform reef in the centre of which is an unvegetated sand cay. A stranded shipwreck lies on the S edge of the reef and the remains of a Royal Australian Airforce Beaufigher aircraft which force-landed near the island in 1942 can be seen at low tide. The only flowering plant recorded is the seagrass *Thallassia hemprichii* which forms dense meadows in the sand pockets in the fringing reef.

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ASHMORE REEF SPECIES LIST

The flora of Ashmore Reef is made up as follows:

Dicotyledons: 13 families (1 naturalised only), 14 genera (1 naturalised only) and 19 species (2 naturalised)

Monocotyledons: 3 families, 9 genera and 8 species (2 naturalised).

(Species marked with a dagger (+) are introduced but not naturalised and are not treated further in this work; * = naturalised taxon).

MAGNOLIOPHYTA (flowering plants)

DICOTYLEDONAE
AMARANTHACEAE
Amaranthus interruptus R.Br.
BORAGINACEAE
Argusia argentea (L.f.) Heine
Cordia subcordata Lam.
CAPPARACEAE
Cleome gynandra L.
CONVOLVULACEAE
Ipomoea macrantha Roem. & Schult.
Ipomoea pes-caprae subsp. *brasiliensis* (L.) Ooststr.
FABACEAE
* *Sesbania cannabina* (Retz.) Poir. var. *cannabina*
GOODENIACEAE
Scaevola taccada (Gaertn.) Roxb.
LAURACEAE
Cassytha filiformis L.
MALVACEAE
Sida pusilla Cav.
NYCTAGINACEAE
Boerhavia albiflora Fosberg
Boerhavia burbidgeana Hewson
Boerhavia glabrata Blume
Boerhavia repens L.
PORTULACACEAE
* *Portulaca oleracea* L.
Portulaca tuberosa Roxb.
RUBIACEAE
Guettarda speciosa L.
SURIANACEAE
Suriana maritima L.
ZYGOPHYLLACEAE
Tribulus cistoides L.

MONOCOTYLEDONAE
ARECACEAE
\+ *Cocos nucifera* L.
HYDROCHARITACEAE
Thalassia hemprichii (Ehrenb.) Asch.
POACEAE
* *Cenchrus brownii* Roem. & Schult.
* *Cenchrus ciliaris* L.
Digitaria mariannensis Merr.
Eragrostis elongata (Willd.) J.Jacq.
Lepturus repens (G.Forst.) R.Br.
Spinifex littoreus (Burm.f.) Merr.
Sporobolus virginicus (L.) Kunth
\+ *Zea mays* L.

CARTIER ISLAND SPECIES LIST

MONOCOTYLEDONAE
HYDROCHARITACEAE
Thalassia hemprichii (Ehrenb.) Asch.

ASHMORE REEF

KEY TO FAMILIES

MAGNOLIOPHYTA

1 Herbs with leaf venation ±parallel, longitudinal (Monocotyledonae)
- **2** Marine plants; leaves elliptic (*Thalassia*) — **83. HYDROCHARITACEAE**
- **2:** Land plants; leaves linear — **91. POACEAE**

1: Plants not as above (Dicotyledonae)
- **3** Leaves opposite
  - **4** Leaves compound (*Tribulus*) — **61. ZYGOPHYLLACEAE**
  - **4:** Leaves simple
    - **5** Stipules present, interpetiolar (*Guettarda*) — **81. RUBIACEAE**
    - **5:** Stipules absent
      - **6** Inflorescence head-like or paniculate (*Boerhavia*) — **13. NYCTAGINACEAE**
      - **6:** Inflorescence a spike (*Achyranthes*) — **15. AMARANTHACEAE**

3: Leaves alternate

7 Leaves compound

8 Leaves pinnate (*Sesbania*) **43. FABACEAE**

8: Leaves 5-digitate (*Cleome*) **32. CAPPARACEAE**

7: Leaves simple

9 Plant parasitic; leaves scale-like (*Cassytha*) **2. LAURACEAE**

9: Plant not parasitic; leaves well-developed

10 Perianth of scarious tepals (*Amaranthus*) **15. AMARANTHACEAE**

10: Perianth of calyx and corolla

11 Ovary of several free carpels (*Suriana*) **40. SURIANACEAE**

11: Ovary syncarpous (*Portulaca*) **16. PORTULACACEAE**

12 Flowers zygomorphic, opened out like a hand (*Scaevola*) **80. GOODENIACEAE**

12: Flowers regular

13 Stamens many, united in a staminal tube (*Sida*) **24. MALVACEAE**

13: Stamens 5, inserted on corolla tube

14 Trailing or twining plant; flowers more than 5 cm diam. (*Ipomoea*)

14: Shrub or small tree: flowers less than 3 cm diam. **70. BORAGINACEAE**

CARTIER ISLAND

Thalassia hemprichii is the only vascular plant on Cartier Island.

CORAL SEA ISLANDS TERRITORY

I.R.H.Telford

GEOGRAPHIC LOCATION

The Coral Sea Island Territory comprises some 46 cays in the south-western Coral Sea between latitudes 16° and 23°S and longitudes 148° and 156°E. Closest to mainland Australia is Cato Is., lying 280 km north-east of Sandy Cape, Queensland, while New Caledonia lies some 900 km to the east-north-east.

PHYSIOGRAPHY AND GEOLOGY

The sea-floor topography of the Coral Sea is complex, related to rifting off New Caledonia and associated rises from continental Australia. The north-western Coral Sea islands, including Willis Is., Magdelaine Cays, Herald Cays, Diamond Islands and Lihou Reef, are the emergent tops of reef platforms that have developed on the higher parts of submarine plateaus off the north-eastern Australian continental shelf – Queensland or Coral Sea Plateau, the Marion Plateau and the western edge of the Bellong Plateau. These plateau bases are continental in nature whereas the Coral Sea Basin is of oceanic crust. The Queensland Plateau is separated from the Great Barrier Reef continental shelf and the

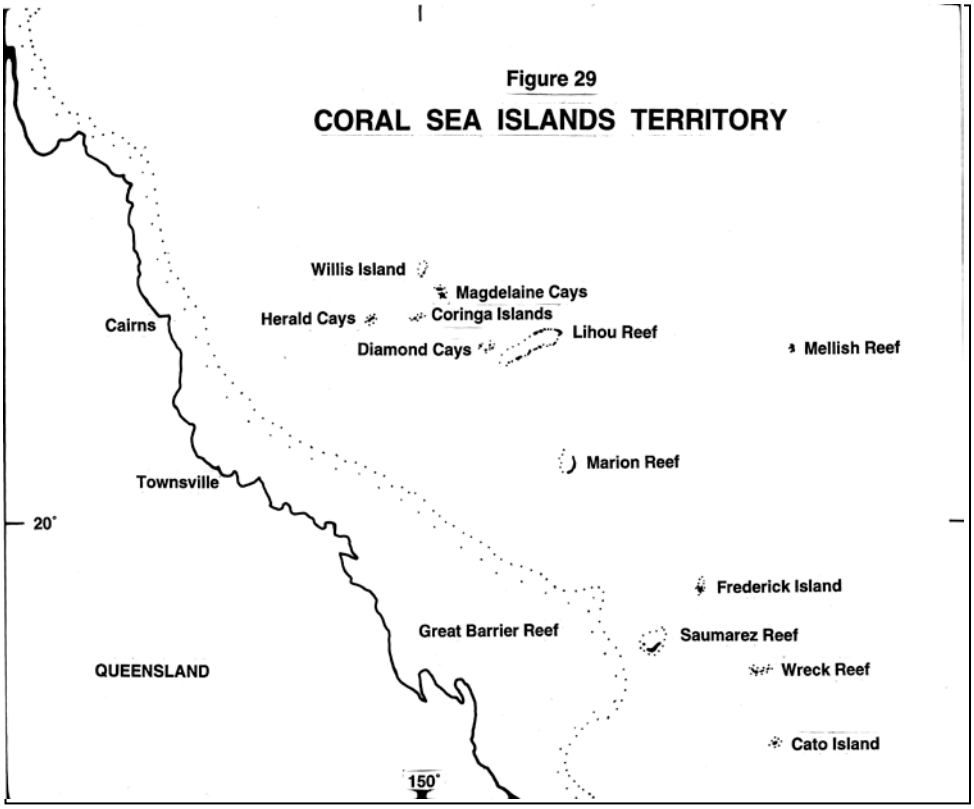
Marion Plateau by the Queensland and Townsville Troughs. After rifting, the plateau started to subside in the middle Eocene, and now lies at a depth of c. 1500 m.

The south-eastern islands of the Coral Sea, lying off the continental base of the Queensland and Marion Plateaus, have a different origin. Wreck Reef and Cato Is. rise steeply from depths of c. 3000 m on the eastern side of the Cato Trough. Frederick Is. rises at the foot of the slope from the Marion Plateau on the western margin of the trough, with Mellish Reef at the trough's northern end. The alignment of these islands with the chain of guyots in the Tasman Sea midway between continental Australia and the Middleton Ridge, together with associated magnetic anomalies, suggest a volcanic origin for their cores. Accumulation of coralline and algal limestone, coral rubble and sand has built cays and atolls.

The extensive reef areas or 'banks' have the general form of large atolls (shelf atolls) with emergent islets. Sand cays have developed on some northern, southern and western bank margins. Most of the cays reach only 1–3 m above high water mark. Those supporting shrubs and trees have a central 'plateau' area c. 4 m high. The highest point is 5 m on the SE Cay, Magdelaine Cays.

SOILS

Soils have been derived almost entirely from coralline and algal limestone and other coralline material with some localised guano accumulation. On the vegetated cays, organic accumulation occurs to a limited extent, except under the closed forest and shrublands of the Coringa and Herald cays.



CLIMATE

Lying just within the Tropical Zone and with the oceanic influence, the islands experience low daily and annual temperature variation. The average summer maximum is 31°C; the average winter minimum 21°C.

The prevailing winds are the south-east trades, which are fairly constant in direction and intensity from May to November. During summer, the trade wind belt is displaced southwards by the intertropical convergence zone to between 10° and 30° S. Resulting low pressure cells cause NW monsoonal winds from December to February. Some tropical depressions deepen to cyclones. On average, 2 or 3 cyclones per year affect the Territory, mainly between December and April. These data are for Willis Is., the most northerly of the Territory at 16°S 150°E, where a weather station has been located since 1922. Eight automatic weather stations are now maintained in the Territory.

VEGETATION

Of the 46 cays, only 22 support land plants. Most of the vegetated cays support only herbfields with shrub and low forest communities occurring only on Coringa Is., Chilcott Is. and Herald and Magdelaine Cays. North-eastern Cay of Herald Cays exhibits the most varied vegetation and floristics with 16 vascular species present.

LITTORAL HERBFIELDS

A littoral herbfield occurs as a narrow fringe at beach tops on most islands with dominant species the grasses *Lepturus repens*, *Stenotaphrum micranthum* and *Sporobolus virginicus*. On the lower cays (below 3 m above sea level) herbfield may dominate the whole cay. Additional species include *Boerhavia albiflora*, the grasses *Thuarea involuta* and *Digitaria ctenantha*, *Achyranthes aspera*, *Portulaca oleracea* and *Tribulus cistoides*. The trailing *Ipomoea pes-caprae* and *Canavalia rosea* are infrequent. Examples occur on Bird Island of Wreck Reef and Beacon Island, Mellish Reef. Some cays support depauperate herbfields. On Willis Is., for example, only 3 indigenous species have been recorded – *Sporobolus virginicus*, *Boerhavia albiflora* and *Tribulus cistoides* and the introduced weed *Euphorbia heterophylla*. Porpoise Cay, Wreck Reef, supports only *Boerhavia albiflora* and *Portulaca oleracea*.

The herbfields appear to be dynamic in species composition and dominance. Cays awash during cyclones may have their vegetation totally removed. Between 1961 and 1967, SW Cay, Saumeraz Reef, lost its *Boerhavia albiflora* patch.

SHRUB COMMUNITY

Open strand shrub community: On cays above 3 m above sea level, a leeward strand open shrub fringe of *Argusia argentea* to 3 m tall usually occurs behind the beach-top herbfield. Further in, scattered shrubs such *Abutilon indicum*, *Sesbania cannabina* and *Plumbago zeylanica* may form low open shrub communities such as on Coringa Is.

SHRUB–LOW FOREST COMMUNITY

On the higher cays (3–5 m above sea level), a more or less closed shrubland or low forest may occur on the central 'plateau'. *Argusia argentea*, *Pisonia grandis* and *Cordia subcordata* may form a shrub community as on Chilcott Is. Low closed forest to 10 m tall dominated by *Pisonia grandis* occurs on NE Cay of the Herald Cays. *Cordia subcordata* and twining *Ipomoea macrantha* are other components. *Ipomoea macrantha* may form a dense

cover scrambling over the forest canopy, particularly on the wind stunted forest margin, as on NE Cay of the Herald Cays.

MARINE COMMUNITY

No marine angiosperms have been recorded for the Territory.

FLORISTICS

Fifteen families of vascular plants have been recorded for the cays, of which 1 is represented by a single naturalised species. Genera number 20 (1 introduced) and species 23 (1 introduced). There is no endemic species. Phytogeographic relationships clearly lie with the littoral floras of the tropical western Pacific Ocean.

Several species recorded for the Territory are erroneous or cannot be substantiated by voucher specimens. *Amaranthus viridis* L. (Amaranthaceae) was listed for Bird Island, Wreck Reef and *Thuarea involuta* for Turtle Is., Lihou Reef, by H.Heatwole, *Report on Fauna and Flora of the Islands of the Coral Sea Islands Territory* (1979), unpublished ANPWS. *Suaeda australis* (R.Br.) Moq. (Chenopodiaceae) was recorded for Chilcott Is. in the ANPWS Coringa-Herald National Nature Reserve Plan of Management (1988). These three records cannot be substantiated by voucher specimens.

Two records in K.A.Hindwood *et al.* (1963) are erroneous: *Excoecaria agallocha* L. (Euphorbiaceae) recorded on Herald Cays is *Ximenia americana*. *Operculina turpethum* (L.) Silva Manso (Convolvulaceae) recorded for Herald and Coringa Islands is apparently a misdetermination of *Ipomoea macrantha*.

Trachymene cussonii (Montrouz.) Burtt and *Boerhavia fistulosa* Fosberg have been recorded from adjacent coral cays of the Great Barrier Reef, Qld. As yet they have not been collected from the Coral Sea Island Territory but may occur there.

USEAGE

The Coral Sea Cays are the breeding sites of at least 11 species of seabirds. Red-footed Boobies (*Sula sula rubripes* Gould) and Noddy Terns (*Anous* spp.) usually nest in trees or shrubs, using *Pisonia grandis* and *Argusia argentea*.

HISTORY

Discovery of the islands of the Coral Sea Islands Territory began in August, 1803, when Cato Is. was sighted and named after H.M.S. *Cato*, one of a 3 ship convoy returning to Britain from Port Jackson. The other vessels were H.M.S. *Bridgewater* and H.M.S. *Porpoise*, the latter carrying Captain Matthew Flinders and a valuable botanical cargo - Robert Brown's Australian collection of dried and living plants. On 17 August 1803, the *Porpoise* and *Cato* were wrecked on Wreck Reef with a loss of 3 crew. Flinders wrote in *A Voyage to Terra Australia* (1814): 'The rare plants collected in ... Terra Australis, for His Majesty's botanic garden at Kew, ... were totally destroyed by the salt water; as were the dried specimens of plants.' Fortunately for science, the specimens were the top set and Brown had retained a duplicate set at Port Jackson.

In 1845, the *Coringa* packet was wrecked on the islets that now bear its name. H.M.S. *Herald* under the command of Captain M.H.Denham undertook hydrographic surveys for the Royal Navy between 1854 and 1860, when the Herald Islands were named. Magdelaine Cays were discovered in 1865 by the crew of the *Duroc* which had been wrecked on Mellish Reef.

During the 1860s the guano deposits on Bird Island, Wreck Reef, were exploited by the Anglo-Australian Guano Company for a year.

The only habitation of the islands, apart from transient camps, is at the Meteorological Station on Willis Is., established in 1922.

The Coringa - Herald National Nature Reserve including the Herald Cays, Coringa Islands and Magdelaine Cays, and Lihou Reef National Nature Reserve were gazetted under the National Parks and Wildlife Conservation Act 1975 on 16 August 1982.

COLLECTORS

The earliest plant collection from the Coral Sea Islands Territory was made in 1858–1859 by Captain H.M.Denham of H.M.S. *Herald*, and Dr Rayner, ship's surgeon, during hydrographic surveys for the Royal Navy. These collections, from Cato Is. in November 1858 and Bird Island, Wreck Reef, in 1859, are housed at K.

The first comprehensive collections were made in 1960–1961 when 2 scientific expeditions (principally ornithological) were mounted by the Australian Museum and the Division of Wildlife Research, CSIRO. Personnel were K.A.Hindwood and D.F.McMichael of the Australian Museum and D.L.Serventy and K.Keith of CSIRO - K.Keith as botanical collector. Specimens are housed at CANB.

The Australian National Parks and Wildlife Service has undertaken biological surveys in the Territory since 1967. Between 1967 and 1979, H.Heatwole, Associate Professor, Department of Zoology, University of New England, studied the fauna and flora under a consultancy contract. Heatwole's botanical collections are housed at BRI. Field trip personnel for ANPWS surveys after 1979 and locations of specimens are: J.Hicks (CANB, CBG) A.Stokes (CANB, CBG), S.Hogg (CANB, CBG) G.Shaunnessy (CBG), and T.Scotney (CBG).

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CORAL SEA ISLANDS TERRITORY SPECIES LIST

The flora of the Coral Sea Islands is made up as follows:

Dicotyledons: 15 families (4 naturalised only), 18 genera (4 naturalised only) and 20 species (4 naturalised)

Monocotyledons: 1 family, 6 genera (1 naturalised only) and 6 species (1 naturalised).

(^ Recorded by H.Heatwole, *Report on Fauna and Flora of the Islands of the Coral Sea Islands Territory* (1979), unpublished ANPWS, but no specimens have been located; * = naturalised taxon).

MAGNOLIOPHYTA (flowering plants)

DICOTYLEDONAE

AMARANTHACEAE
Achyranthes aspera L.

ASTERACEAE
* *Tridax procumbens* L.

BORAGINACEAE
Argusia argentea (L.f.) Heine
Cordia subcordata Lam.

BRASSICACEAE
* *Coronopus integrifolius* (DC.) Spreng.

CLUSIACEAE
Calophyllum inophyllum L.

CONVOLVULACEAE
Ipomoea macrantha Roem. & Schult.
Ipomoea pes-caprae subsp. *brasiliensis* (L.) Ooststr.

EUPHORBIACEAE
* *Euphorbia cyathophora* Murray

FABACEAE
Canavalia rosea (Sw.) DC.

GOODENIACEAE
Scaevola taccada (Gaertn.) Roxb.

MALVACEAE
Abutilon asiaticum var. *australiense* (Hochr. ex Britten) Fosberg

NYCTAGINACEAE
Boerhavia albiflora Fosberg
Boerhavia glabrata Blume
^ *Commicarpus insularum* Meikle
Pisonia grandis R.Br.

OLACACEAE
Ximenia americana L.

PLUMBAGINACEAE
Plumbago zeylanica L.

PORTULACACEAE
* *Portulaca oleracea* L.

ZYGOPHYLLACEAE
Tribulus cistoides L.

MONOCOTYLEDONAE

POACEAE
* *Cynodon dactylon* (L.) Pers.
Digitaria ctenantha (F.Muell.) Hughes
Lepturus repens (G.Forst.) R.Br.
Sporobolus virginicus (L.) Kunth
Stenotaphrum micranthum (Desv.) C.E.Hubb.
^ *Thuarea involuta* (G.Forst.) R.Br. ex Roem. & Schult.

KEY TO FAMILIES

MAGNOLIOPHYTA

1 Grass; leaf venation ±parallel (Monocotyledonae) **91. POACEAE**

1: Plant not as above (Dicotyledonae)

2 Leaves opposite

3 Leaves pinnate (*Tribulus*) **61. ZYGOPHYLLACEAE**

3: Leaves simple

4 Inflorescence a spike (*Achyranthes*) **15. AMARANTHACEAE**

4: Inflorescence head-like or paniculate **13. NYCTAGINACEAE**

2: Leaves alternate

5 Leaves 3-foliolate (*Canavalia*) **43. FABACEAE**

5: Leaves simple, sometimes deeply pinnatisect

6 Flowers solitary

7 Plant minutely stellate-hairy; stamens united into a column (*Abutilon*) **24. MALVACEAE**

7: Plant glabrous; stamens not united

8 Trailing or twining herb; corolla long-tubular (*Ipomoea*) **69. CONVOLVULACEAE**

8: Succulent herb; petals free (*Portulaca*) **16. PORTULACACEAE**

6: Flowers grouped in an inflorescence

9 Leaves pinnatisect; inflorescence an umbel (!*Trachymene*) **64. APIACEAE**

9: Leaves entire (sometimes basal leaves pinnatisect but then inflorescence not umbellate); inflorescence a raceme or panicle

10 Herb (*Coronopus*) **33. BRASSICACEAE**

10: Shrub or tree

11 Fruit, flower base or persistent calyx with stalked sticky glands

12 Inflorescence a panicle; flower base and fruit glandular (*Pisonia*) **13. NYCTAGINACEAE**

12: Inflorescence a raceme; calyx glandular (*Plumbago*) **20. PLUMBAGINACEAE**

11: Fruit or flowers not sticky glandular

13 Corolla bearded inside; ±spinescent shrub (*Ximenia*) **50. OLACACEAE**

13: Corolla glabrous; unarmed shrub or tree **70. BORAGINACEAE**

! not yet recorded for the Coral Sea Islands Territory but may occur there.

SUBANTARCTIC ISLANDS

R.J.Hnatiuk

MACQUARIE ISLAND

Macquarie Is. and Heard Is. are Australia's subantarctic islands. Together they provide a fascinating comparison and contrast of terrestial life in the vast stretches of the Southern Ocean. The major contrasting feature affecting life on the islands is the fact that Macquarie Is. occurs about 240 km north of the 'Antarctic convergence', on the warmer side, while Heard Is. occurs just to the south, on the colder side.

The Antarctic convergence (sometimes known as the Oceanic Polar Front) is that narrow circumpolar region where cold surface water flowing north-eastwards from Antarctica meets and sinks beneath warmer, southward-moving surface water. The temperature difference is only about 2°C, but the impact on biota is profound.

Macquarie Is. lies in about 54°S latitude and 159°E longitude about 1500 km south-southeast of Tasmania and about half way between Australia and Antarctica. The southern ocean stretches for thousands of kilometres to the east and west. The vast expanse of water which isolates the island from other land also ameliorates the air temperature. This together with the fact that Macquarie Is. is one of the cloudiest places on earth results in a climate where average air temperatures vary annually by only 4–4.5°C from mid winter to mid summer. The daily fluctuation of temperatures is also small, on average 1–1.5°C. The island receives only about 18% of the potential solar radiation. Lying as it does in the 'furious fifties', as sailors once called the area, Macquarie Is. experiences seemingly ceaseless strong winds. Precipitation (c. 1050 mm annually) falls on more than 320 days of the year, nearly all as light showers, but occasionally heavy falls occur. Snow occurs in most years, but characteristically disappears in a few days especially at sea level. There are no glaciers. The lakes on the plateau have frozen over in some years.

Macquarie Is. is believed to represent a block of oceanic crustal material, formed in the Upper Oligocene, c. 27 million years ago. The highest points may have emerged from the sea between 200,000 and 90,000 years ago. There are small lava flows of submarine origin but there is no evidence of recent subaerial volcanism. Limited areas of limestone also occur. Soils are essentially skeletal (mineral soil) at high altitude or highly organic loam or

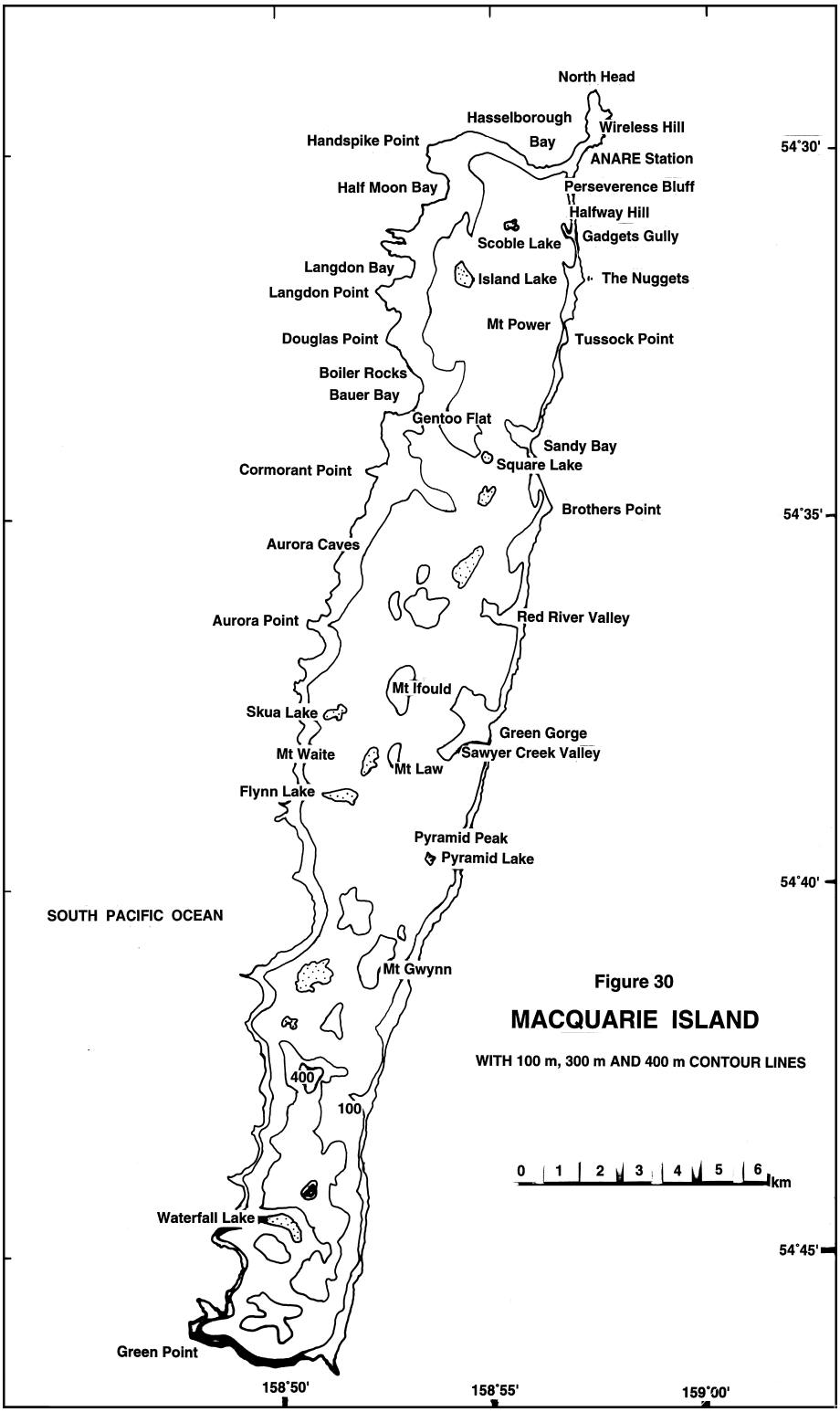

Figure 30

MACQUARIE ISLAND

WITH 100 m, 300 m AND 400 m CONTOUR LINES

peat at low altitude. The low temperatures and perpetual moisture ensure slow decomposition of plant material. On low altitude terraces, peat has accumulated to at least 5–6 m depth in some areas. Landslides occur occasionally on steep slopes where the waterlogged organic soil becomes unstable. Intense grazing by the introduced rabbit destroys most of the 'normal' plant cover and may have contributed to landslips in recent times. Substantial amounts of salt and nutrients including nitrogen and phosphorus are brought in from the ocean by precipitation, wind, and in localised areas by animals such as seabirds and seals.

The island is long and narrow, aligned north–south, about 35 km long and 3 km at its widest. It rises abruptly from the ocean floor. There is a narrow beach and terrace that abut the steeply rising slopes leading to an undulating plateau at about 200–300 m altitude with occasional peaks to 350 m. A number of fresh water lakes occur on the plateau.

The possible role of glaciation in shaping Macquarie Is. has been a matter of much debate, opinions ranging from virtually complete glaciation through to virtually none. The most recent information favours little or no significant Pleistocene glaciation. No glaciers are present now and snow seldom lasts on the ground for more than a week.

Early sailors commented on the greenness of Macquarie Is. which is in strong contrast with other subantarctic islands where the vegetation is predominantly drab yellow-brown. In part, this colour difference is due to the dominant tussock grass on Macquarie Is., *Poa foliosa*. This species has a broad leaf and lacks the long, persistent, dead leaf tips which give the brownness to other tussock grasses in the region. It is noteworthy that the large tussocks on Macquarie Is. and some other subantarctic islands appear to have a very high rate of growth.

The vegetation of Macquarie Is. is commonly classified under five formations: grassland, herbfield, fen, bog and fellfield. The most extensive formation is fellfield. It occurs in most areas above 180 m altitude where wind exposure is high. The vegetation is dominated by the dwarf shrub *Azorella macquariensis* and the moss *Rhacomitrium crispulum* (Hook.f. & Wils.) Hook.f. & Wils. and frequently grows in strips at right angles to the prevailing wind. Barren gravelly areas separate the strips. Freeze-thaw cycles result in solifluction terraces, polygons and strips. At the most exposed high sites, moss balls of *Dicranoweisia antarctica* (C.Muell.) Kindb. provide an unusual vegetation.

In sheltered areas on the plateau below about 300 m and over much of the vegetated parts of the steep slopes leading down to sea level, right to the beach crests, grassland is found. It is dominated by the large tussock grass *Poa foliosa*, but may also contain herbs, notably the large-leaved *Stilbocarpa polaris*. Grasslands generally are found where drainage of water is good, although Elephant Seals (*Mirounga leonina* (Linnaeus)) may create water-filled wallows between tussocks on level sites near the sea. Old wallows may be deceptively carpeted with a mat of small herbs, providing an unpleasant and smelly surprise for unwary walkers.

Herbfield occurs in areas where the water table is high and wind exposure is moderate, from near sea level to over 300 m altitude. It is dominated by the large silvery-leaved rosette plant *Pleurophyllum hookeri*, with or without *Stilbocarpa polaris*. Other small plants grow in the herbfield, e.g. *Carex trifida*, *Cerastium fontanum*, *Festuca contracta* and the dwarf shrub *Coprosma perpusilla*.

Areas with a high water table in valley bottoms throughout much of the altitudinal range and on the beach terraces support fen communities dominated by *Juncus scheuchzerioides*. Bryophytes form an important part of this vegetation. Plants such as *Isolepis aucklandica*, *Agrostis magellanica*, *Colobanthus apetalus* and *Pleurophyllum hookeri* occur here depending upon local variations in moisture and exposure to wind.

Bogs occur where the water table is at the surface or just above or below it. The vegetation is dominated by mosses, apparently most frequently by *Breutelia* spp., but including *Drepanocladus aduncus* (Hedw.) Warnst., *Dicranoloma robustum* (Hook.f. & Wils.) Par., *Chamberlainia salebrosam* (Web. & Mohr) H.Rob. and *Ptychomnion aciculare*

(Brid.) Mitt. *Sphagnum falcatulum* Besch. and *Sphagnum australe* Mitt. occur but are not a major component of the vegetation. Vascular plants occasionally occur either sparsely or as locally dense mats. Species such as *Callitriche antarctica*, *Cardamine corymbosa*, *Colobanthus apetalus*, *Epilobium* spp., *Montia fontana* and *Ranunculus biternatus* are found here.

Animals have significant local effects on the vegetation. Elephant Seals in large numbers 'haul out' during the summer to give birth, mate, and moult. They flatten coastal tussocks as well as create deep, muddy wallows amongst the tussocks. They add considerable quantities of nutrients to the coastal vegetation . In some areas the effects are toxic, but not for very long as the persistent precipitation soon dissipates the excess nutrients.

Several species of penguins come ashore to raise their young and moult. Their effects vary from slight where colonies are small, to complete destruction of vegetation where they are large. The massive rookeries of King Penguins (*Aptenodyptes patagonica* (Miller)) at Hurd Point and Lusitania Bay are largely coastal and affect the tussock grassland above the beaches and on the adjacent dunes and terraces. The extensive colonies of Royal Penguins (*Eudyptes schlegeli* (Finsch)) at Nuggets Creek are estimated to number over half a million birds. There are scarcely any living plants except algae and fungi within these colonies which stretch to several hundred metres inland and to more than 50 m above sea level. *Poa cookii* has been recorded only near penguin rookeries.

The rookeries of other birds such as Giant Petrels (*Macronectes giganteus* (Gemmelin)) and Gentoo Penguins (*Pygoscelis papua* (Forster)) are generally small and have much less impact on the vegetation. The various species of Albatross (*Diomedea* spp., *Phoebetria* spp.) nest amongst tussocks or in herbfield and also have a relatively small influence on the vegetation. Burrowing Petrels and Prions (*Pachyptila* spp.) nest in the uplands. Their effects on the vegetation are not well known. Their numbers are said to have been reduced by the predation of introduced cats and rats.

The turnover of plant species on the island has not been studied. With an area of 120 sq. km, Macquarie Is. ranks as one of the smallest of the subantarctic islands. Its vascular flora is not rich given its size. There have been no losses or gains in the dominant species since records began, but additional species continue to be found. These latter are small in size, inconspicuous and occur among relatively dense, short vegetation. Rather than newly arrived taxa they could just as easily be rare taxa that have occurred there for long periods. There are no major source areas for new propagules, although the biogeographic links are with the nearest other subantarctic islands and then with the mainland masses to the north. The small number of species occuring on Macquarie Is. has been attributed to the harsh climate and remote location. A limited number of trials with exotic species has been attempted, but none succeeded. A few accidental introductions (e.g. *Poa annua*) have become established.

Some animals have been deliberately and successfully naturalised on the Island: Cats (*Felis catus* Linnaeus), rabbits (*Oryctolagus cuniculus* Linnaeus) and the Weka (*Galliralus australis* scottii (Ogilby-Grant)), a flightless New Zealand bird. Accidental introductions that thrive include mice (*Mus* spp.) and rats (*Rattus rattus* (Linnaeus)). Various domestic livestock have been brought to Macquarie Is. over the years, but none now survives there.

The growth-rate of plants on Macquarie Is. is worthy of note. It is surprisingly high for an environment of such a high latitude, low temperature, low radiation, and high wind environment. Several studies appear to confirm these observations, but more work is needed. Some factors that have been suggested as contributing to this unexpected productivity are the efficiency with which the dominant plants utilise the low levels of radiation at temperatures which are low, but not so low as to limit metabolism. Leaf area is high as is the level of chlorophyll. Another important feature appears to be that growth can occur throughout the year at low altitudes, and is interupted for only short erratic periods when the temperature is just below freezing.

Currently 45 species of vascular plants are reported for Macquarie Is. This compares with 12 for Heard Is., 19 for the Prince Edward Is. and 128 for Campbell Is. Ninety one species of mosses of have been recorded on Macquarie Is. (H.Streimann & J.Curnow, *Austral. Fl. Fauna Ser.* 10: 1–479 (1989). The liverwort and lichen floras are similarly rich but less well known.

HEARD ISLAND AND McDONALD ISLANDS

Heard Is., the largest of a small group of islands, lies in about 53°00'S latitude and 73°30'E longitude. It is about 2000 km south-west of Australia, about 1500 km north of Antarctica, and about 450 km south-east of Kerguelen Is. It is about halfway between south-western Australia and southern Africa. The McDonald Islands consist of three small islets and lie about 40 km west of Heard Is.

Heard Is. is about 700 square km in size. The main part is an active volcano with a classical conical shape. Its symmetry is disrupted only by the Laurens Peninsula extending 10 km north-westwards and a 7 km long sliver of land extending eastwards to Spit Point. The central cone is known as Big Ben and the highest peak Mount Mawson, rises to 2745 m. Glaciers cover most of the island and spill directly into the sea in several places. Most ice-free areas occur below 200 m altitude. They represent about 10–15% of the land area. The McDonald Is have no permanent ice or snow.

The gale-swept Southern Ocean dominates the climate. The Antarctic Convergence (that part of the Southern Ocean where the frigid surface water moving north-eastwards, sinks below warmer southward moving water) lies to the north of these islands. Cloud cover is high as indicated by only 11% of potential solar radiation reaching the ground. Precipitation as rain or snow amounts to about 1360 mm annually at sea level, and falls on some 276 days per year. The mean annual temperature is about 1°C. The wind is strong and virtually ceaseless, but is unpredictable, due to the eddies that develop around the central cone and to small-scale avalanches of cold air slipping off the glaciers.

Despite the considerably larger land area of Heard Is. compared to Macquarie Is., the portion covered by vegetation is smaller and less diverse. There are 11 species of vascular plants on Heard Is., 5 species on the McDonald Is, and 46 on Macquarie Is. The differences are largely due to the position of Heard Is. south of the Antarctic Convergence which results in a more severe climate, with more frost, and fewer periods of relatively warm temperature. The presence of glaciers on much of the land reduces the diversity of habitats as well.

The vegetation is typical of the subantarctic. There is tussock grassland close to the sea and fell-field on higher ground. Most ground cover appears to be provided by the tussock grass *Poa cookii*, the cushion plant *Azorella selago*, the Kerguelen Cabbage, *Pringlea antiscorbutica*, and *Acaena magellanica*. Mosses and liverworts are locally common, and over 20 species have been recorded. The details of these plant commmunties, however, are poorly known.

Animals have an impact on the vegetation of these islands similar to that on Macquarie Is., except that there are no records of any animals being successfully introduced by man. The impact is primarily in the form of trampling by seals and penguins and other seabirds that come ashore to moult and breed.

Additionally, the manuring by these animals and the decomposition of the occasional dead body affects the local nutrients. The common seals are the Elephant Seal (*Mirounga leonina* (Linnaeus)), and Antarctic Fur Seal (*Arctocephalus gazella* (Peters)). The Leopard Seal (*Hydrurga leptonyx* (Blainville)) is reported to visit the island in large numbers in early winter, but not to breed there.

The islands were heavily used by sealers during the 19th century. They exterminated nearly all the elephant, fur and leopard seals, as well as most of the penguins in their search for fur and oil. The populations of these species are now recovering.

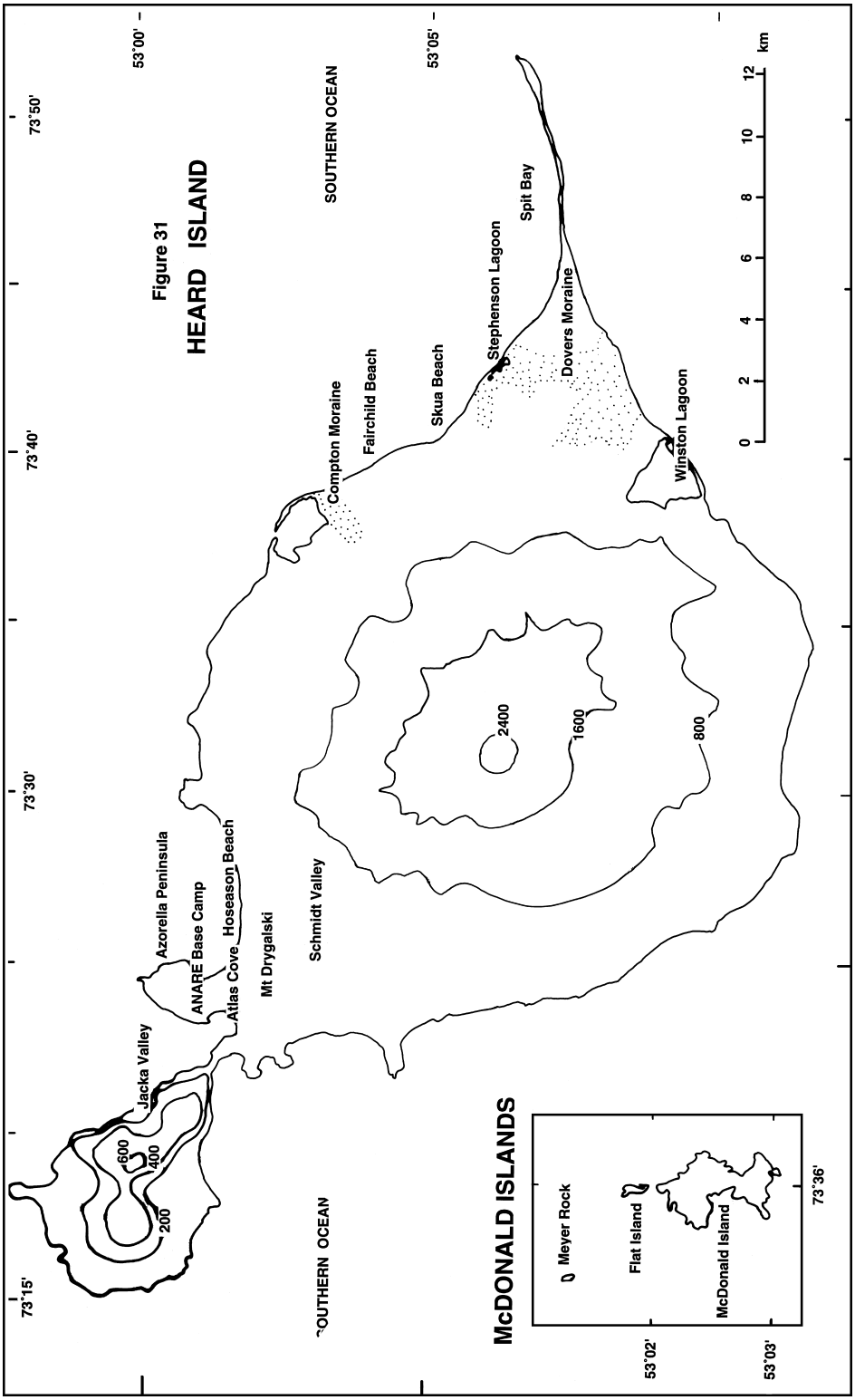
Figure 31
HEARD ISLAND
73°15'
73°30'
73°40'
73°50'
53°00'
53°05'
SOUTHERN OCEAN
SOUTHERN OCEAN
Jacka Valley
Azorella Peninsula
ANARE Base Camp
Atlas Cove
Hoseason Beach
Mt Drygalski
Schmidt Valley
Compton Moraine
Fairchild Beach
Skua Beach
Stephenson Lagoon
Spit Bay
Dovers Moraine
Winston Lagoon
200
400
600
800
1600
2400
0
2
4
6
8
10
12
km
McDONALD ISLANDS
Meyer Rock
Flat Island
McDonald Island
53°02'
53°03'
73°36'

Details of the biology of these islands are still sketchy. The era of scientific occupation began in the 1940s when Heard Is. was manned by the Australian National Antarctic Research Expeditions, but it was abandoned in 1954 when Australian Antarctic bases were opened on the Antarctic mainland. There had been several visits, prior to then, of short duration since the 1874 *Challenger* expedition. Since then there have been several, but only brief, stops by scientific expeditions.

MACQUARIE ISLAND SPECIES LIST

The flora of Macquarie Island is made up as follows:

Dicotyledons: 14 families (1 naturalised only), 19 genera (3 naturalised only) and 24 species (1 endemic, 3 naturalised)

Monocotyledons: 4 families, 12 genera (2 naturalised) and 17 species (1 endemic, 2 naturalised).

Ferns and Fern Allies: 5 families, 5 genera and 5 species.

(e = endemic taxon; * = naturalised taxon).

MAGNOLIOPHYTA (flowering plants)

DICOTYLEDONAE

APIACEAE
- *Azorella macquariensis* Orchard
- *Hydrocotyle novae-zeelandiae* DC.

ARALIACEAE
- *Stilbocarpa polaris* (Hombr. & Jacquinot ex Hook.f.) A.Gray

ASTERACEAE
- *Cotula plumosa* (Hook.f.) Hook.f.
- *Pleurophyllum hookerii* Buchan.

BRASSICACEAE
- *Cardamine corymbosa* Hook.f.

CALLITRICHACEAE
- *Callitriche antarctica* Engelm. ex Hegelm.

CARYOPHYLLACEAE
- * *Cerastium fontanum* Baumg. subsp. *fontanum*
- *Colobanthus affinis* (Hook.) Hook.f.
- *Colobanthus apetalus* var. *alpinus* (Kirk) L.B.Moore
- *Colobanthus muscoides* Hook.f.
- * *Stellaria media* (L.) Vill. subsp. *media*
- *Stellaria parviflora* Banks & Sol. ex Hook.f.

CRASSULACEAE
- *Crassula moschata* G.Forst.

HALORAGACEAE
- *Myriophyllum triphyllum* Orchard

ONAGRACEAE
- *Epilobium brunnescens* (Cockayne) P.H.Raven & Engelhorn subsp. *brunnescens*
- *Epilobium pedunculare* A.Cunn.

POLYGONACEAE
- * *Rumex crispus* L.

PORTULACACEAE
- *Montia fontana* L. subsp. *fontana*

RANUNCULACEAE
- *Ranunculus crassipes* Hook.f.

ROSACEAE
- *Acaena magellanica* (Lam.) Vahl
- *Acaena minor* (Hook.f.) Allan

RUBIACEAE
- *Coprosma perpusilla* subsp. *subantarctica* Orchard
- *Galium antarcticum* Hook.f.

MONOCOTYLEDONAE

JUNCACEAE
- *Juncus scheuchzerioides* Gaudich.
- *Luzula crinita* Hook.f.

CYPERACEAE
- *Carex trifida* Cav.
- *Isolepis aucklandica* Hook.f.
- *Uncinia divaricata* Boott
- *Uncinia hookeri* Boott

POACEAE
- *Agrostis magellanica* Lam.
- * *Anthoxanthum odoratum* L.
- *Deschampsia caespitosa* (L.) P.Beauv.
- *Deschampsia chapmanii* Petrie
- *Festuca contracta* Kirk
- * *Poa annua* L.
- *Poa cookii* (Hook.f.) Hook.f.
- *Poa foliosa* (Hook.f.) Hook.f.
- *Poa litorosa* Cheeseman
- e *Puccinellia macquariensis* (Cheeseman) Allan & Jansen

ORCHIDACEAE
- *Corybas dienemus* D.L.Jones

PTERIDOPHYTA & ALLIES
BLECHNACEAE
Blechnum penna-marina (Poir.) Kuhn
DRYOPTERIDACEAE
Polystichum vestitum (G.Forst.) C.Presl
GRAMMITIDACEAE
Grammitis poeppigiana (Mett.) Pic.Serm.
HYMENOPHYLLACEAE
Hymenophyllum falklandicum Baker
LYCOPODIACEAE
Huperzia australiana (Herter) Holub

HEARD AND McDONALD ISLANDS SPECIES LIST

The flora of Heard & McDonald Islands is made up as follows:

Dicotyledons: 7 families, 7 genera and 7 species

Monocotyledons: 1 family, 3 genera and 5 species (1 naturalised).

MAGNOLIOPHYTA (flowering plants)

DICOTYLEDONAE
APIACEAE
Azorella selago Hook.f.
BRASSICACEAE
Pringlea antiscorbutica R.Br. ex Hook.f.
CALLITRICHACEAE
Callitriche antarctica Engelm. ex Hegelm.
CARYOPHYLLACEAE
Colobanthus kerguelensis Hook.f.
PORTULACACEAE
Montia fontana L. subsp. *fontana*
RANUNCULACEAE
Ranunculus crassipes Hook.f.
ROSACEAE
Acaena magellanica (Lam.) Vahl

MONOCOTYLEDONAE
POACEAE
Deschampsia antarctica E.Desv.
* *Poa annua* L.
Poa cookii (Hook.f.) Hook.f.
Poa kerguelensis (Hook.f.) Steud.
Agrostis magellanica Lam. has been reported from Heard Is. (B.W.Taylor, *ANARE Reports* ser. B, Bot. 2: 145, 1955) but no collections seen.

KEY TO SUBANTARCTIC FAMILIES

DICOTYLEDONAE

1 Leaves compound or deeply dissected

2 Leaves once or more pinnate or pinnatisect

3 Leaves whorled, only submerged ones pinnate; aquatic plants (*Myriophyllum*) **44. HALORAGACEAE**

3: Leaves alternate, all or most pinnate/pinnatisect; land plants

4 Leaflet lamina glabrous (*Cardamine*) **33. BRASSICACEAE**

4: Leaflet lamina pilose

5 Leaves 3-pinnate; fruits unarmed, in a flat capitulum (*Cotula*) **82. ASTERACEAE**

5: Leaves once-pinnate; fruits 4-spined, in a globular head (*Acaena*) **39. ROSACEAE**

2: Leaf lamina palmately divided

6 Stoloniferous herbs, not cushion-forming **6. RANUNCULACEAE**

6: Subshrubs, cushion-forming (*Azorella*) **64. APIACEAE**

1: Leaves entire or shortly toothed

7 Leaves whorled or opposite

8 Leaves whorled (*Galium*) **81. RUBIACEAE**

8: Leaves opposite

9 Leaves toothed **46. ONAGRACEAE**

9: Leaves entire

10 Leaves separate at base

11 Plants glabrous, not cushion-forming **16. PORTULACACEAE**

11: Plants densely or sparingly pilose, at least on stems or petioles, or if glabrous then cushion-forming **18. CARYOPHYLLACEAE**

10: Leaves connate at base or with interpetiolar stipules

12 Subshrubs; stipules with denticles and short marginal hairs (*Coprosma*) **81. RUBIACEAE**

12: Annual or perennial herbs; stipules glabrous

13 Leaves only subconnate at base, somewhat stem-clasping, with a sinus between petioles; stamens 3; ovary 3-locular **16. PORTULACACEAE**

13: Leaves with distinct truncate interpetiolar stipules; stamens 1 or 4; ovary 2- or 4-locular

14 Leaves with a row of c. 3 sunken stomates near tip on each side of midrib **38. CRASSULACEAE**

14: Leaves lacking sunken stomates, but with scattered pellucid glands **73. CALLITRICHACEAE**

7: Leaves alternate, rosulate or in a basal tuft

15 Leaves toothed

16 Leaves lacking ligule

17 Leaves reniform **63. ARALIACEAE**

17: Leaves oblanceolate to obovate **82. ASTERACEAE**

16: Leaves ligulate (ochreate) **19. POLYGONACEAE**

15: Leaves entire **33. BRASSICACEAE**

MONOCOTYLEDONAE

1 Leaf solitary, orbicular **95. ORCHIDACEAE**

1: Leaves numerous, linear to oblong

2 Fruit 1-seeded, indehiscent

3 Stems hollow; leaf sheaths open **91. POACEAE**

3: Stems solid; leaf sheaths closed **90. CYPERACEAE**

2: Fruit a many-seeded capsule **89. JUNCACEAE**

PTERIDOPHYTA & ALLIES

1 Stems densely covered in microphylls; microphylls linear, acute, c. 6 mm long; sporangia born naked in axils of undifferentiated upper microphylls (Huperzia) **97. LYCOPODIACEAE**

1: Rhizomes bearing leaves (fronds) with stipe and lamina; fronds more than 1 cm long; sporangia born in groups (sori) under indusia on lower surface or margins of leaf lamina

2 Fronds 2–4 cm long; lamina membranous (*Hymenophyllum*) **101. HYMENOPHYLLACEAE**

2: Fronds more than 5 cm long; lamina coriaceous

3 Frond lamina entire; sori 1 or 2 near tip of lamina, tending to coalesce (*Grammitis*) **106. GRAMMITIDACEAE**

3: Frond lamina divided; sori otherwise

4 Fronds dimorphic; frond lamina pinnate; sori in two continuous bands occupying almost entire undersurface of fertile fronds (Blechnum) **113. BLECHNACEAE**

4: Fronds monomorphic; frond lamina bipinnate; sori 3–7 per pinnule, round, c. half way between margin and midrib of fertile fronds (*Polystichum*) **110. DRYOPTERIDACEAE**

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MAGNOLIOPHYTA

DICOTYLEDONAE

1. ANNONACEAE

D.J.Du Puy (Ch.Is.)

Trees, shrubs or climbers, often with aromatic bark and leaves, evergreen or deciduous. Leaves alternate, often distichous, simple, entire; stipules absent. Inflorescence terminal, leaf-opposed, axillary, internodal or cauline; flowers solitary or in clusters or racemes, actinomorphic, bisexual, often scented. Sepals 3, valvate or imbricate. Petals in 2 whorls of 3. Stamens many, free, spirally arranged on a broad torus; filaments short, thick, or absent; anthers dehiscing by longitudinal slits. Ovary superior. Carpels few to many, usually free, often stalked, with 1–many, usually parietal, ovules. Fruit of several, usually free, dry or fleshy carpels radiating from receptacle, rarely fused into a syncarp. Seeds with copious mottled endosperm; testa folded; aril often present.

A family of c. 120 genera and c. 2000 species, mostly of moist tropical forest, with a few subtropical or warm-temperate species; c. 13 genera and 26 species occur in Australia; 1 genus (2 species) introduced on Christmas Is. Some species of *Annona* have edible fruits and are cultivated. Many species have medicinal uses. The petals of *Cananga odorata* (Lam.) Hook.f. & Thomson, yield macassar oil, a fragrant oil used in perfumery.

J.Sinclair, A revision of the Malayan Annonaceae, *Gard. Bull. Singapore* 14: 149–516 (1955); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Annonaceae, *Fl. Java* 1: 100–116 (1963).

ANNONA

Annona L., *Sp. Pl.* 1: 536 (1753); *Gen. Pl.* 5th edn, 241 (1754); from the South American name *Annon*, used for some species.

Type: *A. muricata* L.

Trees or shrubs. Leaves distichous; petiole channelled above. Flowers solitary, or up to 10 in clusters, leaf-opposed, internodal or terminal. Sepals small, connate at base. Petals usually free, leathery, valvate, usually greenish or dull purple. Torus conical. Stamens with a broad, truncate connective, exceeding and concealing anther locules. Carpels many, eventually united, each with 1 ovule. Styles either long and enlarging, eventually forming fleshy spines on fruit, or absent; stigmas thick. Fruit an aggregate of monocarps that coalesce into a softly fleshy syncarp, with a fleshy receptacle. Seeds several, large, usually black.

A genus of c. 100 species native to tropical America; some species native to Africa; 2 species naturalised on Christmas Is. Several species have large, sweet fruits and are cultivated in many tropical regions including Christmas and Cocos (Keeling) Is. The most well-known is the Cherimoya or Custard Apple (*A. cherimola* Mill.), grown in the cooler tropics.

W.E.Safford, Classification of the genus *Annona*, *Contr. U.S. Natl Herb.* 18: 1–68 (1914); B.Molesworth Allen, *Malayan Fruits* 26–33 (1967).

Outer petals 20–40 mm long, broadly triangular-ovate; styles 2–3 mm long; fruit 12–25 cm long, covered in soft, fleshy, spine-like projections **1. A. muricata**

Outer petals 15–25 mm long, narrowly oblong; stigmas sessile; fruit 5–10 cm long, covered with a network of raised lines **2. A. reticulata**

1. *Annona muricata L., *Sp. Pl.* 1: 536 (1753)

T: not designated. Epithet from the Latin *muricatus* (muricate) in reference to the ornamentation of the fruit.

Illustrations: B.Molesworth Allen, *Malayan Fruits* fig. 11, 28 (1967); A.B.Graf, *Tropica* t. 72 (1968); E.J.H.Corner & K.Watanabe, *Ill. Guide Trop. Pl.* fig. 3, 107 (1969).

Evergreen, much-branched tree to 7 m tall. Leaves oblong to obovate, cuneate at base, often shortly acuminate, pungent, coriaceous, glossy, glabrous; lamina 6–13 cm long; petiole 3–6 mm long. Flowers usually solitary, often on older wood, foetid; pedicels thick, 10–15 mm long. Sepals c. 3 mm long, reflexed. Petals green, becoming yellowish; outer petals broadly triangular-ovate, 20–40 mm long, acuminate, very thick, rough; inner petals more than half as long as the outer. Stamens 3–4 mm long, very numerous. Styles distinct, 2–3 mm long, enlarging. Fruit ovoid, often oblique, 12–25 cm long, covered in soft, fleshy spine-like projections; skin thin, green becoming yellowish; flesh white, soft. *Durian Belanda, Soursop.* Fig. 32I.

Christmas Is. Naturalised self-sown plants are common along tracks. Recorded for Cocos (Keeling) Is. by H.Forbes, *A Naturalist's Wanderings in the Eastern Archipelago* 42 (1885) but perhaps only cultivated. Native of tropical America.

Ch.Is.; no precise locality, *D.A.Powell 721* (K).

Widely cultivated in tropics for fruit. Fruit produced almost throughout the year so that flowers and fruit are often present simultaneously. The fruit has a delicate, somewhat sweet flavour and is eaten raw or used in icecream or puddings.

2. *Annona reticulata L., *Sp. Pl.* 1: 537 (1753)

T: not designated. Epithet from the Latin *reticulatus* (marked with a network) in reference to the ornamentation of the fruit.

Illustrations: B.Molesworth Allen, *Malayan Fruits* fig. 12, 30 (1967); E.J.H.Corner & K.Watanabe, *Ill. Guide Trop. Pl.* 107 (1969).

Deciduous tree to 6 m tall. Leaves narrowly elliptic or oblong, usually obtuse at base, acute to acuminate, sparsely pubescent on nerves, often undulate; lamina 7–20 cm long; petiole 6–13 mm long. Flowers drooping, usually 1–4 in clusters, internodal on young branchlets; pedicels slender, 20–30 mm long. Sepals erect, 2–3 mm long. Petals yellow-green; outer petals narrowly oblong, 15–25 mm long, obtuse, very thick, finely pubescent; inner petals 1–2.5 mm long. Stamens 1–1.5 mm long. Stigmas sessile. Fruit globose to broadly ovoid, 5–18 cm long, covered with a network of raised lines; skin thin, dull green becoming reddish; flesh creamy white, soft. *Nona Kapri, Custard Apple*.

Christmas Is. Naturalised in a few, probably self-sown stands; also naturalised in tropical mainland Australia. Native of tropical America.

Ch.Is.: cliffs overlooking Isabel Beach, *D.A.Powell 489* (K); W flanks of Phosphate Hill, *D.A.Powell 554* (K); terrace overlooking Flying Fish Cove, *D.A.Powell 854* (K).

Widely cultivated in tropics with somewhat seasonal climate for fruit. The creamy, slightly granular, sweet flesh may be eaten raw or used in milkshakes, custard and other puddings. This species is reputed to have many medicinal uses.

2. LAURACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R.)

Trees, shrubs, or rarely parasitic herbaceous climbers (*Cassytha*), often aromatic. Leaves alternate, subopposite, or opposite, simple, entire, often oil-gland dotted, sometimes longitudinally 3-nerved, often coriaceous and glossy, rarely reduced to scales (*Cassytha*); stipules absent. Inflorescence a raceme, panicle or head, usually axillary, bracteate. Flowers actinomorphic, mostly bisexual, perigynous. Hypanthium cup-shaped, campanulate or turbinate, usually enlarging in fruit. Perianth of 2 whorls of 3, usually subsimilar, imbricate. Stamens usually 12, in 4 whorls; inserted on hypanthium rim; third whorl with large, nectariferous glands on filaments; innermost whorl often staminodal; anthers 2- or 4-locular, dehiscing by valves with conspicuous flaps. Ovary superior, unilocular, surrounded by hypanthium; ovule solitary. Style simple; stigma often discoid. Fruit usually a fleshy berry, basally to entirely enclosed by hypanthium. Seed solitary, without endosperm.

A family of 35–45 genera, with 2000–2500 species, mainly in the tropics and subtropics, with centres of diversity in SE Asia and Brazil; 2 genera (2 species) native on Christmas Is.; 1 genus (1 species) native on Cocos (Keeling) Is. Many species produce aromatic oils and spices of commercial importance, including camphor, oil of sassafras from *Sassafras albidum* (Nees) Nutt. and cinnamon. Sweet laurel (*Laurus nobilis* L.) contains an oil used in perfumery, and the leaves are used as a spice. *Persea americana* Mill., the Avocado , is widely cultivated for its fruits, including on Christmas Is. Several genera, including *Ocotea* Aubl., provide commercially important timbers (Greenheart, Stinkwood).

A.J.G.H.Kostermans, Lauraceae, *Reinwardtia* 4: 193–256 (1957); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Lauraceae, *Fl. Java* 1: 117–135 (1963); J.Hutchinson, Lauraceae, *Gen. Fl. Pl.* 1: 125–143 (1964); A.C.Smith, Lauraceae, *Fl. Vit. Nova* 2: 113–141 (1981).

KEY TO GENERA

1 Parasitic twiners; leaves scale-like **3. CASSYTHA**

1: Trees; leaves well-developed

2 Leaves opposite, with 3 longitudinal nerves extending from base to near apex; fruit subtended by persistent perianth **1. CINNAMOMUM**

2: Leaves alternate, pinnately nerved; fruit base naked, the perianth caduceus

3 Panicles axillary and terminal; tepals inserted on a distinct, campanulate hypanthium c. 2 mm long; anthers 2-locular; fruit 1–1.5 cm diam., spherical, thinly fleshy, purple-black, with a circular apical scar **2. CRYPTOCARYA**

3: Panicles in clusters from short, bracteate, lateral shoots; tepals divided almost to base, the hypanthium almost absent; anthers 4-locular; fruit 5–20 cm long, usually pear-shaped with a minute apical scar, green or purple, with a thick, creamy flesh **+PERSEA**

+*Persea americana* Mill., the Avocado, is cultivated for its fruit on Christmas Is.

1. CINNAMOMUM

Cinnamomum Schaeff., *Bot. Exped.* 74 (1760), *nom. cons.*; from the Greek *kinnamomon* (cinnamon).

Type: *C. zeylanicum* Blume = *C. verum* J.Presl

Trees or erect shrubs; bark and leaves often fragrant. Leaves usually opposite and 3-nerved, sometimes alternate and 1-nerved, coriaceous. Inflorescence paniculate, subterminal, axillary or lateral at base of young shoots. Flowers bisexual, small. Hypanthium cup-shaped, short, somewhat enlarging. Perianth segments 6, subequal, often caducous. Fertile stamens 9, in 3 whorls; third whorl with basal glands; anthers 4-locular; also an innermost whorl of 3 conspicuous staminodes. Style caducous. Fruit a single-seeded berry; base enclosed by the hypanthium and occasionally persistent perianth.

A genus of 150–300 species, distributed from tropical SE Asia, through Malesia, to Australia and the Pacific Islands; 1 species on Christmas Is.

The species can be divided into two groups on the basis of their leaf venation. The majority of species have distinctive, 3-veined leaves. Many species contain pungent, essential oils, the most important being camphor, which can be distilled from *C. camphora* (L.) J.Presl. The dried bark of *C. verum* J.Presl (*C. zeylanicum* Blume) is the source of cinnamon. The characteristic taste and smell of cinnamon is due to the presence of cinnamic aldehyde, mixed with various resins to form a volatile oil. This oil, which can now be produced synthetically, is used for food flavouring, in perfumes and incense, and medicinally.

Cinnamomum iners Reinw. ex Blume, *Bijdr. Fl. Ned. Ind.* 570 (1826)

T: Java, *coll. unknown*; *n.v.* Epithet from the Latin *in-* (without) and *ars* (skill, art), indicating that this species lacks the strongly pungent oils commonly found in the genus.

Illustrations: C.L.Blume, *Rumphia* 1: 41, t. 17, 18 (1836); E.J.H.Corner, *Wayside Trees of Malaya* 2: t. 71 (1952); A.B.Graf, *Tropica* 354 (1978).

Tree 10–25 m tall; branchlets soon glabrescent. Leaves opposite, narrowly elliptic, entire, obtuse, with 3 veins extending from base almost to tip, firmly coriaceous, minutely and sparsely pubescent below, glossy, dark green, pink when young; margin thickened; lamina 8–20 cm long; petiole 7–12 mm long. Panicle c. 6–15 cm long, lax. Flowers small, pale yellow. Pedicels c. 2–3 mm long, pubescent. Hypanthium c. 1.5 mm long. Perianth segments elliptic, obtuse, c. 3 mm long, silvery-pubescent outside, persistent. Fertile stamens 9, finely hairy; anthers minutely bristly; staminodes triangular, stalked. Berry ellipsoidal, 8–15 mm long, pulpy, red or black, surrounded at base by short hypanthium and perianth. *Wild Cinnamon.*

Christmas Is. Grows in disturbed, rather open forest. Distributed from India through Indo-China and Malaysia to the Philippines.

Ch.Is.: east coast, *D.A.Powell 403* (K); east coast, *D.A.Powell 508* (K).

Distinctive in the new leaves that are pink and hang limply, and in its 3-veined leaves. Although this species is closely allied to the true cinnamon, (*C. verum* J.Presl), and is similar in appearance, its leaves and bark are low in aromatic oils and are only slightly cinnamon-scented when crushed. Nevertheless, the bark is sometimes used as food flavouring or to prepare a tonic drink.

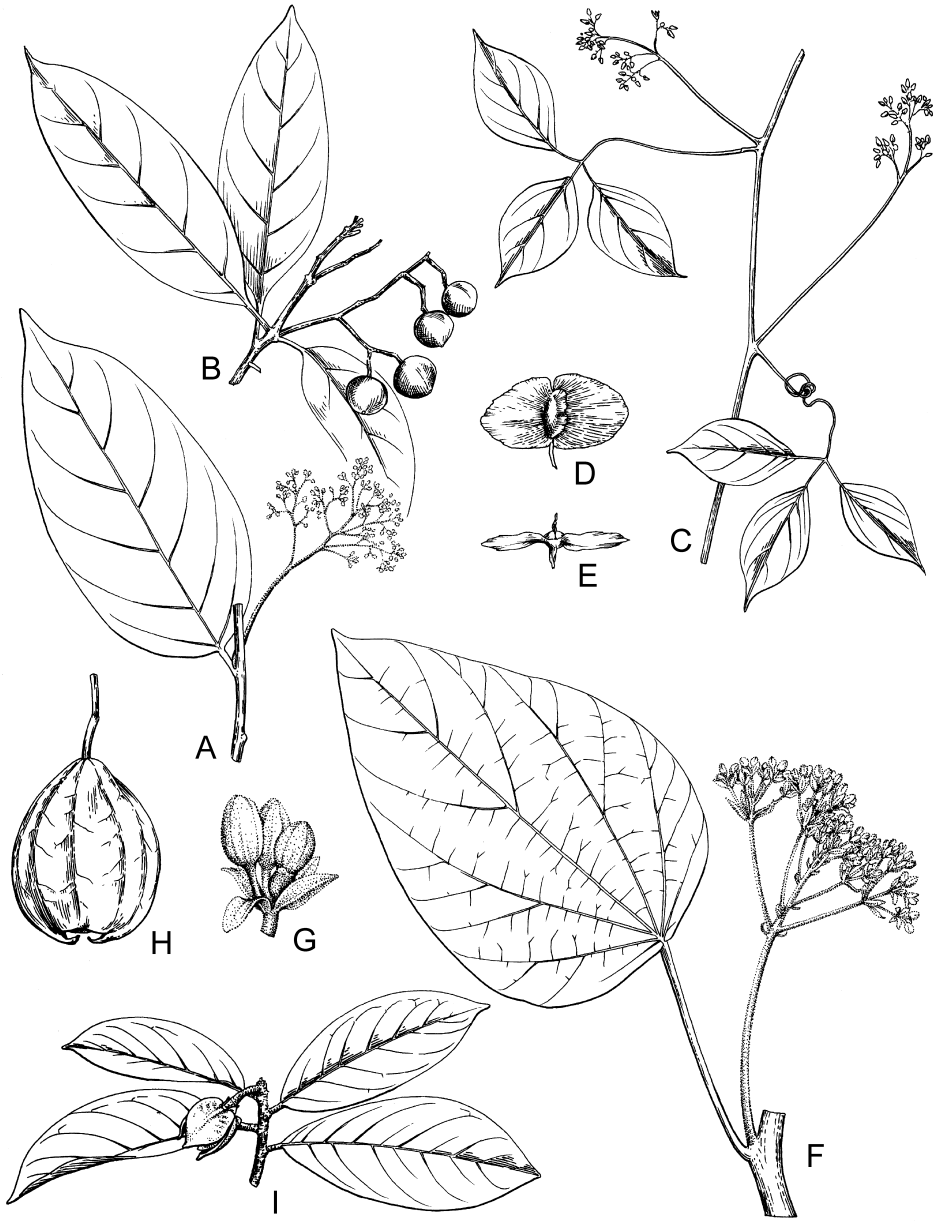

Figure 32. **A–B**, LAURACEAE: *Cryptocarya nitens*. **A**, flowering branchlet X0.4 (C.Andrews 158, K); **B**, fruiting branchlet X0.4 (A.Pearson & D.Powell P80, K); **C–H**, HERNANDIACEAE. **C–E**, *Illigera appendiculata* subsp. *stenoptera*. **C**, flowering stem X0.4 (D.Powell 541, K); **D**, fruit, side view X0.5; **E**, fruit, top view X0.5 (**D–E**, D.Powell 361, K). **F–H**, *Hernandia ovigera*. **F**, flowering branchlet X0.4; **G**, cluster of one female and two male flowers X2, **H**, fruit X0.5 (**F–H**, B.Mitchell 56, K). **I**, ANNONACEAE: *Annona muricata*, flowering branchlet X0.4 (D.Powell 721, K). Drawn by E.Catherine.

2. CRYPTOCARYA

Cryptocarya R.Br., *Prodr.* 402 (1810); from the Greek *kryptos* (concealed, hidden) and *karyon* (nut), as the hard seed is completely enclosed by the enlarging hypanthium.

Type: *C. glaucescens* R.Br.

Trees or erect shrubs. Leaves alternate or subopposite, pinnately nerved (on Christmas Is.) or 3-nerved from the base, coriaceous. Inflorescence paniculate, axillary or terminal. Flowers bisexual, small. Hypanthium campanulate or turbinate, becoming constricted apically after anthesis, enlarging. Perianth segments 6, subequal, caducous. Fertile stamens 9, in 3 whorls (on Christmas Is.); third whorl with basal glands; anthers bilocular; also an innermost whorl of 3 conspicuous staminodes. Style caducous. Fruit with a solitary, large seed, entirely enclosed in the enlarged hypanthium, leaving only a minute aperture at apex; endocarp often bony.

A genus of c. 200–300 species, mainly in the tropics and subtropics with a centre of diversity in Malesia, but also in the S American temperate zone; 1 species on Christmas Is. Several species contain pungent oils.

Cryptocarya nitens (Blume) Koord. & Valeton, *Meded. Lands Plantentuin* 68: 220–222 (1904); S.H.Koorders & T.Valeton, *Bijdr. Boomsorten op Java* 10: 220–222 (1904)

Tetranthera nitens Blume, *Mus. Bot.* 1: 375 (1851). T: Java, *coll. unknown*; *n.v.* Epithet from the Latin *nitere* (to shine), descriptive of the glossy, evergreen leaves of this species.

C. nativitatis Rendle in C.W.Andrews, *Monogr. Christmas Is.* 187 (1900). T: Christmas Is., 1898, *C.W.Andrews 158*; iso: K.

Illustration: S.H.Koorders, *Atlas Baumarten Java* 2: t. 214 (1913).

Tree to 30 m tall; branchlets rusty-pubescent. Leaves alternate, narrowly ovate to oblong-elliptic, shortly acuminate, obtuse to rounded and oblique at base, entire, finely reticulate-veined, glossy above, slightly pubescent below in angles of 8–12 lateral veins; lamina 7–21 cm long; petiole 5–15 mm long. Panicles axillary and terminal, often combining into large, terminal panicles, rusty-pubescent. Flowers greenish-white, sessile. Hypanthium campanulate, c. 2 mm long. Perianth segments elliptic, rounded, c. 2 mm long, densely pubescent outside, caducous. Fertile stamens with pubescent filaments; staminodes sagittate, subsessile. Fruit in clusters, ±spherical, 12–15 mm diam., thinly fleshy, shining purplish black, with a circular, apical scar. Seed solitary. Fig. 32A–B.

Christmas Is. An important constituent of the primary forest on the plateau, forming about 5% of the main canopy and in marginal forest on the terraces, where it may become one of the emergent species. Also occurs in Java and the Malay Peninsula.

Ch.Is.: Phosphate Hill, *H.N.Ridley 2* (K); northern plateau, *D.A.Powell 25* (K); terrace below Drumsite, *D.A.Powell 63* (K); inland terrace, South Point, *A.Pearson & D.A.Powell P80* (K).

H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 221 (1906), noted that although the fruit has scanty pulp, it is an important food for pigeons.

3. CASSYTHA

Cassytha L., *Sp. Pl.* 1: 35 (1753); from the Greek name for *Cuscuta*, dodder, which this genus resembles.

Type: *C. filiformis* L.

Herbaceous perennial twiner, parasitic; stems ±terete, attached to host by small, elliptic haustoria. Leaves alternate, scale-like. Inflorescence an erect, bracteate raceme, spike, head or panicle. Flowers small, bisexual. Hypanthium turbinate. Perianth parts dissimilar, persistent. Sepals scale-like. Petals ovate, thick. Stamens in 4 whorls; outer whorl fertile, petaloid; second and third whorls fertile or staminodal; innermost whorl staminodal; anthers

2-locular. Ovary globular, surrounded by hypanthium. Style short, persistent. Fruit globular, ellipsoidal or obovoid, fleshy, enclosed by enlarged hypanthium, perianth persisting at apex. Seed globular. *Dodder Laurel, Devil's Twine*.

A genus of 17 species, mainly in Australia and Africa; 1 species on Cocos (Keeling) Is. and Ashmore Reef.

J.Z.Weber, A taxonomic revision of *Cassytha* (Lauraceae) in Australia, *J. Adelaide Bot. Gard*. 3: 187–262 (1981).

Cassytha filiformis L., *Sp. Pl.* 1: 35 (1753)

T: illustration in H.A.Rheede, *Hort. Ind. Malab.* 7, t. 44 (1688); lecto, *fide* J.Z.Weber, *J. Adelaide Bot. Gard.* 3: 229 (1981). Epithet from the Latin *filiformis* (thread-like), in reference to the narrow stems of this species.

Stems 0.2–1.5 mm diam., ±striate, pubescent to glabrescent, yellow-green, orange or red. Leaves ovate to narrowly triangular, 1–2.5 mm long, glabrous or ciliate, brown. Spikes 0.5–10 cm long, rarely paired or paniculate. Flowers sessile, globular to ovoid, 1–2 mm long, white or green. Fertile stamens usually 9, occasionally 6, white. Fruit subglobular to obovoid, 4–8 mm long, glabrous, orange or red. Seed 3–4 mm diam., grey to black.

Cocos (Keeling) Is., Ashmore Reef. On Cocos (Keeling) Is. grows on forest margins, in coconut plantations, shrub communities and disturbed sites on coralline sand. On Ashmore Reef recorded by J.Hicks, ANPWS, *pers. comm.*, as killing patches of vegetation on East Is. A widespread tropical and subtropical species, mainly coastal, including Australia (W.A., N.T., Qld and N.S.W.).

C.K.Is.: near settlement, West Is., *I.R.Telford 9965 & C.Howard* (CBG, K); just N of Quarantine Stn, West Is., *A.S.George 16252* (CBG, K); SW of transmitter clearing, West Is., *D.G.Williams 108* (CBG). A.R.: material unavailable.

Most commonly parasitises *Scaevola taccada* on Cocos (Keeling) Is.

3. HERNANDIACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees or shrubs, sometimes climbing, sometimes polygamous or monoecious, evergreen or deciduous. Leaves alternate, simple, lobed or palmately compound; stipules absent. Inflorescence usually an axillary, much-branched, compound cyme, sometimes corymbose; bracts present or absent. Flowers actinomorphic, bisexual or unisexual. Perianth segments 2–10, in 2 valvate, similar whorls or 1 imbricate whorl. Stamens 2–7, in 1 whorl, sometimes alternating with staminodes; filaments sometimes with 2 basal, nectariferous glands; anthers bilocular, dehiscing by lateral or apical valves. Ovary inferior, unilocular; ovule 1. Style simple, absent in male flowers; stigma discoid and oblique, or capitate. Fruit nut- or drupe-like, dry and winged or somewhat fleshy and enclosed in an inflated cup. Seed 1, without endosperm.

A pantropical family of 4 genera and c. 58 species, typically in coastal habitats, and well represented on tropical oceanic islands; 3 genera (4 species) on Christmas Is.; 1 genus (1 species) on Cocos (Keeling) Is. The wood of this family is generally light and soft, not durable, and sometimes used to make dug-out canoes. *Gyrocarpus* is often placed in family Gyrocarpaceae, with wood anatomy, perianth arrangement and staminal and gynoecial characters suggesting a separate origin from Hernandiaceae.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Hernandiaceae, *Fl. Java* 1: 135–137 (1963); J.Hutchinson, Hernandiaceae, *Gen. Fl. Pl.* 1: 143–145 (1964); K.Kubitzki,

Monographie der Hernandiaceen, *Bot. Jahrb. Syst.* 89: 78–209 (1969); A.C.Smith, Hernandiaceae, *Fl. Vit. Nova* 2: 108–113 (1981); A.C.Smith, Gyrocarpaceae, *op. cit.* 143–145.

KEY TO GENERA

1 Climbing shrub; leaves trifoliolate; inflorescence a panicle-like cyme; fruit nut-like with 4 longitudinal wings **2. ILLIGERA**

1: Tree; leaves simple; inflorescence corymbose; fruit drupe-like, ±enclosed in a cupule, or nut-like with apical wings

2 Leaves entire; stamens with 2 basal glands; female flowers subtended by a distinct cupule; fruit without drupe-like wings, enclosed in a large, inflated cupule **1. HERNANDIA**

2: Leaves usually 3- or 5-lobed; stamens without glands; female flowers not subtended by a cupule; fruit nut-like with 2 long, apical wings **3. GYROCARPUS**

1. HERNANDIA

Hernandia L., *Sp. Pl.* 2: 981 (1753); *Gen. Pl.* 5th edn, 421 (1754); after Francisco Hernandez, a 16th century Spanish naturalist and physician, who studied the natural history of Mexico and the West Indies.

Type: *H. sonora* L.

Trees, monoecious. Leaves simple, entire, sometimes peltate, crowded towards branchlet tips; petiole long. Inflorescence a bracteate, corymbose thyrse; peduncle long. Flowers unisexual, in clusters of 1 female and 2 male subtended by involucre of 3 or 4 bracts; perianth in 2 similar whorls. Male flowers: perianth segments usually 6–10; stamens usually 3–5, each subtended by 2 glands; anthers bilocular, dehiscing by 2 lateral valves. Female flowers: perianth segments usually 8–12; style sigmoid or straight, surrounded basally by 4 or 5 free or connate glands; stigma discoid, oblique; pedicel inflated into an enlarged cupule subtending flower. Fruit a drupe, enclosed by fleshy cupule.

A pantropical genus of c. 24 species; 1, possibly 2, species on Christmas Is.; 1 species on Cocos (Keeling) Is.

Leaves peltate; fruit cupule 2–3 cm long, aperture not toothed **2. H. nymphaeifolia**

Leaves not peltate; fruit cupule c. 5 cm long, aperture concealed by 2 apical teeth **1. H. ovigera**

1. Hernandia ovigera L., *Herb. Amboin.* 14 (1754)

T: illustration of *Arbor ovigera femina* G.E.Rumphius, *Herb. Amboin.* 3: 193, t. 123 (1743), *fide* E.D.Merrill, *Interpr. Herb. Amboin.* 239 (1917). Epithet from the Latin *ovum* (egg) and *gerere* (to carry, bear), referring to the fruit which is enclosed in a large, inflated, whitish cup which resembles an eggshell.

[*H. peltata auct. non* Meissner: C.W.Andrews, *Monogr. Christmas Is.* 187 (1900)]

Illustrations: K.Kubitzki, *Bot. Jahrb. Syst.* 89: 139, fig. 31 (1969); A.B.Graf, *Tropica* 523 (1979).

Tree to 40 m; trunk frequently buttressed. Leaves ovate, rounded to cordate at base, shortly acuminate, subcoriaceous, subglabrous, dark green with pale veins; lamina 6–37 cm long; petiole 6–40 cm long. Inflorescence pubescent; involucral bracts 4, oblong, 6–8 mm long, whitish. Perianth segments elliptic, c. 5 mm long, pubescent. Male flowers: perianth segments 6; stamens 3; pedicel c. 3 mm long. Female flowers: perianth segments 8; style sigmoid, surrounded by 4 free glands; stigma obliquely flattened; cupule 3–4 mm long. Drupe spherical, 1.7–2.2 cm long, black, inflated; apex conical; cupule c. 5 cm long, whitish, with 2 apical teeth concealing a constricted aperture. *Hearse Tree, Buah Keras Laut.* Fig. 32F–H.

Christmas Is. Grows as an important constituent of the primary rainforest on high ground and the plateau forming about 13% of the canopy (c. 30 m tall) and about 25% of the emergent species (30–40 m tall). Occurs throughout Malesia, from Sumatra to the Solomon Islands.

Ch.Is.: plateau, Oct. 1904, *H.N.Ridley* (K); railway line between camp 5 and South Point, *B.A.Mitchell 56* (AD, CBG, K, MEL).

The wood is very soft and is not used. The seeds are inedible and purgative. The cup surrounding the fruit allows it to float, and water or sea-dispersal is likely.

2. Hernandia nymphaeifolia (C.Presl) Kubitzki, *Bot. Jahrb. Syst.* 90: 272 (1970)

Biasolettia nymphaeifolia C.Presl, *Reliq. Haenk.* 2: 141 (1835). T: Mariana Is., Guam, *T.P.X.Haenke*; holo: PR *n.v., fide* A.C.Smith, *Fl. Vit. Nova* 2: 111 (1981). Epithet from the Greek *nymphaia* (water-lily) and the Latin *folium* (a leaf), in reference to the leaves resembling water-lily leaves.

H. peltata Meissner in DC., *Prodr.* 15(1): 263 (1864). T: in China & Penins. Ind. or ?in Ceylon, *Staunton*! *Thwaites CP2914*, lecto: C-DC; isolecto: B, BM, G, L, W, all *n.v., fide* K.Kubitzki, *Bot. Jahrb. Syst.* 90: 154 (1969).

Illustrations: F.M.Bailey, *Compr. Cat. Queensland Pl.* t. xiii (1910), as *H. peltata*; F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 249, fig. 39(2) (1980); A.C.Smith, *Fl. Vit. Nova* 2: 110, fig. 39 (1981).

Tree to 15 m. Leaves broadly ovate, bluntly acuminate, peltate, coriaceous, glabrous, dark green; lamina 10–25 cm long, 7–15 cm wide; petiole 6–25 cm long. Inflorescence to 25 cm long, pubescent; peduncle glabrescent; involucral bracts 4, obovate, 3–5 mm long, white. Perianth segments elliptic, 4–6 mm long, pubescent, white. Male flowers: perianth segments 6; stamens 3; pedicel c. 3 mm long. Female flowers: perianth segments 8; style straight, surrounded by 4 basally connate glands; cupule c. 2 mm long. Drupe subglobular to ovoid, 20–28 mm long, ribbed, with a rounded apical protuberance, black; cupule 2–3 cm long, translucent white ageing pink, with a circular aperture. *Sea Hearse*, *Kayu Jambu Hutan*.

Cocos (Keeling) Is. Grows in strand forest with *Calophyllum inophyllum* and *Cocos nucifera* in coral sand. Widespread adjacent to tropical beaches of N Indian and W Pacific Oceans from Madagascar and E Africa to Pitcairn Is. including NE Australia (Qld).

C.K.Is.: North Keeling Is., *I.R.Telford 10024 & C.Howard* (CBG); c. 1 km N of settlement, West Is. (Pulo Panjang), *A.S.George 16249* (CBG, K); c. 1 km SE of Ujong Pulo Jau, South Is., *I.R.Telford 10083 & C.Howard* (CBG).

A collection from Christmas Is., *C.W.Andrews 146* (K), may represent this species. Further collections, of fruiting material especially, are required to confirm this. It is most likely to occur at lower altitudes than *H. ovigera*, on the lower and coastal terraces.

2. ILLIGERA

Illigera Blume, *Bijdr. Fl. Ned. Ind.* 1153 (1826); after J.C.W.Illiger, an early 19th century Director of the Berlin Zoological Museum and author of a work on botanical terminology.

Type: *I. appendiculata* Blume

Climbing shrubs; bisexual. Leaves digitately 3-foliolate (on Ch.Is.), scattered along climbing stems; petiole long. Inflorescence a terminal or axillary, bracteate, lax, panicle-like cyme; peduncle long. Perianth segments in 2 whorls of 5, narrowly oblong, valvate, deciduous; inner whorl narrower. Stamens 5, alternating with 5 staminodes; filaments each with 2 spathulate to tubular glands at base; anthers bilocular, opening by 2 lateral valves. Style grooved; stigma discoid, oblique. Fruit nut-like, 4-angled, longitudinally 2–4-winged, coriaceous.

A genus of c. 18 species, distributed in tropical Africa and Madagascar, SE Asia, Malesia and New Guinea, with the centre of diversity in the Indo-Malayan region; 1 species on Christmas Is.

Illigera appendiculata Blume, *Bijdr. Fl. Nederl. Ind.* 1153 (1826)

subsp. **stenoptera** Kubitzki in H.G.A.Engler, *Bot. Jahrb. Syst.* 89: 164 (1969).

T: Lesser Sunda Islands, Sumbawa, *Soejarto 79*; *n.v.* Epithets from the Latin *appendix* (appendage), indicating the presence of small appendages on the bases of the stamens; and the Greek *stenos* (narrow) and *pteros* (a wing) in reference to the narrow wings on the fruit.

Illustration: K.Kubitzki, *op. cit.* 165, fig. 39, vii, fruit only.

Climbing shrub to 25 m tall; stems glabrous. Leaflets mostly broadly elliptic, rounded to obtuse at base, shortly acuminate, entire, pubescent beneath in axils of veins; lateral veins 3–6 pairs; lamina 2.5–10 cm long; petiole slender, 6–12 cm long, twining; petiolules 0.3–2.7 cm long. Inflorescence 3.5–9 cm long, increasing to 40 cm in fruit; pedicels 2–3 mm long, pubescent. Perianth segments 10, c. 6 mm long, sparsely pubescent, pink; outer whorl narrowly ovate; inner whorl linear. Stamens 5, c. 3 mm long; glands 2, tubular, hooded; staminodes 5, minute. Style slender; stigma 3-lobed, undulate. Fruit 7–9 mm long; wings dimorphic, closely parallel-veined, coriaceous, glabrous, 2 wings c. 1.5 cm wide, 2 wings c. 0.5 cm wide. Fig. 32C–E.

Christmas Is. Grows in rather open woodland on the terraces. Distributed through Sumatra, Java, the Lesser Sunda Islands, Borneo, Celebes and the Moluccas. Flowers Jan., fruits June or July.

Ch.Is.: cliff face above Flying Fish Cove, *D.A.Powell 361* (K); terrace on N side of Toms Ridge, *D.A.Powell 541* (K); coastal terrace, Smith Point, *B.A.Mitchell 129* (CBG, K); limestone cliffs above Flying Fish Cove, *D.J. & B.P.Du Puy CI46* (CBG, K).

Subspecies *stenoptera* mainly differs from subsp. *appendiculata* in its smaller fruit with the largest pair of wings only 1.5–1.7 cm wide (3–3.5 cm in subsp. *appendiculata*). The broader winged subspecies does not occur on Christmas Is.

3. GYROCARPUS

Gyrocarpus Jacq., *Select. Stirp. Amer. Hist.* 282 (1763); from the Greek *gyros* (circle, turn) and *karpos* (fruit), after the winged fruit which spins round as it falls.

Type: *G. americanus* Jacq.

Trees, mostly polygamous. Leaves simple, entire to palmately 3- or 5-lobed, palmately veined, crowded towards branchlet tips; petiole long. Flowers unisexual or bisexual, mostly male, in ebracteate, pedunculate, compound cymes. Perianth segments 1-whorled. Male flowers: perianth segments 4–7, usually 7, imbricate; stamens 4–7, usually 7, alternating with 4–7 staminodes; anthers bilocular, opening by 2 distinct, apical valves; pistil rudimentary. Bisexual and female flowers: perianth segments 2, persistent, greatly enlarging; staminodes usually present, sometimes with 2–5 stamens; style slender; stigma capitate. Fruit nut-like, bony, with 2 long, spathulate, apical wings formed by the enlarged perianth segments. Seed 1.

A pantropical genus of 3 species, commonly found near coasts; 1 species on Christmas Is. and a single record from last century for Cocos (Keeling) Is.

Gyrocarpus americanus Jacq., *Select. Stirp. Amer. Hist.* 282, t. 178, fig. 80 (1763)

subsp. **americanus**

T: Colombia, Cartagena, *N.Jacquin s.n.*; holo: BM. Epithet from the species being native to America.

G. asiaticus Willd., *Sp. Pl.* 4: 982 (1806). T: illustration of *G. jacquinii sens.* Roxb. *non* Gaertn., in W.Roxburgh, *Pl. Coromandel* 1: 1, t. 1 (1795).

Deciduous tree to 20 m; bole and branches massive; branchlets glabrescent. Leaves broadly ovate, cordate to rounded at base, entire or acutely 3- or 5-lobed, densely woolly below; lamina 10–25 cm long; petiole 5–15 cm long. Flowers small, densely crowded in corymbose cymes, scented; cymes 5–12 cm long, clustered at branchlet apices; peduncle 2–8 cm long. Male flowers: perianth segments c. 1 mm long, pubescent; stamens 4–7, alternating with 4–7 clavate staminodes. Bisexual flowers: perianth segments 2–2.5 mm long, pubescent, persistent, enlarging; stamens 3–5, alternating with 3–5 staminodes; ovary pubescent. Fruit 1–1.5 cm long, ellipsoidal, bony, hairy; wings narrowly spathulate, 5–10 cm long, finely pubescent. *Cabbage Tree, Kayu Kolec.*

Christmas Is. Common on the lower terraces, forming part of the canopy of open forest. Widely distributed in eastern Africa, throughout SE Asia and Malesia, north-eastern Australia, the Pacific islands and tropical America. Recorded for Cocos (Keeling) Is. by K.Kubitzki, *op. cit.* 183, where a collection by D.Prain, 1890, is cited. The species has not been collected there since.

Ch.Is.: Drumsite Rd, c. 200 m from Settlement, *A.Pearson & D.A.Powell P61* (K); second terrace, South Point, *B.Molesworth Allen P13* (K); coastal terrace, North West Point, *B.A.Mitchell 156* (CBG, K).

Flowers before the leaves appear, but both occur together later on, the leaves falling when the fruit is ripening. The fruit is probably sea-dispersed. The wood is soft and pithy, but the trunk can be easily hollowed out to make 'koleks', a type of outrigger canoe. A variant with darker, more dense and more durable wood is also reported from Christmas Is. The trunk of these specimens is reddish, marred by outgrowths on the lower part, suggesting an abnormality due to insect or fungal attack.

4. PIPERACEAE

D.J.Du Puy (Ch.Is.)

Herbs or shrubs, sometimes climbing, epiphytic or lithophytic, often aromatic. Stems often swollen at nodes. Leaves alternate, rarely opposite or whorled, simple, gland-dotted, sometimes succulent, often palmately nerved; stipules adnate to petiole or absent. Inflorescence a dense, axillary or terminal spike, occasionally sparsely branched. Flowers minute, usually sessile, bisexual or unisexual; bract minute. Perianth absent. Stamens usually 2–6; anthers 2-locular, free or (in *Peperomia*) confluent, dehiscing longitudinally. Ovary superior, usually unilocular; ovule 1. Stigmas 1–5; style short or absent. Fruit a drupaceous berry, 1-seeded, with a succulent, thin or dry pericarp. Seed 1.

A tropical and subtropical family of 10 genera and c. 3200 species, with greatest diversity in S America; 2 genera on Christmas Is. The two genera, *Piper* and *Peperomia*, include most of the species in this family. *Peperomia* is sometimes placed in the family Peperomiaceae. The origins of the Piperaceae are not understood, but they may be an extreme reduction from the primitive order Ranales.

F.A.W.Miquel, *Syst. Piperac.* 1–575 (1843–1844); C.de Candolle, *Piperacearum Clavis Analyticum, Candollea* 1: 65–415 (1923); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Piperaceae, *Fl. Java* 1: 167–174 (1963).

KEY TO GENERA

Climbing or erect shrub or woody herb; leaves more than 8 cm long; stipules adnate to petiole **1. PIPER**

Epiphytic or lithophytic herb; leaves less than 8 cm long; stipules absent **2. PEPEROMIA**

1. PIPER

Piper L., *Sp. Pl.* 1: 28 (1753); *Gen. Pl.* 5th edn, 18 (1754); from the Latin *piper* (black pepper), probably derived from *pepto* (to digest) in reference to its digestion-stimulating properties.

Type: *P. nigrum* L.

Mostly climbing or erect shrubs, often glandular and aromatic, dioecious, polygamous or bisexual. Leaves alternate, spirally arranged or distichous, palmately 3–5-nerved with other main lateral veins branching from near the leaf base, often oblique at base; stipules various. Spikes solitary, terminal, soon appearing leaf-opposed by growth of axillary buds, usually fleshy. Flower minute, often unisexual, often sunken into rachis; bracts small, peltate. Stamens 2–4, rarely more, short. Ovary ovoid to globose, unilocular; ovule 1. Stigmas 2–5, usually sessile. Berry shortly stalked or sessile, globose.

A pantropical genus of c. 2000 species, mostly in rainforest; 2 species on Christmas Is.

Piper nigrum L. is cultivated throughout the tropics, but probably originated in SE Asia. The fruits are the black peppercorns which are used as a condiment or spice. White pepper is the mature fruit with its thin, fleshy skin removed. The hot, spicy flavour is due to the alkaloid piperine. *Piper sarmentosum* Roxb., a woody herb to c. 1 m tall with deep green, glossy, bullate leaves and white flower spikes, is cultivated on Christmas Is. A single patch in Drumsite is maintaining itself outside cultivation and this species may become naturalised. The leaves are used to flavour curries.

Climbing shrub; leaves palmately veined, glabrous; petiole to 30 mm long **1. P. betle**

Erect shrub; leaves pinnately veined, scabrid; petiole c. 2–7 mm long **2. P. aduncum**

1. *Piper betle L., *Sp. Pl.* 1: 28 (1753)

T: Ceylon [Sri Lanka], Herb. P.Hermann, vol. 3, fol. 32, n. 27; syn: BM. Epithet from a Latin corruption of the Tamil word *vettila*, for betel.

Illustration: A.B.Graf, *Tropica* 821 (1978).

Climbing shrub, dioecious or monoecious. Nodes swollen. Leaves ovate, cordate to rounded and somewhat oblique at base, acuminate, entire, glabrous or with sparse minute hairs; lamina 8–15 cm long; petiole 6–30 mm long; stipules adnate to petiole. Spike to 10 cm long; bracts dense, peltate, c. 1 mm diam.; peduncle short in male spikes, up to as long as rachis in female spikes. Stamens 2, short. Ovary globose; stigmas 3–5, sessile. Berries immersed in rachis; apex rounded, exserted. Seed globose, 3–5 mm diam. *Betel leaf.*

Christmas Is. Introduced and now covers a small area near Drumsite. Both male and female plants have been collected, and this population seems to maintain itself. Native to Malesia, now widely cultivated in tropical SE Asia and Africa.

Ch.Is.: Drumsite, *D.A.Powell 261* (K); close to Drumsite, *D.A.Powell 284* (K).

The leaf is used in Africa and SE Asia as a masticatory, digestive or stimulant. The fresh betel leaf, which contains stimulating alkaloids, is first covered in slaked lime. A sliver of betel nut (the seed of the palm *Areca catechu*) and an extract of the leaves of *Uncaria gambir* (Rubiaceae) are then added, and the leaf is folded and chewed. The betel nut turns the saliva bright red. Tobacco may also be added to enhance the intoxicating effect, and other flavourings such as cardamon, nutmeg, camphor, menthol, *Eucalyptus* or sugar are also often included.

2. *Piper aduncum L., *Sp. Pl.* 1: 29 (1753)

T: Herb. C.Linnaeus 47.5; syn: LINN. Epithet from the Latin *aduncus* (hooked), in reference to the curved inflorescence.

An erect shrub 2–5 m tall; bisexual. Nodes swollen, purplish. Leaves distichous, elliptic to narrowly elliptic, oblique and shallowly cordate at base, acuminate, entire, pinnately

veined, scabrid above, pubescent beneath; lamina 12–22 cm long; petiole 2–7 mm long; stipules 2–3 cm long, caducous. Spike 10–12 cm long, suberect basally, arching, decurved above, pale yellow when young; bracts dense, peltate, creamy hairy, c. 0.5 mm diam.; peduncle 12–17 cm long. Stamens usually 4. Ovary ±ovoid; stigmas 2 or 3, short, subulate. Berries crowded, in fruiting spikes forming dark green rings alternating with paler rings of scales. Seed compressed, c. 1.25 mm long, brown.

Christmas Is. Naturalised in an area of secondary regrowth near Drumsite, probably introduced with machinery or materials. Native of tropical S America, widely naturalised in Malesia.

Ch.Is.: outskirts of Drumsite, near the market garden, *D.J. & B.P.Du Puy CI15* (K).

2. PEPEROMIA

Peperomia Ruiz & Pav., *Prodr.* 8 (1794); from the Greek *peperi* (pepper) and *homoios* (alike), as this genus resembles and is related to *Piper*, which includes the pepper plant.

Type: *P. secunda* Ruiz & Pav.

Perennial herbs, often epiphytic, sometimes lithophytic. Leaves alternate, opposite or whorled, often fleshy, often minutely gland-dotted, usually palmately 3- or 5-nerved; stipules absent. Spikes terminal, axillary, leaf-opposed or extra-axillary, usually fleshy, terete, occasionally branched. Flowers minute, bisexual, often sunken into rachis; bract small, fleshy, peltate to elliptic. Stamens 2, confluent above forming single anther. Ovary globose to ellipsoidal, often gland-dotted, unilocular; ovule 1. Stigma simple, glabrous or minutely pubescent. Berry shortly stalked or sessile.

A pantropical genus of 600–1000 species, with greatest diversity in the New World; 3 species on Christmas Is., 1 of which appears to be endemic. The taxonomy of this genus is poorly understood, and is in need of revision. *Peperomia* is characterised by its lack of stipules, its 2 stamens, and anatomical features. Several species are cultivated as ornamentals, usually for their coloured or textured foliage.

1 Leaves mostly broadly ovate or deltoid with a cordate base **3. P. pellucida**

1: Leaves elliptic or rhomboidal with an acute to obtuse base

2 Erect herb c. 20 cm tall with a creeping base; leaves 1.5–6.5 cm long, mostly alternate **1. P. laevifolia**

2: Creeping herb 5–10 cm tall; leaves 1–3 cm long, mostly opposite **2. P. rossii**

1. Peperomia laevifolia (Blume) Miq., *Syst. Piperac.* 107 (1843)

Piper laevifolium Blume, *Catalogus* 33 (1823). T: Java, cult. Bogor., *C.L.Blume s.n.*; iso: K. Epithet from the Latin *laevis* (smooth) and *folium* (leaf), in reference to the glabrous, waxy leaves.

P. nativitatis C.DC. in H.G.A.Engler, *Bot. Jahrb. Syst.* 56: 506 (1921). T: Christmas Is., 1887, *E.J.Lister*; syn: CAL, photo seen; isosyn: K; Christmas Is., 1904, *H.N.Ridley*; syn: CAL, photo seen; isosyn: K.

Epiphytic or lithophytic herb, glabrous; stems c. 20 cm tall, erect or ascending, creeping at base, rooting at nodes. Leaves alternate, the uppermost occasionally opposite, rhomboidal to elliptic, obtuse to acute at base, entire, obtuse to subacuminate; minutely gland-dotted, fleshy, shining dark-green above, glaucous beneath; lamina 1.5–6.5 cm long; petiole 2–8 mm long. Spikes 1 or 2 in upper leaf axils or to 4 at stem apex, simple or rarely sparsely branched, 2–8 cm long, c. 2 mm diam. when fresh; rachis fleshy; flowers many, sessile; bracts circular, c. 0.5 mm diam., peltate. Ovary sunken into rachis, ovoid; stigma sessile, minutely penicillate, oblique. Berry broadly ovoid, apiculate, to 1 mm long. Figs 9, 33D.

Christmas Is. Grows as an epiphyte on tall trees in primary forest on the plateau. Also in Java, Sumatra, Borneo, the Philippines and New Guinea.

Ch.Is.: summit, 6 Oct. 1887, *E.J.Lister* (K); N half of plateau, *C.W.Andrews 145* (K, BM); plateau, *H.N.Ridley 109* (K); S slopes of Aldrich Hill, *D.A.Powell 585* (K); near Grants Well, *D.J. & B.P.Du Puy CI31* (CBG, K).

This was described by C.de Candolle, *loc. cit.* (1921), as an endemic of Christmas Is., as *P. nativitatis*, from specimens collected by C.W.Andrews and H.N.Ridley. In his key to the species (*Candollea* 1: 350, 1923) de Candolle used its acute leaves, longer spike and globose fruit to distinguish it from *P. laevifolia* from Java. However, the variation described above, in specimens from Christmas Is., largely overlaps with the variation of *P. laevifolia* on Java. These two taxa are therefore indistinguishable and are not treated here as distinct species.

2. Peperomia rossii Rendle ex Baker f. in C.W.Andrews, *Monogr. Christmas Is.* 186 (1900)

T: Christmas Is., 1898, *C.W.Andrews s.n.*; holo: BM; iso: K. Epithet after the Clunies-Ross family who settled on Christmas Is. in 1888.

Epiphytic herb, glabrous; stems creeping, rooting at nodes; flowering shoot erect, c. 5–10 cm tall. Leaves usually opposite, acute at base, elliptic, entire, rounded to subacute, glabrous, minutely gland-dotted; lamina usually 1–3 cm long; petiole 3–4 mm long. Spike terminal, or in upper leaf axils, solitary, simple, 2.5–4.5 cm long; rachis fleshy; flowers many, sessile; bracts circular, peltate, c. 0.5 mm diam. Ovary sunken into rachis, ovoid; stigma sessile, oblique. Berry subglobose, apiculate, less than 1 mm long. Fig. 33E.

Known only from the type collection.

The specimen is of a much smaller plant than *P. laevifolia* and appears to be distinct as indicated in the key. It is, however, closely related to this and several other species (including *P. elliptica* A.Dietr., *P. insularum* Miq. and *P. curtispica* C.DC.), but none shows a similar combination of the following characters: plant glabrous; leaves opposite, elliptic, obtuse, glandular; inflorescence solitary, apical; bracts peltate and stigma oblique. A full revision of the genus is required to establish the affinities of this plant.

3. *Peperomia pellucida (L.) Kunth, *Nov. Gen. Sp.* 1: 64 (1816)

Piper pellucidum L., *Sp. Pl.* 1: 30 (1753). T: Herb. Hort. Cliff. *6*, Piper 1; syn: BM; Herb. C.Linnaeus 47.8; syn: LINN. Epithet from the Latin *per* (through) and *lucidus* (clear), referring to the somewhat translucent appearance of the plant.

[*Peperomia exigua auct. non* Miq.: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 220 (1906)]

Annual, lithophytic herb, glabrous; stems c. 20 cm tall, erect or ±decumbent, much-branched. Leaves alternate, broadly ovate to triangular, entire, subacute to acuminate or blunt at apex, cordate to broadly rounded at base, without distinct gland dots, glossy above, glaucous beneath; lamina 0.8–3 cm long; petiole 3–13 mm long. Spikes solitary, axillary, 2.5–6.5 cm long, very slender; flowers sessile; bracts circular, c. 0.3 mm diam., peltate. Ovary ovoid; stigma almost sessile, minutely penicillate. Berry globose, beaked, c. 0.5 mm long.

Christmas Is. Naturalised but not recorded since 1906, and may not still be extant on the island. Native to tropical America; naturalised in many tropical regions.

Ch.Is.: on rocks close to Ross Old House, *C.W.Andrews 191* (BM).

5. ARISTOLOCHIACEAE

D.J.Du Puy (Ch.Is.)

Herbs or shrubs, often climbing. Leaves alternate, simple, often cordate at base, entire or lobed; stipules absent, pseudostipules sometimes present. Inflorescence axillary or cauline, racemose or cymose, or flowers solitary or clustered. Flowers often zygomorphic, bisexual, usually 3-merous; perianth and stamens usually epigynous. Calyx segments usually 3, connate. Petals reduced or absent. Stamens 6–36, free or adnate to styles; anthers bilocular, longitudinally dehiscent. Ovary usually inferior, 4–6-locular; styles 3–several, connate; ovules many. Fruit usually a 6-valved, septicidal capsule, dehiscing acropetally or basipetally; seeds many, often immersed in pulpy endocarp, occasionally winged.

A pantropical and warm temperate family of 7–9 genera with c. 450 species; 1 genus (1 species) naturalised on Christmas Is. *Aristolochia* and *Asarum* are commonly cultivated as ornamentals. The foliage is an important food source for the larvae of many species of Swallow-tails (family Papilionidae).

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Aristolochiaceae, *Fl. Java* 1: 161–164 (1963); H.W.Pfeifer, A Revision of the North and Central American species of *Aristolochia* (Aristolochiaceae), *Ann. Missouri Bot. Gard.* 53: 115–196 (1966); A.C.Smith, Aristolochiaceae, *Fl. Vit. Nova* 2: 52–56 (1981); Ding Hou, Aristolochiaceae, *Fl. Males.* ser. I, 10: 53–108 (1984).

ARISTOLOCHIA

Aristolochia L., *Sp. Pl.* 2: 960 (1753); *Gen. Pl.* 5th edn, 410 (1754); from the Greek *aristos* (very good, best) and *locheia* (to give birth), as the species were used medicinally during childbirth, following the doctrine of signatures (whereby the configuration of an organ resembles the form of a human organ or disease), the bud somewhat resembling a foetus.

Type: *A. rotunda* L.

Climbing herbs or shrubs, rarely erect; flowers and foliage often foetid. Leaves cordate at base, entire; pseudostipules sometimes present. Flowers axillary or cauline, often solitary or clustered, strongly zygomorphic. Calyx tube straight to sigmoid, inflated basally forming utricle that encloses sexual organs, then constricted before expanding into a 1–3-lobed, often highly coloured petaloid limb. Petals absent. Anthers usually 5 or 6, sessile on stylar column. Ovary inferior, 5- or 6-locular; styles often 5 or 6, connate basally. Capsule dehiscing by 5 or 6 valves from base, closed at apex; pedicel splitting concurrently; seeds flat, sometimes winged.

A mainly pantropical and subtropical genus of c. 400 species, with greatest diversity in central and S America, and with a few temperate species; 1 species naturalised on Christmas Is. Several species commonly cultivated as garden or greenhouse ornamentals.

***Aristolochia littoralis** Parodi, *Anales Soc. Ci. Argent.* 5: 155, *contrib.* 47 (1878)

T: Argentina, *D.Parodi s.n.*; *n.v.* Epithet from the Latin *littoralis* (of the seashore, beach), as this species was first recorded as an element of the strand vegetation.

A. elegans Mast., *Gard. Chron.* n. ser., 34: 301, t. 61 (1885). T: near Rio de Janeiro, Brazil, *A.Glaziou 13163*; holo: K.

Illustration: A.B.Graf, *Tropica* 145 (1978), as *A. elegans*.

Slender climber to 2–3 m. Leaves triangular to reniform, deeply cordate at base, ±rounded to obtuse, glabrous, glaucous beneath; lamina 4–9 cm long; petiole 2–5 cm long; pseudostipules auriculate, foliaceous, sometimes absent. Flowers solitary. Calyx tube

strongly sigmoid; utricle ellipsoidal, c. 2.5 cm long, retrorsely hairy inside, greenish white; limb broadly ovate, 4–8 cm long, cordate at base, entire, glabrous, yellowish mottled with dark purple, with a purple blotch near throat. Anthers 6. Capsule cylindrical, 3.5–4 cm long, beaked; beak conspicuous, 5–7 mm long, with discoid apex; valves 6; pedicel splitting into 6 slender filaments as capsule opens. Seeds ovate, c. 4 mm long, flat, with narrow, marginal wing. *Calico Flower, Dutchman's Pipe*.

Christmas Is. Naturalised in secondary forest, 50–150 m alt. Native to S America and occurs in many tropical regions as an escape from cultivation.

Ch.Is.: cliffs directly behind Isabel Beach, *D.A.Powell 482* (K).

Widely grown in the tropics and as a greenhouse climber in temperate climates. The flowers are probably fly-pollinated, the insect being trapped in the utricle until the retrorse hairs in the throat wither, allowing it to escape. The hairs do not wither until the pollen has been shed, so the insect is dusted with fresh pollen before it leaves the flower.

6. RANUNCULACEAE

A.E.Orchard (M.Is., H.Is.)

Perennial or annual herbs, or less commonly woody shrubs or climbers. Leaves usually alternate, rarely opposite, simple or more often variously dissected or compound (usually ternately divided or cut, or 1–2-pinnate), usually exstipulate. Inflorescence a raceme, panicle, lax leafy cyme or solitary flower. Flowers hypogynous, usually bisexual and actinomorphic. Sepals usually 5–8 but sometimes fewer or more, sometimes petaloid. Petals free, variable in number but often c. 5. Stamens usually many, free. Carpels 1 to several or many, usually free, each with a distinct style and seated on a more or less elongated receptacle; ovules 1–many. Fruit usually a follicle, achene or berry.

A cosmopolitan family of c. 50 genera and 2000 species, best developed in the Northern Hemisphere; in Australia 10 genera (5 introduced) and c. 60 species; on the subantarctic islands 1 genus (1 species). Many genera such as *Anemone*, *Aquilegia*, *Clematis*, *Delphinium*, *Helleborus* and *Ranunculus* are important in floriculture.

G.Bentham, Ranunculaceae, *Fl. Austral.* 1: 4–15 (1863); T.F.Cheeseman, Ranunculaceae, *Vasc. Fl. Macquarie Is.* 16 (1919); B.W.Taylor, Ranunculaceae, *Fl. Veg. Soils Macquarie Is.* 105–107 (1955); H.H.Allan, Ranunculaceae, *Fl. New Zealand* 1: 139–172 (1961); C.J.Webb *et al.*, Ranunculaceae, *Fl. New Zealand* 4: 1001–1039 (1988).

RANUNCULUS

Ranunculus L., *Sp. Pl.* 1: 548 (1753); *Gen. Pl.* 5th edn, 243 (1754); diminutive form of the Latin *rana* (frog), the name of a plant in the writings of Pliny.

Type: *R. auricomus* L.

Annual or perennial terrestrial or aquatic herbs. Roots fibrous, swollen or bulbous; stems erect, creeping or stoloniferous. Leaves usually alternate, rarely opposite, often in a basal rosette, simple and entire to variously palmately, ternately or pinnately lobed or divided, exstipulate but petiole semi-sheathing. Flowers solitary or in lax leafy cymes. Sepals 3–5. Petals 5–15, usually yellow. Stamens usually many, spirally arranged. Carpels few to many; ovules 1 per carpel, basal. Fruit a head of achenes, each usually with a glabrous beak formed by the persistent style.

A cosmopolitan genus of 400–500 species, with the greatest diversity in the temperate Northern Hemisphere; c. 45–50 species in Australia (10 introduced); 1 species on the

Australian subantarctic islands.

G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 8: 42 (1984). J.J.Scott, New records of vascular plants from Heard Island, *Polar Record* 25: 37–42 (1989).

Ranunculus crassipes Hook.f., *Fl. Antarct.* 1: 224 (1845)

T: Kerguelens Land [Kerguelen Is.], May–July 1840, *J.D.Hooker*; *n.v.* Epithet refers to the thicker, more succulent nature of this species as compared to *R. biternatus* Sm.

[*R. biternatus auct. non* Sm.: T.F.Cheeseman, *Vasc. Fl. Macquarie Is.* 16 (1919)]

Illustrations: J.D.Hooker, *Fl. Antarct.* pl LXXXI (1845); B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* pl. 26 (1955).

Perennial herb, stoloniferous, glabrous. Leaves ternate or ternatifid, ±orbicular, 1.5–5 cm long including petiole (to 15 cm in shade); lamina usually 3–12 mm diam.; lobes acutely 2–5-toothed. Flowers solitary; scape short, stout. Sepals c. 5, 4.5–6 mm long. Petals 5–7, oblanceolate to obovate-spathulate, 4.5–5.5 mm long. Stamens many, 1.7–3 mm long. Carpels 12–20, glabrous. Achenes reddish purple, smooth, turgid, 1.5–1.7 mm long excluding style. *2n* = 48, *J.M.R.Hughes s.n.* (HO88875); also D.M.Moore, *Bot. Not.* 113: 187 (1960). Figs 10, 39F–I.

Macquarie Is., Heard Is. Widespread and abundant in boggy areas on Macquarie Is., but apparently confined to Skua Beach on Heard Is. Also on Kerguelen Is. Flowers Dec.–Mar.; fruits c. Mar., the achenes persisting until Sept.

M.Is.: Gadgets Gully, 2 Sept. 1948, *N.R.Laird* (HO); Wireless Hill, *R.D.Seppelt 12204* (HO); 700 m W of Handspike Corner, *R.D.Seppelt 12232* (HO); 450 m SW of Mt Ifould, *R.D.Seppelt 12380* (HO). H.Is.: Skua Beach, 23 Dec. 1986, *J.J.Scott* (HO).

Most recent authors have treated this species on Macquarie Is. and Heard Is. under the name *R. biternatus* Sm., considering this to be a highly variable and circumpolar species on islands ranging from the Falkland, South Georgia and Diego Ramirez, Crozet, Amsterdam, Marion, Kerguelen, Heard and Macquarie Islands, as well as from S America. Hj. Eichler considered (*pers. comm.*) that Hooker's recognition of *R. crassipes* as distinct from *R. biternatus* was correct. His judgement is followed here. *Ranunculus crassipes* can be distinguished by its usually ternate or ternatifid (not biternate or biternatifid) leaves, and its usually thicker habit.

7. MENISPERMACEAE

L.L.Forman (Ch.Is.)

Mostly woody climbers, dioecious. Leaves alternate, usually simple, often palmatinerved at base, exstipulate. Inflorescence axillary, sometimes on leafless stems, cymose, pseudoracemose or thyrsoid. Flowers small, hypogynous; female sometimes zygomorphic. Sepals usually in 1 or 2(–4) whorls of 3; outer whorls smallest, usually free. Petals mostly 3 or 6 in 1 or 2 whorls, usually free and smaller than sepals. Stamens mostly 3 or 6, free or variously connate. Ovary superior; carpels usually 3 or 6, free; ovules 2, ventral. Fruit drupaceous, sometimes on a carpophore; style-scar terminal to sub-basal; endocarp usually bony and ornamented, sometimes with a ventral intrusion into seed-cavity around which the seed is curved. Seeds often horseshoe-shaped, sometimes convex or straight; endosperm present, sometimes ruminate or absent.

A mainly tropical family of 73 genera and c. 350–400 species; 2 genera and 3 species occur on Christmas Is. but probably only 1 species is native.

L.Diels, Menispermaceae, *Pflanzenr.* 46: 1–345 (1910); L.L.Forman, Menispermaceae, *Fl. Males.* ser. I, 10: 157–253 (1986).

KEY TO GENERA

Plant yellowish-pubescent; leaves truncate to rounded at base; petiole not twisted at base; inflorescence axillary; drupe with style-scar near base **1. PACHYGONE**

Plant glabrous; leaves cordate at base; petiole twisted at base; inflorescence on leafless stem; drupe with terminal style-scar **2. TINOSPORA**

1. PACHYGONE

Pachygone Miers, *Ann. Mag. Nat. Hist.* ser. 2, 7: 37 (1851); from the Greek *pachys* (thick) and *gone* (offspring), referring to the thick cotyledons.

Type: *P. plukenettii* (DC.) Miers

Tristichocalyx F.Muell., *Fragm.* 4: 27 (1863). T: *T. pubescens* (Benth.) F.Muell.

Woody climbers. Inflorescence axillary, raceme-like. Leaves usually ±ovate; petiole not twisted. Sepals 6, sometimes 12, inner ones larger, imbricate. Petals 6, auriculate at base. Male flowers: stamens 6, free. Female flowers: staminodes 6; carpels 3; style reflexed; stigma entire. Drupe with style-scar near base; endocarp subcompressed-obovoid, rather smooth. Seed strongly curved around a central cavity in endocarp; endosperm absent; cotyledons thick, contiguous.

A genus of c. 10 species in SE Asia, Malesia, Australia and the Pacific; 1 of the 2 species in Australia occurs on Christmas Is.

Pachygone ovata (Poir.) Hook.f. & Thomson, *Fl. Indica* 1: 203 (1855)

Cissampelos ovata Poir. in J.B.A.P.M. de Lamarck., *Encycl.* 5: 10 (1804). T: 'Indes orientales', *P.Sonnerat*; *n.v.* Epithet from the Latin *ovatus* (ovate) in reference to the leaf shape.

P. pubescens Benth., *Fl. Austral.* 1: 58 (1863); *Tristichocalyx pubescens* (Benth.) F.Muell., *Fragm.* 4: 27 (1863); *Cebatha pubescens* (Benth.) Kuntze, *Revis. Gen. Pl.* 1: 9 (1891). T: Quail Is., Qld, Sept. 1855, *J.Flood*; holo: K.

Tinospora hullsii F.Muell., *Fragm.* 5: 147 (1866); *Pachygone hullsii* (F.Muell.) F.Muell., *Fragm.* 9: 81 (1875). T: Escape Cliff, Qld, *C.Hulls s.n.*; iso: K.

Limacia nativitatis Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 170 (1906). T: Flying Fish Cove, Christmas Is., Oct. 1904, *H.N.Ridley 140*; iso: K.

Illustration: L.Diels, *Pflanzenr.* 46: 243, fig. 80 (1910).

Woody climber to 15 m or more, yellowish pubescent. Leaves ovate-lanceolate to broadly ovate, truncate to rounded at base, acute to obtuse; lamina 5–11 cm long; petiole 2.5–4 cm long. Inflorescence of c. 3–5 flowers in clusters along main axis, 4–17 cm long; pedicels usually 1–3 mm long. Sepals yellow, the largest 1.5–2.5 mm long. Drupes 7–8 mm long, 6 mm wide, glabrous; fruiting pedicel 3–5 mm long.

Christmas Is. Climbing on trees, reaching the canopy in the forest, also on limestone pinnacles above North East Point. In Australia: W.A., N.T., Qld. Also in S India, Sri Lanka, central and eastern Malesia.

Ch.Is.: Sept.–Oct. 1887, *J.J.Lister s.n.* (K); c. 1 km S of no. 4 camp, *D.A.Powell 107* (K); central area, *D.A.Powell 295* (K); Flying Fish Cove, *D.A.Powell 422* (K); terrace overlooking North East Point, *D.A.Powell 774* (K).

Excluded species

[*Tiliacora racemosa auct. non* Colebr.: E.G.Baker in C.W.Andrews, *Monogr. Christmas Is.* 171 (1900)]

This is probably *Pachygone ovata* (Poir.) Hook.f. & Thomson, but the Andrews specimen has not been found.

2. TINOSPORA

Tinospora Miers, *Ann. Mag. Nat. Hist.* ser. 2, 7: 35 (1851); from the Latin *tinus* (*Viburnum tinus*) and the Greek *spora* (seed) in reference to the endocarp.

Type: *T. cordifolia* (Willd.) Hook.f. & Thomson

Fawcettia F.Muell., *Fragm.* 10: 93 (1877). T: *F. tinosporoides* F.Muell.

Woody climbers, sometimes flowering when leafless. Leaves often cordate; petiole swollen and twisted at base. Inflorescence often raceme-like. Sepals 6, usually free, inner ones usually larger. Petals 3 or 6. Male flowers: stamens 6, free (in Asia). Female flowers: staminodes 6; carpels 3; stigma with reflexed pointed lobes. Drupe with terminal style scar; endocarp dorsally convex, sometimes papillose to smooth, with a ventral aperture. Seed straight, ventrally convex; endosperm usually ruminate; cotyledons thin, divaricate.

An Old World genus of 32 species including 4 in Australia; 2 species, probably introduced, first collected on Christmas Is. in 1980. So far only male plants have been found there, but both species regenerate readily by means of their aerial roots.

L.L.Forman, A revision of *Tinospora* in Asia to Australia and the Pacific, *Kew Bull.* 36: 375–421 (1981).

Mature stems strongly tuberculate; leaves lacking hollow domatia in basal nerve-axils; petals usually 3; endocarp whitish, 11-13 mm long **1. T. crispa**

Stems bearing pustules but not tuberculate; leaves with a pair of hollow domatia in basal nerve-axils; petals 6; endocarp blackish grey, 7–9 mm long **2. T. baenzigeri**

1. *Tinospora crispa (L.) Hook.f. & Thomson, *Fl. Indica* 1: 183 (1855)

Menispermum crispum L., *Sp. Pl.* 2nd edn, 2: 1468 (1763). T: illustration of *Funis felleus*, G.E.Rumphius, *Herb. Amboin.* 5: t. 44, fig. 1 (1747). Epithet from the Latin *crispus* (crisped or twisted) in reference to the stem.

Woody climber to c. 15 m high, glabrous, flowering when leafless; stems becoming prominently tuberculate, containing very bitter sap, producing very long, filiform, aerial roots. Leaves broadly ovate to orbicular, cordate at base, usually long-acuminate; hollow domatia absent from axils of basal nerves; lamina 7–14 cm long. Inflorescence raceme-like on old stems; male 9–20 cm long; female shorter; pedicels 2–4 mm long. Sepals green, the largest 3–4 mm long. Petals 3, sometimes 1–3 additional reduced petals present. Drupe orange; endocarp whitish, ellipsoidal, 11–13 mm long. Fig. 33A–C.

Christmas Is. Climbing on trees and over rocks on the shore-terraces, probably introduced. SE Asia to central Malesia and the Philippines.

Ch.Is.: Smiths Point, *D.A.Powell 263F* (K); Smiths Point, *D.A.Powell 407A* (K).

Widely cultivated and used medicinally in SE Asia; probably introduced to Christmas Is. by immigrant workers. Sometimes grows with *T. baenzigeri*.

Figure 33. **A–C**, MENISPERMACEAE: *Tinospora crispa*. **A**, leaf X0.5; **B**, stem X0.5 (**A–B**, H.Bänziger 71-16, K); **C**, male inflorescence X0.5 (H.Bänziger 71-15, K). **D–E**, PIPERACEAE. **D**, *Peperomia laevifolia*, flowering shoot X0.5 (C.Andrews 145, K). **E**, *Peperomia rossii*, flowering plant X0.5 (Christmas Is., C.Andrews, holo, BM). **F–I**, ULMACEAE: *Celtis timorensis*. **F**, sterile branchlet X0.5; **G**, flowering branchlet with bisexual inflorescence X0.5 (**F–G**, C.Andrews 63, K); **H**, flowering branchlet with female inflorescence X0.5 (Nurta-Hasan 71, K); **I**, fruit X1 (B.Mitchell 86, K). Drawn by E.Catherine.

2. *Tinospora baenzigeri Forman, *Kew Bull.* 36: 399 (1981)

T: Peninsular Thailand, 16 Mar. 1927, *A.F.G.Kerr 12345*; holo: K. Epithet given in honour of H.Banziger who discovered the species in Thailand.

Similar to *T. crispa* but differing as follows. Stems bearing scattered pustular lenticels but lacking prominent tubercles. Leaves with hollow domatia in axils of basal nerves on lower surface. Flowers with pedicels to 13 mm long. Petals 6. Drupe with endocarp blackish grey, 7–9 mm long.

Christmas Is. Climbing on trees and over rocks on the shore-terraces, probably introduced. Native in Thailand, possibly also in S Vietnam and Malaya.

Ch.Is.: Smiths Point, *D.A.Powell 263A–263E* (K); Smiths Point, *D.A.Powell 407B* (K); Isabel Beach, *D.A.Powell 408* (K); Waterfall Rd, *D.A.Powell 409* (K).

This species is not known to have any uses; it was probably introduced, possibly accidentally, with *T. crispa*, see L.L.Forman, *Kew Bull.* 39: 113 (1984).

8. ULMACEAE

D.J.Du Puy (Ch.Is.)

Trees and shrubs, often monoecious. Leaves alternate, often distichous, simple, often oblique at base, usually serrate, pinnately nerved or with 3 nerves from base; stipules caducous. Inflorescence an axillary cyme or cymose cluster; cymes frequently branched, panicle-like or thyrsoid; flowers very small, usually actinomorphic, bisexual or unisexual. Perianth campanulate, usually with 4–8 deep to shallow, imbricate or valvate lobes. Disc absent. Stamens usually as many as and opposite perianth lobes, absent or staminodal in female flowers; anthers bilocular, longitudinally dehiscent. Ovary superior, unilocular, often rudimentary in male flowers; ovule 1. Style with 2 divergent stigmatic arms that are sometimes lobed. Fruit a samara, often broadly winged, or a thinly fleshy drupe. Seed 1.

A family of c. 15 genera and c. 200 species, widely distributed in the tropics and subtropics, with some species in northern or southern temperate zones; 2 genera (2 species) on Christmas Is. The genera *Ulmus*, *Zelkova* and *Celtis* produce strong, flexible, attractive wood. The bark has a high content of mucilaginous substances and is used in the preparation of medicinal ointments. It is also fibrous and can be used to make rough ropes.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Ulmaceae, *Fl. Java* 2: 10–12 (1965); J.Hutchinson, Ulmaceae, *Genera Fl. Pl.* 2: 144–150 (1967); E.Soepadmo, Ulmaceae, *Fl. Males*. ser. I, 8: 31–76 (1977); A.C.Smith, Ulmaceae, *Fl. Vit. Nova* 2: 156–166 (1981).

KEY TO GENERA

Leaves strongly 3-nerved from base to near apex; pubescent on veins beneath; leaf base obtuse or rounded; flowers mostly bisexual or male; perianth caducous; drupe 7–11 mm long **1. CELTIS**

Leaves pinnately nerved, densely covered with velvety grey hair beneath; leaf base cordate; flowers mostly female or male; perianth persistent, subtending fruit; drupe c. 3 mm long **2. TREMA**

1. CELTIS

Celtis L., *Sp. Pl.* 2: 1043 (1753); *Gen. Pl.* 5th edn, 467 (1754); a Latin plant name of antiquity.

Type: *C. australis* L.

Trees or shrubs, monoecious or polygamomonoecious. Leaves oblique, serrate to entire, 3-nerved; stipules peltate, or basifixed and scarious. Inflorescence often branched, panicle-like; male inflorescences on lower, often leafless parts of branchlets; bisexual or female inflorescences in axils of young leaves. Flowers minute. Perianth lobes mostly 4 or 5, deeply divided, imbricate, membranous, recurved, caducous. Stamens 4 or 5, eventually exserted, rarely rudimentary (in female flowers). Ovary sessile; style very short; stigmatic arms 2, long, divergent, entire to deeply bifid, plumose, rudimentary in male flowers. Fruit a drupe, with remains of stigma at apex; pyrene bony, smooth or ridged.

A genus of c. 50–60 species, distributed throughout the tropics and subtropics, and extending into northern and southern temperate zones; 1 species on Christmas Is.

Celtis timorensis Span., *Linnaea* 15: 343–344 (1841)

T: Timor, *J.B.Spanoghe s.n.*; iso: K. Epithet from Timor, locality of the original collection.

C. cinnamomea Lindl. ex Planch., *Ann. Sci. Nat.* ser. 3, 10: 303 (1848). T: Sylhet, Bangladesh, *N.Wallich* cat. no. *3696*; syn: K.

Illustration: E.Soepadmo, *Fl. Males.* ser. I, 8: 64, fig. 23f–h (1977), leaves only.

Tree to 25 m tall; young branchlets rufous-pubescent, glabrescent. Leaves ovate to oblong, obtuse or rounded to subcordate at base, oblique, serrulate towards apex, acuminate, strongly 3-veined, pubescent on veins beneath; lamina 5–13 cm long; petiole 3–8 mm long; stipules ovate. Inflorescence to 3 cm long, woolly hairy; bisexual inflorescences c. 2–7-flowered, lax; male inflorescences c. 10–20-flowered, much-branched. Perianth lobes 4 or 5, oblong, c. 2 mm long, obtuse, membranous, ciliate. Stamens 4 or 5; anthers large, sometimes absent. Receptacle woolly. Ovary ovoid, c. 2 mm long; stigmatic arms linear, spreading, absent in male flowers. Drupe ovoid, somewhat compressed, 7–11 mm long, glabrous; beak bifid; pyrene rugose. *Stinking Wood, Kayu Busok.* Fig. 33F–I.

Christmas Is. Common throughout the island forming about 1% of the primary rainforest canopy, also in understorey. More frequent in marginal forest, where it may become one of the emergent trees, and in open forest on terraces. Distributed from India and Sri Lanka through Indo-China and Malesia to the Philippines.

Ch.Is.: no precise locality, *C.W.Andrews 63* (K); Flying Fish Cove, *H.N.Ridley 130* (K); northern plateau, *D.A.Powell 22* (K); first terrace immediately below Drumsite, *D.A.Powell 54* (K).

Resembles *Cinnamomum iners* Reinw. ex Blume in its 3-veined leaf, but can easily be distinguished by its serrulate leaf margin. The bark is distinctively mottled inside. The wood smells foetid due to the presence of skatole, and is said to drive away evil spirits. The fruit is dispersed by water as the seed is protected by the hard, durable endocarp.

2. TREMA

Trema Lour., *Fl. Cochinch.* 2: 562 (1790); from the Greek *trema* (hole), alluding to the pitting on the pyrene of the fruit.

Type: *T. cannabina* Lour.

Trees or tall shrubs; monoecious. Leaves often oblique at base, serrate, pinnately nerved; stipules free. Inflorescences usually male or female, sometimes mixed, often on separate branches, often branched, panicle-like or thyrsoid, subsessile, hairy. Flowers minute. Perianth deeply 4- or 5-lobed, valvate, persistent. Receptacle usually pilose. Stamens 4 or 5, absent or staminodal in female flowers. Ovary sessile, ovoid, rudimentary in male flowers;

style very short, with 2 divergent stigmatic arms. Fruit a small, ovoid or subglobose drupe, often with remains of stigma at apex, and subtended by persistent perianth; pyrene bony, pitted.

A genus of 10–15 species, distributed throughout the tropics and subtropics; 1 species on Christmas Is. The species are often gregarious, growing on all types of disturbed soils, including volcanic ash, limestone and heavy laterite.

***Trema tomentosa** (Roxb.) Hara, *Fl. E. Himalaya* 2: 19 (1971)

Celtis tomentosa Roxb., *Fl. Ind.*, ed. W.Carey, 2: 66 (1832). T: Chittagong, Bangladesh, *coll. unknown*; *n.v.* Epithet from the Latin *tomentosus* (felted), a term for a covering of dense, short hairs.

[*Sponia amboinensis auct. non* (Willd.) Decne.: C.W.Andrews, *Monogr. Christmas Is.* 188 (1900)]

[*T. amboinensis auct. non* (Willd.) Blume: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 226 (1906)]

Tree to 15 m tall; branchlets whitish hairy. Leaves ovate to oblong, cordate and very oblique at base, serrulate, finely short-acuminate, grey-velvety beneath; lamina 7–15 cm long; petiole 6–12 mm long. Inflorescences mainly unisexual and on separate branchlets, c. 1–2.5 cm long, branched, lax, whitish hairy; male inflorescence with c. 20–100 flowers, female with c. 5–15 flowers. Perianth lobes usually 5, ovate, 1–1.5 mm long, cream; stamens usually 5, absent in female flowers. Ovary ellipsoidal, c. 1.5 mm long, reduced in male flowers. Drupe ellipsoidal, c. 3 mm long, fleshy, subsessile, red becoming black, with persistent perianth at base, and shrivelled stigmatic remains at apex. *Nettle Tree*.

Christmas Is. Uncommon species of marginal forest, occurring most frequently on forest edges and spreading along roads through forest. Widespread in eastern tropical Africa and Madagascar, and in SE Asia from India and China, through Indo-China and Malesia to Australia (Qld) and the Pacific islands.

Ch.Is.: no precise locality, *C.W.Andrews 32* (K); no precise locality, *D.A.Powell 280* (K); near Waterfall, E coast, *B.A.Mitchell 77* (CBG, K); track to Grants Well, *D.J. & B.P.Du Puy CI99* (CBG, K).

Appears to have been introduced at about the end of the 19th century, when it was recorded as mainly occurring on cultivated ground. The fibrous bark can be used to make rope. The leaves have purgative properties. The drupes are eaten by birds. It could prove to be a useful ground cover species in disused quarries, growing rapidly and densely on relatively poor soils, producing abundant seed throughout the year, and easily shaded out once stronger species become established.

9. MORACEAE

D.J.Du Puy (Ch.Is.)

Mostly trees, shrubs, climbers or lianes; monoecious or dioecious; mostly with milky sap. Leaves alternate, rarely opposite, simple, sometimes toothed or palmately lobed; stipules 2, sometimes connate, frequently spathe-like and sheathing the terminal bud, caducous, leaving an annular scar. Inflorescences axillary to cauliflorous, often paired, unisexual or mixed, catkin-like, a panicle, raceme, spike or head, or sometimes flowers crowded in flat or hollow, fleshy receptacles. Flowers small, unisexual or sterile (gall), actinomorphic. Perianth usually of 4 segments, free or connate, imbricate or valvate, persistent, sometimes absent. Male flowers: stamens usually 4, sometimes solitary; anthers usually bilocular, longitudinally dehiscent; rudimentary ovary sometimes present. Female flowers: ovary unilocular, superior to inferior or immersed in inflorescence axis; ovule 1; styles 1 or 2; stigmas linear. Fruits drupaceous, free or connate, in small to large fleshy syncarps (*Maclura*) or syconia (*Ficus*).

A mainly tropical and subtropical family of c. 53 genera and c. 1400 species; 2 genera (3 species) native to Christmas Is. Two species of *Morus* have been cultivated in temperate countries since antiquity: *M. nigra* L. (Black Mulberry) for its edible fruit, and *M. alba* L., chiefly for its leaves which are the food source of the silk-worm. *Ficus carica* L. (the edible fig) has been cultivated for many centuries, although there are other species with edible fruit. *Artocarpus altilis* (Parkinson) Fosberg (Breadfruit) and *A. heterophyllus* Lam. (Jackfruit) are cultivated on Christmas Is. *Ficus elastica* Roxb. and *Castilla elastica* Cerv. have been cultivated for their latex, used to produce rubber.

E.J.H.Corner, The Classification of Moraceae, *Gard. Bull. Singapore* 19: 187–252 (1962); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Moraceae, *Fl. Java* 2: 12–13 (1965).

KEY TO GENERA

Flowers and fruits inside a smooth, spherical, fleshy receptacle (fig), 0.7–1 cm diam., with an apical pore (closed by bracts), and subtended by 3 bracts, the whole resembling a berry **1. FICUS**

Flowers and fruits densely crowded on a spherical to cylindrical inflorescence or syncarp, not subtended by bracts, not berry-like **2. MACLURA**

1. FICUS

Ficus L., *Sp. Pl.* 2: 1059 (1753); *Gen. Pl.* 5th edn, 482 (1754); the Latin name for the edible fig, *F. carica*.

Type: *F. carica* L.

Trees, shrubs, climbers or lianes, sometimes epiphytic when young. Leaves simple, palmately lobed, entire or dentate, often with many cystoliths; stipules conical, enveloping bud. Inflorescences (figs) often paired, fleshy, containing many flowers, subtended by several bracts; apical aperture closed by bracts. Flowers minute, unisexual or sterile (gall), usually separated by bracteoles. Perianth segments usually 3–5, free or connate, imbricate, often reddish. Male flowers mostly near aperture; stamens usually 1–3. Female flowers: style 1, lateral; stigma simple or bifid. Gall flowers similar to females; ovary empty or containing an insect larva; style funnel-shaped. Drupes many per fig, thinly pulpy; endocarp woody.

A genus of c. 600–800 species with a pantropical and subtropical distribution, occasionally in warm-temperate regions; 2 species on Christmas Is. Pollination is by a small fig-wasp which hatches out of the gall flowers, mates and then leaves the fig through the apical aperture, carrying some pollen with it. It searches out a fig in which to lay its eggs, and may find either a fig tree with only female flowers, in which case pollination is effected, or one with gall flowers, in which the larvae can develop. The gall flowers have funnel-shaped stigmas which allow the ovipositor of the wasp to pass down to the flower, ensuring that the egg is laid inside the ovary of the flower. Many species produce latex which can be used to make rubber, but these have been superseded by synthetic rubber, or rubber produced from *Hevea* species (Euphorbiaceae). Several species are used as ornamentals, including *F. benjamina* L., *F. pumila* L., and *F. pandurata* Hance. The edible fig, widely grown in warm-temperate regions, is *F. carica* L.

E.J.H.Corner, Taxonomic Notes on *Ficus* Linn., Asia and Australasia, *Gard. Bull. Singapore* 17: 368–485 (1960); E.J.H.Corner, Check-List of *Ficus* in Asia and Australasia with Keys to Identification, *Gard. Bull. Singapore* 21: 1–186 (1965).

Branches usually with many aerial roots; leaves 2.5–9 cm long, cuneate at base; fig rounded at apex **1. F. microcarpa**

Branches without aerial roots; leaves 10–25 cm long, rounded to cordate at base; fig with a 1 mm long beak at apex **2. F. saxophila**

1. Ficus microcarpa L.f., *Suppl. Sp. Pl.* 1: 442 (1782)

var. **microcarpa** f. **microcarpa**

T: Java, C.P.Thunberg Herb. 24334, & Herb. C.Linnaeus 1240.19; ?iso: LINN microfiche seen, S. Epithet from the Greek *micros* (small) and *karpos* (fruit), descriptive of the small figs of this species.

[*F. retusa auct. non* L.: C.W.Andrews, *Monogr. Christmas Is.* 189 (1900)]

[*F. retusa* var. *nitida auct. non* L.: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 226 (1906)]

Illustration: E.J.H.Corner, *Wayside Trees of Malaya* 2: t. 207 (1952), as *F. retusa*.

Strangling, spreading tree to 25 m tall, often originally epiphytic, or creeping shrub on exposed rocks, with aerial roots, monoecious. Leaves oblong-obovate to elliptic, cuneate at base, entire, rounded, obtuse or shortly blunt-acuminate, glabrous, glossy; lamina 2.5–9 cm long; petiole 2–15 mm long; stipules 5–10 mm long, caducous. Figs sessile, axillary, globose, 7–10 mm diam., yellow or pink, becoming darker, containing male, female and gall flowers; basal bracts 3, rounded, c. 1.5 mm long. Flowers pedicellate; bracteoles narrow, triangular; perianth segments 3, free, ovate, c. 1 mm long, concave, red. Male flowers: stamen 1. Female flowers: style slender; stigma simple, linear. Gall flowers: style funnel-shaped. *Jejawi, Malayan Banyan*. Fig. 12.

Christmas Is. Common in primary forest on the Plateau, or against rocks in exposed situations; widely distributed in SE Asia, from Sri Lanka, India and S China, through Indo-China, Malesia, the Philippines and New Guinea, to Australia.

Ch.Is.: no precise locality, *C.W.Andrews 120* (K); Drumsite Rd, c. 183 m from Settlement, *A.Pearson P70* (K); Waterfall Rd, Chinese cemetery, *A.Pearson P46* (K); Waterfall Rd, Chinese cemetery, *D.A.Powell 559* (K); alongside railway line between camp 5 and South Point, *B.A.Mitchell 55* (CBG, K).

Produces many aerial roots which may form pillars supporting the branches. Cliffs covered by this species form a suitable nesting site for the Christmas Island Frigate Bird. This species resembles *F. benjamina*, and is sometimes cultivated as a decorative street tree or in pots or tubs. It is often misnamed as *F. retusa*. The infraspecific classification follows E.J.H.Corner, *Gard. Bull. Singapore* 17: 397–398 (1960) & *Gard. Bull. Singapore* 21: 22–23 (1965).

2. Ficus saxophila Blume, *Bijdr. Fl. Ned. Ind.* 437 (1825)

T: Bantam Prov., Java, *C.L.Blume*; *n.v.* Epithet from the Latin *saxum* (rock) and the Greek *philein* (to love), as this species frequently occurs as a lithophyte.

Tree or shrub to c. 20 m tall, dioecious. Leaves ovate, rounded to cordate at base, entire, shortly acuminate, glabrous, glossy; lamina 10–25 cm long; petiole 4–8 cm long; stipules c. 1–3.5 cm long, caducous. Figs often paired, sessile, axillary on leafy shoots, globose, shortly beaked at apex, 8–10 mm diam., yellow, orange or red, often mottled, containing male and gall flowers or female flowers; basal bracts 3, ovate, rounded, c. 3 mm long, pubescent. Flowers sessile, separated by narrow, triangular bracteoles; perianth segments 4, narrowly ovate, c. 1 mm long, acute. Male flowers: few; stamen 1. Female flowers: style simple; stigma linear. Gall flowers many. Fig. 34A.

Christmas Is. Grows on cliffs and limestone pinnacles throughout the island and may also form part of the regeneration vegetation after clearing. This species occurs in Indo-China, Java, the Lesser Sunda Islands, Celebes, the Philippines and New Guinea.

Ch.Is.: without precise locality, *H.N.Ridley 110* (K); Drumsite Rd, c. 183 m from Settlement, *A.Pearson P71* (K); Egeria Point, S of Winifreds Beach, *B.A.Mitchell 71* (CBG, K); Egeria Peninsula, cliffs due S of Winifred Beach car park, *B.A.Mitchell 184* (CBG, K); North West Point, *D.J. & B.P.Du Puy CI90* (CBG, K).

2. MACLURA

Maclura Nutt., *Gen. N. Amer. Pl.* 2: 233 (1818), *nom. cons.*; after William Maclure, early 19th century President of the Academy of Natural Sciences, Philadelphia.

Type: *M. aurantiaca* Nutt.

Trees or shrubs, sometimes climbing, usually with axillary spines, dioecious. Leaves simple, entire or toothed; stipules small. Inflorescence axillary, unisexual, usually capitate, often bracteate, pedunculate. Flowers minute, 4-merous; bracteoles and perianth segments often with 2–7 yellow glands. Male flowers: anthers 4; ovary rudimentary, often subulate, or absent. Female flowers: sometimes connate; perianth segments persistent, becoming fleshy in fruit; stamens absent; ovary unilocular, free or immersed in receptacle; stigma entire or bilobed. Drupe thinly pulpy, enclosed in fleshy perianth, often combined into fleshy syncarps with only a few fertile seeds.

A pantropical and subtropical genus of 12 species with 1 species on Christmas Is. *Maclura pomifera* (Raf.) C.K.Schneid., the Osage Orange, is an ornamental species from N America, with large, yellow fruits. *Maclura excelsa* (Welw.) Bureau, from tropical Africa, yields a fine timber used for making furniture and is widely cultivated.

Maclura cochinchinensis (Lour.) Corner, *Gard. Bull. Singapore* 19: 239 (1962)

var. **cochinchinensis**

Vaniera cochinchinensis Lour., *Fl. Cochinch.* 564 (1790); *Cudrania cochinchinensis* (Lour.) Kudô & Masam., *Ann. Rept. Taihoku Bot. Gard.* 2: 272 (1932). T: Cochinchina, *J. de Loureiro*; *n.v.* Epithet from Cochinchina, now the southern tip of Vietnam, and the locality of the original collection.

Cudrania javanensis Trécul, *Ann. Sci. Nat.* ser. 3, 8: 123, t. 3, figs 76–85 (1847). T: Nepal, *N.Wallich* Cat. no. *4642D*; syn: K.

Erect or climbing shrub; branchlets often with axillary thorns; thorns 7–25 mm long on older stems. Leaves variable, usually elliptic, obtuse at base, entire, shortly acuminate and mucronate, pubescent on veins beneath when young; lamina 2.5–10 cm long; petiole 3–16 mm long, glabrescent. Inflorescences capitate, bracteate, often paired in leaf axils. Male inflorescence spherical, c. 5 mm diam., yellow; flowers with 4 stamens. Female inflorescence c. 10 mm diam.; peduncle 4–10 mm long; perianth segments spathulate, concave, with 2 immersed glands. Drupe enclosed in fleshy, enlarging perianth, combined into a fleshy, spherical syncarp, c. 1–1.5 cm diam. Seeds ovoid, somewhat compressed, c. 3 mm long.

Christmas Is. Widespread through E Africa, India and Sri Lanka, Indo-China, Malesia and Australia frequently occurs as a robust climbing shrub in forest, but may also form an erect or scrambling shrub in open situations.

Ch.Is.: Flying Fish Cove, *J.J.Lister s.n.* (K); plateau, *C.W.Andrews 11* (K); South Point, *A.Pearson & D.A.Powell P65* (K); Andrews Lookout, Phosphate Hill, *B.A.Mitchell 21* (CBG, K); plateau edge above Ross Hill, *B.A.Mitchell 75* (CBG, K).

H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 229 (1906) described this species as 'abominably spiny', the often recurved, strong spines being capable of inflicting serious injury. The reddish heartwood of mature stems is used in cloth dyeing, imparting a yellow colour. The young leaves are said to be edible.

10. URTICACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Herbs, shrubs or trees, mostly monoecious or dioecious, sometimes with stinging hairs. Leaves alternate or opposite, simple, entire to strongly toothed, sometimes 3-veined from base, often with conspicuous cystoliths; stipules free or connate. Inflorescence usually axillary, cymose, unisexual, often condensed or the flowers crowded on a common, fleshy receptacle. Flowers minute, usually actinomorphic; perianth valvate or subimbricate. Male flowers with 3–5 perianth segments, usually 4; stamens usually as many as perianth segments, antitepalous; anthers dorsifixed, 2-locular, longitudinally dehiscent; ovary rudimentary. Female flowers with 3–5 perianth segments, or cupular to tubular and shortly dentate, often persistent; staminodes sometimes present, scale-like; ovary superior, unilocular; ovule 1; stigma 1, sessile, linear or penicillate. Fruit a small, ovoid achene, sometimes enclosed in perianth, which may become fleshy, or clustered on common, fleshy receptacle.

A pantropical, subtropical and temperate family of c. 49 genera with between 800 and 1900 species; 5 genera (6 species) on Christmas Is.; 1 genus (1 species) on Cocos (Keeling) Is. Several genera, including *Laportea*, *Dendrocnide* and *Urtica*, are notorious for their stinging hairs. Most species are wind-pollinated, with the stamens inflexed in bud and springing back sharply at anthesis, releasing most of their pollen at once, and the stigma either penicillate or linear and often hairy to efficiently collect airborne pollen. The stems are often fibrous, and *Boehmeria nivea* (L.) Gaudich. (Ramie fibre) is cultivated throughout the tropics for its very fine, strong fibre which is used to make high quality cloth and thread.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Urticaceae, *Fl. Java* 2: 36–51 (1965); A.C.Smith, Urticaceae, *Fl. Vit. Nova* 2: 209–251 (1981); W.-L.Chew, Urticaceae, *Fl. Australia* 3: 68–93 (1989).

KEY TO GENERA

1 Short, creeping herb to c. 10 cm tall; leaves circular, 1–5 mm diam. **5. PILEA**

1: Erect or decumbent herb, shrub or tree; leaves ovate, elliptic or narrowly obovate, 2–40 cm long

2 Leaves ovate, with 3 strong veins from base to about middle of leaf

3 Herb; monoecious; leaf margins coarsely dentate; male flowers 5-merous; stigma penicillate **1. LAPORTEA**

3: Tree or shrub; dioecious; leaf margins crenate to entire; male flowers 4-merous; stigma filiform, pubescent **3. PIPTURUS**

2: Leaves elliptic or narrowly obovate, without 3 distinct basal veins

4 Small tree or shrub, with stinging hairs; leaves elliptic, 15–40 cm or more long, rounded to shallowly cordate at base; all flowers and achenes in lax panicles; stigma filiform **2. DENDROCNIDE**

4: Succulent herb or sparsely branched shrub, glabrous; leaves usually narrowly obovate, 9–22 cm long, cuneate and distinctly oblique at base; male flowers in long-pedunculate, branched cymes, and female flowers and achenes densely clustered on sessile, fleshy receptacles; stigma penicillate **4. PROCRIS**

1. LAPORTEA

Laportea Gaudich. in L. de Freycinet, *Voy. Uranie. Bot.* 498, '1826' (1830), *nom. cons.*; after M.Laporte, probably a companion of C.Gaudichaud on his explorations.

Type: *L. canadensis* (L.) Wedd.

Herbs or shrubs, usually monoecious, often with stinging hairs. Leaves spirally arranged, simple, toothed; stipules connate and forming an axillary scale, bifid. Inflorescence axillary, usually paniculate, lax, unisexual or bisexual. Flowers many, in small clusters. Male flowers 4- or 5-merous. Female flowers: tepals 4, 2 large, lateral, and 2 small, unequal; ovary ovoid; stigma short or (not in our area) linear, papillate. Achene small, ovoid with reflexed apex, compressed, sharply deflexed, partially enclosed in persistent perianth; fruiting pedicel often winged.

A pantropical genus of 22 species, usually weedy, with greatest diversity in Madagascar and Africa, and with a few temperate species; 1 species on Christmas Is. and 1 on Cocos (Keeling) Is. W.-L.Chew, *Gard. Bull. Singapore* 25: 115 (1969) combined *Fleurya* Gaudich. with this genus, distinguishing it at sectional level by the asymmetrical, dorsiventral wings on the pedicel of the female flower or fruit, and by the presence of an articulation at the top of the pedicel. The island species belong in this section.

W.-L.Chew, A Monograph of Laportea (Urticaceae), *Gard. Bull. Singapore* 25: 111–178 (1969); F.R.Fosberg, Disposition of *Urena gaudichaudiana* Henslow, *Ann. Mag. Nat. Hist.* ser. 12, 9: 423–424 (1956).

Plant glandular-hairy; inflorescences with male and female flowers (C.K.Is.) **1. L. aestuans**

Plant with few or no glandular hairs; inflorescences unisexual (Ch.Is.) **2. L. ruderalis**

1. Laportea aestuans (L.) Chew, *Gard, Bull. Singapore* 21: 200 (1965)

Fleurya aestuans (L.) Gaudich., *Voy. Uranie* 497 (1830); *Urtica aestuans* L., *Sp. Pl.* 2nd edn, 1396 (1763). T: Surinam; *n.v.* Epithet from the Latin *aestuans* (moving to and fro); application unclear.

Urera gaudichaudiana Hensl., *Ann. Nat. Hist.* 1: 341 (1838). T: illustration in *Ann. Nat. Hist.* 1: t. XII (1838): holo, *fide* D.M.Porter, *J. Linn. Soc. Bot.* 93: 160 (1986).

Illustrations: W.-L.Chew, *Gard. Bull. Singapore* 25: 147, fig. 19 (1969); F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 271, fig. 43(1–3) (1980).

Erect annual monoecious herb with few branches usually to 1 m; stems glandular hairy. Leaves broadly ovate, coarsely serrate, acuminate, rounded, truncate or cordate at base, with stinging hairs scattered on upper surface and on veins on lower surface; lamina 3–30 cm long; petiole 2–20 cm long. Panicle to 20 cm long, sparsely hispid, bisexual. Male flowers 4- or 5-merous; tepals c. 1.5 mm long, apically glandular hairy. Female flowers 4-merous; lateral tepals c. 0.5 mm long; dorsal tepal c. 0.25 mm long, glandular hairy; stigma minutely penicillate. Achene 1–2 mm long, partly winged, with warty depressions on faces.

Cocos (Keeling) Is. Grows on North Keeling Is. in strand forest under *Pisonia grandis* and *Argusia argentea* in coralline sand. Occurs from India through SE Asia to Java and the Lesser Sunda Islands.

C.K.Is.: Cocos Islands, Apr. 1836, *C.Darwin* (CGE), *fide* F.R.Fosberg, *loc. cit.* (1956); W ocean shoreline, North Keeling Is., *D.G.Williams 154* (CBG, K, PERTH).

Collected on the main atoll by Charles Darwin in April 1836, but apparently not persisting there. Darwin's collection cited above was the holotype of *Urera gaudichaudiana* but it cannot be located, hence D.M.Porter's nomination, *loc. cit.*, of the plate as holotype for Henslow's name. J.S.Henslow, *loc. cit.*, stated 'the single specimen brought home by Mr Darwin consists of an herbaceous stem about seven inches long, belonging apparently to a perennial.' The specimen was examined by F.R.Fosberg, *loc. cit.* (1956), in the 1950s. The above description is drawn in part from W.-L.Chew. *op. cit.* 164.

2. Laportea ruderalis (G.Forst.) Chew, *Gard. Bull. Singapore* 21: 201 (1965)

Urtica ruderalis G.Forst., *Fl. Prodr.* 66 (1786). T: Society Islands, *J.G.Forster s.n.*; iso: BM. Epithet from the Latin *ruderalis* (growing among rubbish), this species often growing in waste ground.

[*Fleurya ruderalis auct. non* Gaudich. (1830): C.W.Andrews, *Monogr. Christmas Is.* 189 (1900)]

Annual, little to much-branched herb to 60 cm tall, monoecious. Leaves broadly ovate, cuneate, rounded or cordate at base, strongly dentate, acute to shortly acuminate, sparsely hispid with scattered hairs on upper surface, glabrescent; lamina 2–12 cm long; petiole 1–14 cm long. Panicles solitary, unisexual, shorter than leaves, sparsely hispid with many minute flowers; pedicels c. 1.5 mm long, not winged. Male flowers 5-merous; perianth segments navicular, 1–1.5 mm long, corniculate; stamens 5, white. Female flowers 4-merous; perianth with 2 segments c. 0.5 mm long, enclosing ovary, 1 smaller, hooded, and 1 minute, persistent; stigma minutely penicillate. Achenes c. 1.25 mm long, partially winged, the faces with central depressions.

Christmas Is. In rocky and disturbed areas, especially near the coast and behind beaches preferring semi-shade. Distributed from the Pacific islands and New Guinea to the Philippines and the Lesser Sunda Islands.

Ch.Is.: without precise locality, Sept.–Oct. 1887, *E.J.Lister* (K); Flying Fish Cove, *C.W.Andrews 134* (K); Flying Fish Cove, *H.N.Ridley 155* (K); Lily Beach, *D.A.Powell 557* (K); Egeria Point, SW of Winifred Beach, *B.A.Mitchell 74* (CBG).

These collections, with the leaves becoming unusually large, having scattered stinging hairs and male flowers 5-merous, resemble the closely related *L. aestuans* (L.) Chew; they differ from that species in having few or no glandular hairs, unisexual inflorescences, and a distinctive, minutely penicillate stigma. The H.N.Ridley and C.W.Andrews collections were cited by W.-L.Chew, *op. cit.* 169 as *L. ruderalis*; perhaps the circumscription of this species requires broadening.

2. DENDROCNIDE

Dendrocnide Miq., *Pl. Jungh.* 1: 29 (1851); from the Greek *dendron* (tree) and *knide* (nettle), as the species all have stinging hairs.

Type: *D. costata* Miq.

Trees or shrubs, mostly short, with stinging hairs, usually dioecious; wood soft; branching sympodial. Leaves alternate or spirally arranged, often clustered at branchlet tips, simple, sometimes peltate, entire to crenate or dentate; stipules large, entirely connate. Inflorescence axillary, panicle-like or raceme-like, unisexual, many-flowered. Male flowers usually with 4 perianth segments, rarely 5; stamens 4; rudimentary ovary present. Female flowers: tepals 4 in 2 unequal pairs, sometimes connate into a tubular perianth, persistent; ovary unilocular; stigma simple, filiform. Achene small, reflexed or erect, spherical to ovoid, asymmetrical, flattened or inflated, rugose or smooth.

A genus of c. 36 species, distributed from India and S China, through Indo-China, Malesia, the Philippines and New Guinea, to the Pacific islands and N Australia, with centres of diversity in New Guinea and the Philippines; 2 species occur on Christmas Is. The wood is soft and of little use. The leaves and inflorescences often have stinging hairs that are capable of inflicting a painful injury.

W.-L.Chew, A Monograph of Dendrocnide (Urticaceae), *Gard. Bull. Singapore* 25: 1–104 (1969).

Leaves ovate, usually distinctly peltate; female flowers with 4 unequal perianth segments; achenes c. 2 mm long, smooth, flattened **1. D. peltata**

Leaves elliptic, not peltate; female flowers with a 4-lobed, tubular perianth; achenes c. 4–5 mm long, rugose, slightly compressed **2. D. sinuata**

Figure 34. **A**, MORACEAE: *Ficus saxophila*, flowering branchlet X0.5 (B.Mitchell 184, K). **B–E**, URTICACEAE. **B**, *Pilea peploides*, flowering plant X0.5 (D.Powell 343, K). **C**, *Procris pedunculata* var. *pedunculata*, flowering shoot X0.5 (B.Mitchell 24, K). **D–E**, *Dendrocnide peltata* var. *murrayana*. **D**, flowering branchlet with female inflorescences X0.5; **E**, portion of a female inflorescence X4 (**D–E**, D.Powell 75, K). Drawn by E.Catherine.

1. Dendrocnide peltata (Blume) Miq., *Pl. Jungh.* 1: 30 (1851)

Urtica peltata Blume, *Bijdr.* 496 (1825). T: Java, *C.L. von Blume s.n.*; holo: probably L *n.v.* Epithet from the Latin *pelta* (a shield), referring to the peltate leaves.

Illustration: W.-L.Chew, *Gard. Bull. Singapore* 25: 43, fig. 16 (1969).

Tree to 30 m tall, dioecious. Leaves broadly ovate, usually distinctly peltate, rounded to cordate at base, crenate, acute to shortly acuminate, subglabrous above, subglabrous to densely irritant-pubescent beneath; lamina c. 7–20 cm long; petiole 3–10 cm long; stipules 1–2 cm long. Panicles solitary, 5–15 cm long, lax, puberulous, with scattered, stinging hairs; flowers minute, green, shortly pedicellate, in small clusters. Male flowers 4-merous; perianth segments c. 1.5 mm long; subtended by c. 4 slender bracts. Female flowers: perianth segments 4, slender, persistent, two c. 0.75 cm long, one slightly shorter, one c. 0.25 mm long; stigma c. 1.5 mm long, pubescent. Achenes deflexed, subcircular, c. 2 mm long, obliquely beaked, flattened, smooth, with perianth enclosing base. *Jelaton, Stinging Tree*.

Indigenous to Christmas Is., Java, Bali and New Guinea. There are 2 varieties, both of which occur on Christmas Is., 1 being endemic. The irritant hairs can inflict severe, painful stings.

Leaf lamina densely covered in short, whitish, irritant hairs beneath **1a.** var. **peltata**

Leaf lamina glabrous to subglabrous beneath **1b.** var. **murrayana**

1a. Dendrocnide peltata (Blume) Miq. var. peltata

Leaf lamina densely pubescent to villous beneath, with profuse irritant hairs; petiole reddish.

Christmas Is. Not collected on the island until 1968, by that time a mature tree. It is becoming more common along roadsides, especially in the west of the island. All parts of the plant sting severely. This variety occurs throughout the range of the species.

Ch.Is.: cliffs overlooking North East Point, 0.4 km west of North West Point, *D.A.Powell 85* (K); plateau edge above Ross Hill Gardens, *B.A.Mitchell 154* (CBG, K).

1b. Dendrocnide peltata var. murrayana (Rendle) Chew, *Gard. Bull. Singapore* 25: 45 (1969)

Laportea murrayana Rendle in C.W.Andrews, *Monogr. Christmas Is.* 189 (1900); *Dendrocnide peltata* subsp. *murrayana* (Rendle) Chew, *Gard. Bull. Singapore* 21: 205 (1965). T: Flying Fish Cove, Christmas Is., 1897, *C.W.Andrews 147*; iso: BM, K. Epithet in honour of Sir John Murray, who financed Andrews' expedition to Ch. Is. in 1897.

Leaf lamina subglabrous to glabrous beneath; petiole green. Fig. 34D–E.

Christmas Is. Endemic.

Ch.Is.: without precise locality, *C.W.Andrews 147* (BM, K); Smith Point, *H.N.Ridley 157* (K); cliffs immediately behind Flying Fish Cove, *D.A.Powell 75* (K); no precise locality, *D.A.Powell 78* (K).

First collected on the island in 1897 and has since become much more common. Has fewer stinging hairs than var. *peltata* and consequently inflicts a less severe sting.

2. Dendrocnide sinuata (Blume) Chew, *Gard. Bull. Singapore* 21: 206 (1965)

Urtica sinuata Blume, *Bijdr.* 505 (1825). T: Java, *C.L. von Blume s.n.*, Leiden herb. no. 908-188-3235; ?holo: L *n.v.*, *fide* W.-L.Chew, *Gard. Bull. Singapore* 25: 40 (1969). Epithet from the Latin *sinuatus* (wavy, curved), in reference to the leaf margin.

[*Laportea crenulata auct. non* Gaudich.: C.W.Andrews, *Monogr. Christmas Is.* 189 (1900)]

Illustration: W.-L.Chew, *Gard. Bull. Singapore* 25: 43, fig. 16 (1969).

Tree to 10 m tall, dioecious; stems hollow. Leaves elliptic, rounded to shallowly cordate at

base, subentire to crenate or sinuate, acuminate, glossy, deep green, with sparse stinging hairs especially on veins beneath, glabrescent; lamina 15–40 cm or more long; petiole c. 2–15 cm long; stipules c. 2 cm long. Panicles lax, solitary, 5–30 cm long, with many stinging hairs; female inflorescences longer than male; flowers minute, green, shortly pedicellate. Male flowers 4-merous, perianth segments c. 2 mm long. Female flowers: perianth tubular, 4-lobed, c. 1 mm long, persistent; stigma c. 4–9 mm long, minutely hairy. Achenes erect, ovoid, 4–5 mm long, beaked, somewhat compressed, rugose, with perianth enclosing base. *Pulus, Pulutus, Stinging Tree.*

Christmas Is. Grows as a weedy species, colonising gaps in the forest. Frequent along roads and tracks throughout the island, as it regenerates quickly from branches that become broken and buried during the construction and maintenance of roads and tracks. Distributed from India and southern China, through Indo-China to Sumatra, Java, Bali and Christmas Is.

Ch.Is.: without precise locality, Sept.–Oct. 1887, *J.J.Lister, s.n.* (K); Phosphate Hill, *H.N.Ridley 158a, 160* (K); first terrace immediately below Drumsite, S of Flying Fish Cove, *D.A.Powell 47* (K); Dolly Beach track, *A.Pearson & D.A.Powell P97* (K); access track to Aldrich Hill, Christmas Is. Natl Park, *B.A.Mitchell 106* (CBG, K).

The most common stinging tree. H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 228 (1906), noted that the severity of the sting varies in this species, and that the specimens on Christmas Is. sting rather severely. All parts of the plant can inflict painful stings, but the inflorescence is especially venomous.

3. PIPTURUS

Pipturus Wedd., *Ann. Sci. Nat.* ser. 4, 1: 196–197 (1854); from the Greek *piptien* (to fall) and *oura* (tail), after the caducous, tail-like stigma.

Type: *P. velutinus* (Decne.) Wedd.

Trees or shrubs, usually dioecious, without irritant hairs. Leaves alternate, often clustered at branchlet tips, simple, entire to crenate or serrate, sometimes white-tomentose beneath; stipules entirely connate. Inflorescences axillary, paniculate, unisexual; flowers in clusters on a spherical, enlarging receptacle. Male flowers: perianth deeply 4- or 5-lobed; stamens 4 or 5; rudimentary ovary often present. Female flowers: perianth urceolate, minutely 4- or 5-toothed, persistent; ovary unilocular, enclosed by perianth; stigma exserted, simple, filiform, pubescent. Achene small, enclosed by perianth, several immersed in enlarged, fleshy receptacle, the whole fruit-like.

A genus of 40–50 species distributed from the Mascarene Islands and India, through Malesia and N Australia to the Pacific islands; 1 species common on Christmas Is.

C.Skottsberg, Remarks on *Pipturus argenteus* and *P. incanus* of Weddell, *Acta Horti. Gothob.* 7: 43–63 (1931).

Pipturus argenteus (G.Forst.) Wedd. in A.de Candolle, *Prodr.* 16(1): 235. 19 (1869)

var. **lanosus** Skottsb., *Acta Horti. Gothob.* 7: 63 (1931)

T: not designated. Epithets from the Latin *argenteus* (silvery) descriptive of the undersides of the leaves which have a dense covering of short, whitish hairs; and, the Latin *lana* (wool) and *-osus* (abundance).

Boehmeria irritans Ridl., *Kew Bull.* 1926: 477 (1926). T: Christmas Is., *C.W.Andrews 60*; syn: K; Phosphate Hill, *H.N.Ridley 156a*; syn: K.

[*Boehmeria platyphylla, auct. non* D.Don: C.W.Andrews, *Monogr. Christmas Is.* 190 (1900)]

Small tree or shrub to 8 m tall, dioecious; branchlets pubescent. Leaves ovate, usually cordate at base, crenate, acuminate, with 3 strong veins from base, white-tomentose beneath; lamina 5–25 cm long; petiole 3–12 cm long; stipules bifid. Inflorescences unisexual, 4–9 cm long, sparsely branched. Flowers c. 1 mm long, in discrete, sessile, spherical clusters; clusters 3–4 mm diam. Male flowers 4-merous. Female flowers: perianth

urceolate, densely pubescent, persistent; stigma c. 3 mm long, pubescent. Fruiting clusters 5–8 mm across, of several brown achenes, each enclosed by its perianth, partially immersed in a spherical, fleshy, white-hairy receptacle. *Pulus scrobbo*.

Christmas Is. Common in marginal and open forest, along roads and tracks and on soil tips. Extends from the Pacific islands through New Guinea, N Australia and the Philippines to Borneo, Java and Sumatra.

Ch.Is.: South Point, *B.Molesworth Allen P18* (K); Cemetery Rd, North East Point, *B.A.Mitchell 37* (CBG, K); northern periphery of Field 10, *B.A.Mitchell 44* (CBG, K).

The fibres of this plant have a good tensile strenth, and are used to make string and rope. The specimens from Christmas Is. are included in var. *lanosus* Skottsb., which is distinguished by its leaf indumentum.

4. PROCRIS

Procris Comm. ex Juss., *Gen. Pl.* 403 (1789); from the Greek *prokris* (dried fig), as the inflorescence resembles a small fig with the seeds exposed.

Type: *P. axillaris* J.F.Gmel.

Shrubs or herbs, monoecious or dioecious, usually succulent and glabrous. Leaves opposite, appearing alternate due to one of each pair being greatly reduced and caducous; persistent leaves oblique, entire to toothed, fleshy; cystoliths many; petiole short; stipules entirely connate, minute. Inflorescences axillary, unisexual. Male flowers in lax, pedunculate, branched cymes; perianth 4- or 5-merous, membranous, valvate; ovary subglobose, rudimentary. Female flowers minute, crowded on a fleshy, sessile or stalked, spherical or clavate receptacle; perianth deeply 5-lobed, membranous, persistent; stigma penicillate, sessile, caducous. Achene small, partially enclosed in perianth, sessile, many crowded on the receptacle, the whole fruit-like.

A genus of c. 16 species, mostly from India and China through Indo-China, Malesia and the Philippines to New Guinea and the Pacific islands, with some representatives in Africa; 1 species on Christmas Is.

H.Schroeter, Monographie der Gattung *Procris*, *Repert. Spec. Nov. Regni Veg.* 45: 179–192, 257–300 (1938)

Procris pedunculata (J.R.Forst. & G.Forst.) Wedd. in A.de Candolle, *Prodr.* 16(1): 191 (1869)

var. **pedunculata**

T: Society Islands, Tahiti, *J.R.Forster & G.Forster s.n.*; lecto: K, *fide* A.C.Smith, *Fl. Vit. Nova* 2: 232 (1981). Epithet from the Latin *pedunculatus* (stalked), referring to the pedunculate male inflorescence.

Erect to decumbent herb or small shrub, 0.3–2 m tall, monoecious, glabrous; stems succulent, infrequently branched. Persistent leaves narrowly oblong, elliptic or obovate, unequal-sided, oblique at base, abruptly acuminate, entire to very weakly denticulate, glabrous, fleshy, bright green; lamina 9–22 cm long; petiole 5–15 mm long. Caducous leaves ovate, c. 3–15 mm long. Male flowers in long-pedunculate, branched cymes c. 4–8 cm long; perianth segments 5, oblong, c. 2.5 mm long, greenish white. Female flowers densely clustered on a sessile, fleshy receptacle c. 5–8 mm diam.; perianth segments 5, narrowly spathulate, c. 1.5 mm long, concave, membranous; stigma penicillate. Achenes c. 1 mm long, sessile on reddish receptacle. Fig. 34C.

Christmas Is. Grows in crevices in limestone cliffs or rocks, preferring shaded or moist situations where it sometimes forms thickets. Extends from the Pacific islands and New Guinea to the Philippines and W Malesia, and also appears to include the islands of the western Indian Ocean.

Ch.Is.: no precise locality, *C.W.Andrews 76, 91* (K); Flying Fish Cove, *H.N.Ridley 227* (K); inland cliff,

D.A.Powell 96 (K); Ross Hill summit, *B.A.Mitchell 24* (CBG, K); behind Ross Hill trig., *D.J. & B.P.Du Puy CI54* (CBG, K).

The leaves are used to wash hair.

5. PILEA

Pilea Lindl., *Collect. Bot.* ad t. 4 (1921), *nom. cons.*; from the Latin *pileus* (felt cap), as one of the tepals of the female flower is expanded and forms a hood over the flower and fruit.

Type: *P. muscosa* Lindl., *nom. illeg.* = *P. microphylla* (L.) Liebm.

Annual or perennial herbs, sometimes prostrate, monoecious or dioecious. Leaves opposite, in equal or unequal pairs, entire to serrate, usually 3-nerved, with linear cystoliths; stipules entirely connate, scale-like. Inflorescence an axillary, branched cyme, pedunculate or sessile, sometimes clustered; flowers minute. Male flowers usually 4-merous; perianth segments often with a dorsal to apical appendage, sometimes connate, valvate; ovary rudimentary, conical. Female flowers 3-merous; perianth with one segment exceeding others and sometimes hooded over ovary or fruit; staminodes scale-like, minute; stigma penicillate, sessile, caducous. Achene small, ovoid, slightly compressed and oblique, often partially enclosed by perianth.

A mainly tropical and subtropical genus of c. 650 species; 1 species on Christmas Is.

Pilea microphylla (L.) Liebm. (Artillery Plant or Gunpowder Plant) and *P. cadiera* Gagnep. & Guillaumin (Aluminium Plant) are widely cultivated.

Pilea peploides (Gaudich.) Hook. & Arn., *Bot. Beech. Voy.* 96 (1832)

Dubrueilia peploides Gaudich. in L.de Freycinet, *Voy. Uranie. Bot.* 495 (1826). T: Hawaii (Sandwich Is.), Honolulu, *W.Hildebrand*; syn: K. Epithet from the ancient Latin name *peplus*, for *Euphorbia peplis* L., which this species resembles in habit.

Short, creeping herb, to c. 10 cm tall, monoecious, glabrous. Leaves orbicular, cuneate at base, entire to crenulate, with many transverse, linear cystoliths; lamina 1–5 mm long; petiole 1–6 mm long. Inflorescence bisexual, condensed, often clustered in leaf axils, subtended by several bracts; peduncle short; flowers minute. Male flowers 4-merous; perianth c. 0.6 mm long, cup-shaped, splitting into 4 segments, fused at base. Female flowers c. 0.3 mm long, with 3 ovate perianth segments, one twice as large as the others and concave; ovary ovoid; stigma penicillate, Achene c. 0.5 mm long, ovoid, oblique, brown. Fig. 34B.

Christmas Is. Frequently grows around settlements and as a weed of cultivated land, especially in damp habitats such as ditches. A widespread species from India and China, through Indo-China and Malesia to the Pacific islands including Hawaii.

Ch.Is.: Drumsite, *D.A.Powell 343* (K).

11. CASUARINACEAE

I.R.H.Telford (C.K.Is.)

Evergreen trees or shrubs, monoecious or (not in our area) dioecious; branchlets slender, jointed, with several to many articles, striate with longitudinal ridges and grooves; stomates confined to grooves. Leaves reduced to small scale-like teeth in whorls of 4–20 at apex of each branchlet article. Inflorescences unisexual, of alternating whorls of tooth-like bracts; each bract subtending 2 lateral bracteoles and 1 flower; male inflorescence a catkin-like

spike; female inflorescence a small globose to ovoid head. Male flowers: perianth segments 1 or 2, scale-like, hooded, falling at anthesis; stamen 1; anther 2-locular, basifixed. Female flowers: perianth absent; carpels 2, fused; ovules usually 2; style 2-branched. Infructescence cone-like; bracteole pairs enlarged forming lateral valves. Fruit 1-seeded, samara-like. Seed lacking endosperm, often with more than 1 embryo.

A family of 4 genera and c. 90 species, mainly in Australia with 3 genera and 59 species; also adjacent tropical islands and SE Asia; 1 genus (1 species) naturalised on Cocos (Keeling) Is.

G.Bentham, Casuarinaceae, *Fl. Austral.* 6: 192–202 (1873); K.L.Wilson & L.A.S.Johnson, Casuarinaceae, *Fl. Australia* 3: 100–174 (1989).

CASUARINA

Casuarina L., *Amoen. Acad.* 143 (1759); from the neo-Latin *casuarius* (cassowary), in reference to the drooping branchlets of the type species resembling feathers of the cassowary.

Type: *C. equisetifolia* L.

Trees. Branchlets with articles terete, smooth; grooves deep and closed, concealing stomates. Leaves in whorls of 5–17. Male inflorescences: elongate spikes. Female inflorescences: subglobose to ovoid heads on short lateral branches. Cones subglobose to cylindroid, pubescent at least when immature; bracts thin in exposed part; bracteoles ±protruding from cone surface, not greatly thickened. Samara glabrous, dull, pale.

A genus of 17 species from SE Asia to Polynesia; 5 in mainland Australia; 1 of which also cultivated and naturalised on Cocos (Keeling) Is.

***Casuarina equisetifolia** L., *Amoen. Acad.* 143 (1759)

subsp. **equisetifolia**

T: illustration in G.Rumphius, *Herb. Amboin.* 3: t. 57 (1743); holo, *fide* L.A.S.Johnson, *Fl. Australia* 3: 201 (1989). Epithet from *Equisetum* (a horsetail fern) and the Latin *folium* (a leaf), describing the resemblance of the branchlets to horsetail ferns.

Illustration: F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 249, fig. 39(3–5) (1980).

Tree to 35 m; bark furrowed; branchlets drooping, to 30 cm long; articles 5–12 mm long, 0.5–1 mm diam.; grooves pubescent; ridges angular, glabrous or pubescent. Leaf teeth 7 or 8, rarely 6, erect, 0.3–1 mm long. Male spikes 7–40 mm long. Cones ellipsoidal, 12–24 mm long, 9–11 mm diam., sparsely pubescent, bracteoles acute; peduncle 3–13 mm long. Samara 6–8 mm long, grey.

Cocos (Keeling) Is. Naturalised in strand forest with *Calophyllum inophyllum* and *Terminalia catappa* on lagoon shores in calcareous sand. Native from SE Asia through Malesia, Melanesia and Polynesia to northern Australia from Darwin to Cairns.

C.K.Is.: Home Is., *I.R.Telford 10047 & C.Howard* (AD, CBG, K, MEL).

H.B.Guppy, *J. Trans. Victoria Inst.* (*London*) 275 (1890) wrote '... mention should be made of *Casuarina equisetifolia*, introduced into the Settlement Is. more than half a century ago by the grandfather of the present proprietor, and now spreading by natural means.'

12. PHYTOLACCACEAE

I.R.H.Telford (C.K.Is.)

Evergreen herbs, shrubs or trees, usually glabrous. Leaves alternate, simple, entire, stipulate or exstipulate. Inflorescence a terminal, axillary or lateral raceme, bracteate. Flowers actinomorphic, rarely zygomorphic, unisexual or bisexual. Perianth of 4 or 5 segments in 1 whorl, imbricate, persistent. Stamens 3 to many, hypogynous, free, staminodal or absent in female flowers; anthers 2-locular. Ovary superior, rarely inferior; carpels 1 to many, free or connate; ovule 1 per carpel, basal; styles as many as carpels, free. Fruit a drupe, berry, nut or achene. Seeds with endosperm.

A family of c. 20 genera and c. 100 species, mainly of tropical America, also Africa, southern Asia to eastern Australia and Hawaii; 1 genus (1 species) naturalised on Cocos (Keeling) Is.

H.Walter, Phytolaccaceae, *Pflanzenr.* 39: 1–154 (1909); A.Heimerl, Phytolaccaceae, *Nat. Pflanzenfam.* 2nd edn, 16c: 135–164 (1934); C.A.Backer, Phytolaccaceae, *Fl. Males.* ser. I, 4: 227–232 (1951); H.J.Hewson, Phytolaccaceae, *Fl. Australia* 4: 1–5 (1984).

RIVINA

Rivina L., *Sp. Pl.* 1: 121 (1753), as *Rivinia*; honouring Augustus Rivinus (1652–1723), German botanist and physician.

Type: *R. humilis* L.

Herbs, monoecious. Stipules absent. Inflorescence a terminal or axillary raceme. Flowers bisexual. Perianth segments 4, equal. Stamens 4. Ovary 1-carpellate, glabrous. Fruit a berry. Seed ovoid.

A genus of 3 species or 1 variable species native to tropical America; 1 species naturalised on Cocos (Keeling) Is.

*Rivina humilis L., *Sp. Pl.* 1: 121 (1753)

T: from the West Indies, *coll. unknown*; *n.v.* Epithet is the Latin for lowly, in reference to the insignificant appearance of the plant.

Illustration: H.J.Hewson, *Fl. Australia* 4: 3, fig. 1F, G (1984).

Erect herb, sometimes shrub-like, woody at base, to 2 m, usually less than 1 m. Leaves ovate-oblong to ovate-lanceolate, acute to acuminate; lamina to 12 cm long, 4 cm wide; petiole to 5 cm long. Racemes 4–12 cm long. Perianth segments ovate, 2–3 mm long, white to pink, green in fruit. Berry globose to obovoid, 3–4 mm diam., red or orange. Seed c. 2 mm long, pubescent. *Coral Berry*.

Cocos (Keeling) Is. A common weed in coconut plantations and disturbed sites in coralline sand. Native to tropical America.

C.K.Is.: North Keeling Is., *I.R.Telford 10019 & C.Howard* (CBG, K); SE of airstrip, West Is. (Pulo Panjang), *A.S.George 16224* (AD, BRI, CBG, MEL); 0.5 km SW of Scout Park, West Is., *D.G.Williams 17* (BISH, CBG, PERTH).

13. NYCTAGINACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R., C.S.Is.)

Trees, shrubs, herbs or climbers, often glandular. Leaves mostly opposite or sometimes alternate, sometimes in unequal pairs, simple; stipules absent. Inflorescence a terminal or axillary, compound cyme, often paniculate, corymbose, or glomerulose, bracteate; bracts sometimes forming an involucre, sometimes coloured. Flowers usually actinomorphic, bisexual or unisexual. Perianth tubular, often campanulate or funnel-shaped, often articulate above ovary; upper part petaloid, often lobed, plicate or valvate, usually caducous; lower part enclosing ovary, persistent and often enlarging. Stamens 1–40, basally connate; anthers longitudinally dehiscent. Ovary superior, unilocular; ovule 1; style filiform; stigma capitate, lobed or fimbriate. Fruit usually enclosed by enlarged perianth base; base sometimes with glandular hairs, glandular ridges, or glands on prickles, rarely winged. Seed with or without endosperm.

A predominantly tropical and subtropical family of 26–30 genera and c. 300 species, with greatest diversity in S America; 4 genera on Christmas Is.; 2 genera on Cocos (Keeling) Is.; 3 genera on the Coral Sea Is.; 1 genus on Ashmore Reef. *Bougainvillea spectabilis* Willd. and *Mirabilis jalapa* L. are widely cultivated ornamental species.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Nyctaginaceae, *Fl. Java* 1: 269–272 (1963); J.F.Stemmerik, Nyctaginaceae, *Fl. Males*. ser. I, 6: 450–468 (1964); R.D.Meikle & H.J.Hewson, Nyctaginaceae, *Fl. Australia* 4: 5–18 (1984).

KEY TO GENERA

1 Tree or large shrub; stamens 6–14; fruit 10–35 mm long **1. PISONIA**

1: Herb or subshrub; stamens usually 2–5; fruit 2.5–8 mm long

2 Perianth c. 50 mm long, showy; flowers and fruits subtended by an involucre of 5 bracts resembling a calyx **2. MIRABILIS**

2: Perianth small to minute, 2–10 mm long; flowers subtended by 2 minute bracteoles

3 Perianth limb more than 4 mm long, funnel-shaped; fruit c. 7 mm long, slightly 10-ribbed, with an apical band of conspicuous, sticky glandular warts; leaves almost equal in each pair **3. COMMICARPUS**

3: Perianth limb less than 3 mm long, cup-shaped; fruit 2.5–3 mm long, usually prominently 3–5-ribbed, with minute, sticky, glandular hairs; leaves often unequal in each pair **4. BOERHAVIA**

1. PISONIA

Pisonia L., *Sp. Pl.* 2: 1026 (1753); *Gen. Pl.* 5th edn, 451 (1754); named after W.Piso, an early 17th century Dutch physician and authority on the natural history of Brazil.

Type: *P. aculeata* L.

Trees and shrubs. Leaves opposite, partially alternate, or crowded towards branchlet tips. Inflorescence usually a terminal or axillary, many-flowered, corymbose cyme, enlarging in fruit; pedicels short, usually with 1–3 small bracts. Flowers bisexual or unisexual. Perianth rather fleshy; upper part shortly 4–6-lobed, valvate, caducous or withering; lower part glandular or not, enlarging around ovary. Stamens mostly 5–14, unequal, exserted beyond perianth in male and bisexual flowers. Ovary slender; style exserted; stigma lobed to

fimbriate. Fruit narrow, clavate to fusiform, truncate or beaked, with 5 viscid glandular, longitudinal ridges, or the glands raised on stiff prickles.

A pantropical and subtropical genus of c. 35 species, with greatest diversity in the New World; 3 species in Australia, 2 of which occur on Christmas Is., 1 on Cocos (Keeling) Is. and the Coral Sea Is. The wood is very soft and spongy. The fruits are often glandular and sticky, and are dispersed by adhering to birds' feathers.

J.F.Stemmerik, Notes on *Pisonia* L. in the Old World, *Blumea* 12: 275–284 (1964).

Leaves glabrous; flowers c. 6 mm long, without rows of black glands; perianth lobes 2 mm long; fruit 25–35 mm long, with 5 longitudinal, viscid ridges **1. P. umbellifera**

Leaves shortly hairy on veins beneath; flowers c. 4 mm long, with 5 rows of black glands; perianth lobes c. 0.5 mm long; fruit 10–14 mm long, with 5 longitudinal rows of glandular prickles **2. P. grandis**

1. Pisonia umbellifera (J.R.Forst. & G.Forst.) Seem., *Bonplandia* 10: 154 (1862)

Ceodes umbellifera J.R.Forst. & G.Forst., *Char. Gen. Pl.* 141, t. 71 (1776). T: New Hebrides, Tanna, *J.R. & G.Forster s.n.*; lecto: BM, *fide* A.C.Smith, *Fl. Vit. Nova* 2: 267 (1981). Epithet from the Latin *umbella* (a parasol) and *ferre* (to bear), the inflorescence being umbrella-shaped.

P. excelsa Blume, *Bijdr.* 14: 735 (1826). T: Gunong Salak, W Java, *C.L.Blume s.n.*; holo: L, *fide* J.F.Stemmerik, *Blumea* 12: 280 (1964).

Tree or shrub, c. 5–20 m tall. Leaves opposite, often crowded towards branchlet tips, usually narrowly elliptic, usually acute, glabrous, glossy, deep green; base acute to obtuse, often oblique; lamina c. 8–30 cm long; petiole c. 1.5–3 cm long. Corymbs usually several grouped together, in a terminal, umbelliform, compound inflorescence; pedicels c. 3–5 mm long, with basal bracteoles. Flowers narrowly campanulate, c. 6 mm long, distinctly lobed; lobes c. 2 mm long, sparsely pubescent, without rows of black glands, white. Stamens 6–14, exserted. Fruit narrowly fusiform, c. 2.5–3.5 cm long, with 5 longitudinal, viscid glandular ridges. *Jamboe, Bird Lime Tree*.

Christmas Is. Frequent on the plateau and higher terraces, beneath rainforest canopy, but also on the shore terrace. Distributed from Madagascar to Taiwan and the Ryukyu Islands, and throughout Malesia to N & E Australia and the Pacific islands.

Ch.Is.: summit, *J.J.Lister s.n.* (K); plateau, *H.N.Ridley 151* (K); shore terrace, *D.A.Powell 749* (K); track to Dolly Beach, *A.Pearson P68* (K); valley SE of Ross Hill, *D.J. & B.P.Du Puy CI76* (CBG, K).

Pisonia brunoniana Endl. was treated as a synonym of *P. umbellifera* by R.D.Meikle & H.J.Hewson, *Fl. Australia* 4: 18 (1984) but is quite distinct.

The common name, Bird Lime Tree, is due to the sticky fruits which adhere to the feathers of birds, and may disrupt the plumage to such an extent that the bird can no longer fly and dies. The fruits are also said to be used to trap birds.

2. Pisonia grandis R.Br., *Prodr.* 422 (1810)

T: Australia, north coast, *R.Brown iter australiense 3011*; iso: BM. Epithet from the Latin *grandis* (large), this species attaining larger dimensions than the others in the genus.

Illustrations: F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 237, fig. 37 (1980); A.B.Cribb & J.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 165, 167 (1985).

Tree to 20 m tall; bole short, thick; branchlets thick. Leaves usually opposite, elliptic to ovate, obtuse to rounded and oblique at base, obtuse, sometimes shortly acuminate, shortly hairy on veins beneath, with distinctly darker veins; lamina 6–25 cm long; petiole 1–2.5 cm long. Corymbs terminal, usually solitary, often on short side-shoots; pedicels to 2 mm long, with apical or scattered bracteoles. Flowers c. 4 mm long, funnel-shaped, weakly lobed; lobes c. 0.5 mm long, densely pubescent, white with 5 rows of glistening, black glands. Stamens 6–10, shortly exserted. Fruit c. 1–1.4 cm long, narrowly clavate, with 5

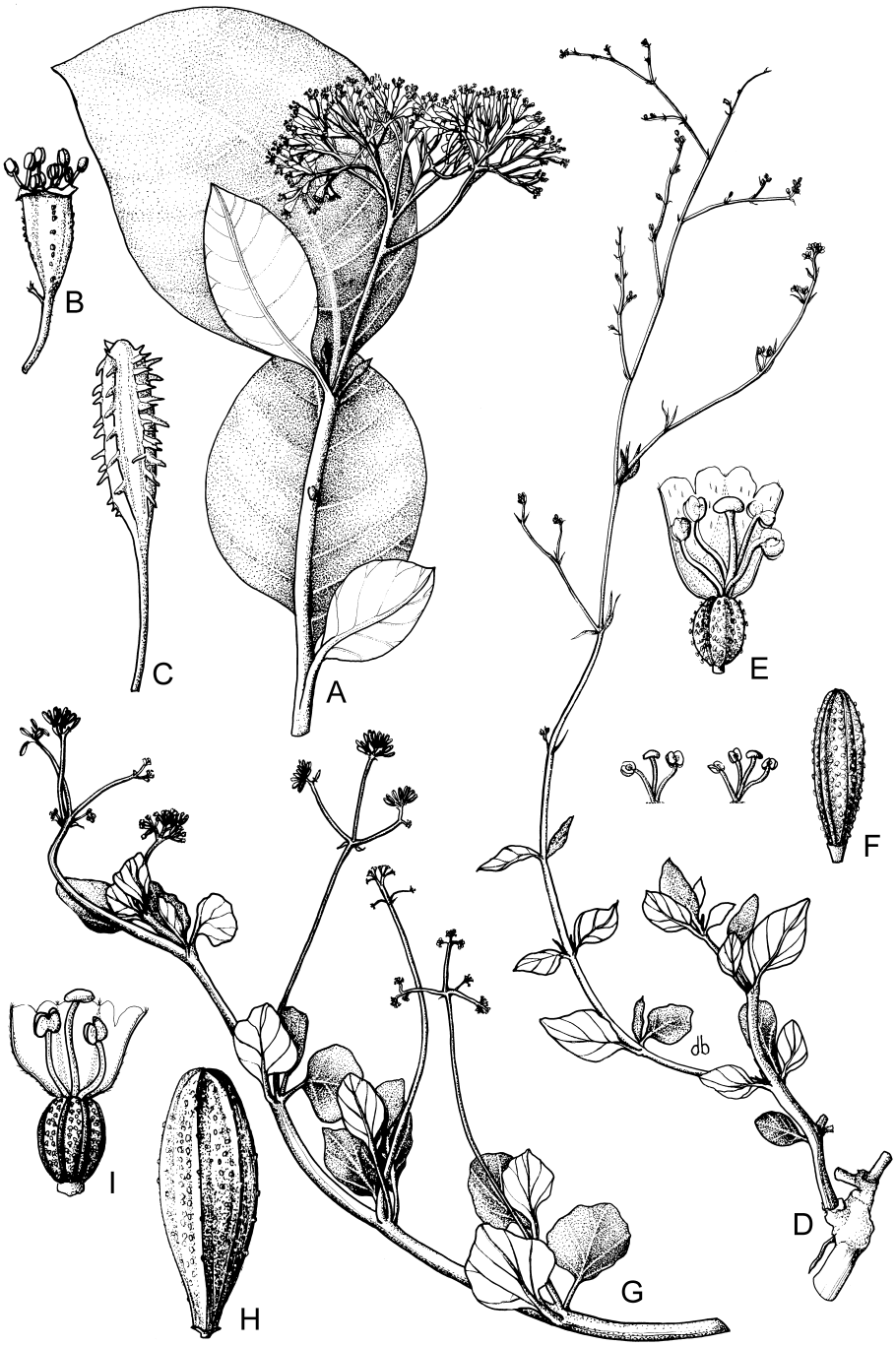

Figure 35. **A–H**, NYCTAGINACEAE. **A–C**, *Pisonia grandis*. **A**, flowering branchlet X0.5 (I.Telford 10009, CBG); **B,** flower X2.5; **C**, fruit X2.5 (**B–C**, I.Telford 10022, CBG). **D–F**, *Boerhavia glabrata*. **D**, habit X0.5 (J.Hicks 7, CBG); **E**, flower X8; **F**, fruit X8 (**E–F**, N.Sarti 14, PERTH). **G–I**, *Boerhavia albiflora*. **G**, habit X0.5; **H**, fruit X8; (**G–H**, A.Skeat, 15 Dec. 1981, CBG); **I**, flower X8 (T.Scotney & W.Jeffs, Oct. 1987, CBG). Drawn by D.Boyer.

longitudinal rows of stiff, sticky, glandular prickles; prickles c. 1 mm long. *Ampol, Cabbage Tree*. Figs 16, 35A–C.

Christmas Is., Cocos (Keeling) Is., Coral Sea Is. Scattered in marginal forest on Christmas Is. especially on the shore terrace where it can form pure stands. Once dominant in primary forest on Cocos atolls in coralline sand but almost totally cleared from the main islands and now mainly confined to North Keeling Is. Occurs on those Coral Sea islands with closed shrub and forest communities in the Magdelaine and Herald Cays. Widely distributed through the tropical Indian Ocean and Pacific Oceans from Madagascar to Taiwan, throughout Malesia, to NE Australia and the Pacific islands.

Ch.Is.: South Point, Oct. 1904, *H.N.Ridley* (K); north-eastern terraces, *D.A.Powell 748* (K). C.K.Is.: North Keeling Is., *I.R.Telford 10022 & C.Howard* (CBG, K); 1 km N of settlement, West Is., *D.K.Williams 21* (CBG). C.S.Is.: SE Cay, Magdelaine Cays, 6 Oct. 1987, *T.Scotney & W.Jeffs* (CBG); NE Cay, Herald Cays, *J.Hicks 4* (CBG).

Occurs frequently on islands of coral limestone, and appears dependent on presence of large amounts of bird guano, perhaps because this artificially increases the acidity of the soil (see H.K.Airy Shaw, *Kew Bull.* 7: 87–97, 1952). Often used as a nesting or roosting tree on islands frequented by seabirds. The fruits are able to stick to birds' feathers and so be dispersed. This can be a most impressive tree, the short bole eventually having a very large girth, and the thick branches forming an enormous, spreading crown. A chlorotic-leaved variant is often planted as a decorative tree, known as the Cabbage Tree.

2. MIRABILIS

Mirabilis L., *Sp. Pl.* 1: 177 (1753); *Gen. Pl.* 5th edn, 82 (1754); from the Latin *mirabilis* (wonderful), due to the bright, showy flowers that open rapidly in the evening.

Type: *M. jalapa* L.

Erect herbs, subglabrous or glandular-hairy; roots fleshy. Leaves opposite, in equal pairs. Inflorescence a terminal, leafy, corymbose cyme, with 1–many flowers. Flowers rather large, showy, ephemeral, bisexual, subtended by a deeply 5-lobed, calyx-like, enlarging involucre of bracts. Perianth constricted above ovary; upper part slender, funnel-shaped, 5-lobed, plicate, brightly coloured, caducous; lower part ribbed or warty, green. Stamens 3–6, exserted beyond perianth; filaments unequal. Ovary ellipsoidal; style exserted; stigma shortly lobed to fimbriate. Fruit ribbed or tuberculate, not sticky-glandular, partially enclosed in involucre. Seed 1.

A genus of c. 60 species from tropical America, with 1 Himalayan and Chinese species; 1 species naturalised on Christmas Is.

*Mirabilis jalapa L., *Sp. Pl.* 1: 177 (1753)

T: Herb. Hort. Cliff. 53, *Mirabilis* 1; syn: BM; Herb. C.Linnaeus. 240.2; syn: LINN. The tuberous root was mistakenly used as a source of jalap, a purgative prepared from the powdered root of *Ipomoea purga* (Wender.) Hayne, in the Convolvulaceae, hence the epithet.

Illustration: V.H.Heywood (ed.), *Fl. Pl. World* 69, fig. 2A–C (1978).

Herb, 50–80 cm tall; stems fleshy; root tuberous. Leaves ovate or oblong to triangular, mostly truncate to shallowly cordate at base, shortly acuminate, pubescent on margins and veins; lamina c. 2–9 cm long; petiole 1–4 cm long. Flowers 3–7 in corymbs, ephemeral; pedicel to 5 mm long. Involucre 8–10 mm long, increasing to c. 15 mm in fruit; lobes acute. Perianth finely pubescent; apical portion c. 4–5 cm long, funnel-shaped, white, yellow, pink, red or bicoloured; basal portion c. 0.5 cm long, globose. Stamens 5. Fruit subspherical, 7–8 mm long, ribbed, black, enclosed in involucre. *Four o'clock Plant*.

Christmas Is. Cultivated on Christmas Is. and occasionally naturalised. Native to tropical America, probably Peru; widely cultivated as an annual in temperate regions, and as an herbaceous ornamental in the tropics, frequently becoming naturalised in moist, tropical

regions.

Ch.Is.: shore terrace, between Settlement and Waterfall, *D.A.Powell 492* (K); along north-east coast road to Waterfall, *R.Shivas 903* (PERTH).

The flowers open during the late afternoon and evening, and close early the next morning, giving the plant its common name. The powdered seeds or dried root are sometimes used as a facial cosmetic, to improve the complexion.

3. COMMICARPUS

Commicarpus Standl., *Contr. U.S. Natl Herb.* 12: 373 (1909); from the Greek *commi* (gum) and *carpus* (a fruit), in reference to the sticky, glandular warts on the fruit.

Type: *C. scandens* (L.) Standl.

Perennial, scrambling or diffuse subshrub, glabrous, pubescent or glandular-hairy. Leaves opposite, in equal or unequal pairs; upper leaves reduced. Inflorescence an axillary cyme, bracteate glomerule, verticil or umbel, sometimes branched. Flowers bisexual, subtended by 2 minute bracteoles. Perianth constricted above ovary; upper part (limb) funnel-shaped, 5-lobed, plicate, caducous; lower part ribbed, glandular, persistent. Stamens 2–6, exserted beyond perianth. Ovary enclosed by perianth base; style exserted; stigma capitate. Fruit small, fusiform or club-shaped, longitudinally 10-ribbed, variously studded with large, sticky, glandular warts.

A genus of c. 23 species, mostly endemic in Africa with 1 species in tropical America; 2 endemic species in Australia, 1 of which occurs on the Coral Sea Is.; 1 widespread species in SE Asia, including Christmas Is.

R.D.Meikle, A Key to Commicarpus, *Notes Roy. Bot. Gard. Edinburgh* 36: 235–249 (1978).

Flowers pink or mauve; corolla c. 5 mm diam. **1. C. chinensis**

Flowers white; corolla c. 4 mm diam. **2. C. insularum**

1. Commicarpus chinensis (L.) Heimerl in A.Engler & K.Prantl, *Nat. Pflanzenfam.* 2nd edn, 16C: 117 (1934)

subsp. **chinensis**

Valeriana chinensis L., *Sp. Pl.* 1: 33 (1753). T: near Canton, China, *P.Osbeck s.n.*; syn: LINN. Epithet from China, the country of origin of the type collection.

Illustration: J.F.Stemmerik, *Fl. Males.* ser. I, 6: 453, fig. 1A–E (1964), as *Boerhavia chinensis*.

Scrambling subshrub, to c. 1 m tall. Leaves triangular to ovate, truncate, obtuse or shallowly cordate at base, not fleshy, usually sinuate, obtuse to acute, often mucronate, usually pubescent on margins; lamina 1–6 cm long; petiole 2–22 mm long. Inflorescence often sparsely branched, sparsely pubescent; flowers in lax glomerules of 3–8. Perianth 9–10 mm long, with sessile glands towards base; upper caducous part c. 5 mm diam., pale lilac, finely pubescent. Stamens 3 or 4, long exserted. Style c. 11 mm long. Fruit c. 7 mm long, club-shaped, slightly 10-ribbed, with a conspicuous, apical band of sticky, stalked, glandular warts. Fig. 37C–E.

Christmas Is. Apparently confined to ledges on the limestone cliffs at North West Point; distributed from southern China and India, through Indo-China to Malesia, and southern Africa.

Ch.Is.: North West Point, *D.A.Powell 652* (K).

2. Commicarpus insularum Meikle, *Kew Bull.* 34: 341, 342, fig. 1 (1979)

T: Emu Park, Qld, *S.T.Blake 15338*; holo: BRI. Named from the Latin *insula* (an island), in reference to the frequent occurence of the species on islands.

Illustration: R.D.Meikle, *loc. cit.*

Subshrub; stems creeping, to 1 m long. Leaves ovate, entire or sinuate, acute or acuminate, subglabrous or minutely puberulous; lamina 1.5–5 cm long; petiole to 2.5 cm long. Umbels 3–6-flowered; peduncle to 10 cm long; pedicels to 7 mm long. Perianth c. 8 mm long; upper caducous part c. 4 mm diam., white. Stamens 3 or 4, shortly exserted. Fruit clavate, c. 8 mm long, 3 mm diam., irregularly glandular warty, particularly towards apex.

Coral Sea Is. Reported from herbfield in coralline sand. Also on the cays, continental islands and adjacent mainland coast within the Great Barrier Reef, Qld.

The species was cited by H.Heatwole in an unpublished Australian National Parks & Wildlife Service report (1988) as *C. chinensis* but no specimen has been located. Description drawn from Qld material.

4. BOERHAVIA

Boerhavia L., *Sp. Pl.* 1: 3 (1753); *Gen. Pl.* 5th edn, 4 (1754); after the Dutch physician and botanist, Hermann Boerhaave (1668–1738).

Type: *B. erecta* L.

Annual or perennial, erect to prostrate herbs or subshrubs; often with sticky, glandular hairs. Leaves opposite, often in unequal pairs; upper leaves bract-like. Inflorescence axillary in small, cymose, bracteate glomerules, often branched and combined into axillary or apparently terminal pseudopanicles; basic inflorescence unit (ultimate flower head) an umbel, glomerule or single flower. Flowers small, bisexual, subtended by 2 minute bracteoles. Perianth small, constricted above ovary; upper part (limb) corolla-like, cup-shaped or campanulate, 4- or 5-lobed, plicate, caducous; lower part 3–5-ribbed, mostly with glandular hairs, persistent. Stamens mostly 1–4. Ovary enclosed by perianth base; style included or exserted; stigma capitate. Fruit small, fusiform or club-shaped, longitudinally 3–5-ribbed, often glandular-hairy; ribs often mucous when wet. *Tarvines*.

A pantropical and subtropical genus of c. 20 species; 8 species in mainland Australia, 5 of which occur on the tropical oceanic islands – 1 species on Cocos (Keeling) Is. and Christmas Is.; another on Cocos (Keeling) Is. and cays of Ashmore Reef and the Coral Sea; another on Cocos (Keeling) Is. and Ashmore Reef; another on cays of Ashmore Reef and the Coral Sea; another on Ashmore Reef.

F.R.Fosberg, Studies in the genus *Boerhavia* L. (Nyctaginaceae), 1–5, *Smithsonian Contr. Bot.* 39: 1–20 (1978); F.R.Fosberg, New & Noteworthy Plants from the Great Barrier Reef Sand Cays, Australia, *Brittonia* 40(1): 55–59 (1988).

A difficult genus requiring a monographic revision. Some previous treatments have been conservative in approach, such as that of R.D.Meikle & H.J.Hewson, *Fl. Australia* 4: 18 (1984). Narrower species circumscriptions adopted by F.R.Fosberg, *op. cit.* (1978, 1988) are followed here.

1 Leaves less than 5 mm wide (A.R.) **5. B. burbidgeana**

1: Leaves more than 5 mm wide

2 Inflorescence usually terminal, compound, diffuse

3 Fruit with ribs glandular-hairy, sometimes sparsely so, furrows not glandular-hairy; flowers bright purple-pink (Ch.Is., C.K.Is.) **3. B. diffusa**

3: Fruit with ribs smooth, furrows glandular-hairy; flowers white or pale pink (A.R., C.S.Is.) **4. B. glabrata**

2: Inflorescence usually axillary

4 Basic inflorescence units many-flowered; fruit with narrow ribs, not mucous (C.K.Is., A.R., C.S.Is.) **1. B. albiflora**

4: Basic inflorescence units few-flowered, rarely of single flowers; fruit with prominent ribs, mucous (C.K.Is., A.R.) **2. B. repens**

1. Boerhavia albiflora Fosberg, *Smithsonian Contr. Bot.* 39: 11 (1978)

T: Enderbury Is., *F.R.Fosberg & Stoddart 54748*; holo: US *n.v.*, *fide* F.R.Fosberg, *loc. cit.* Epithet from the Latin *albus* (white) and *flos* (a flower) in reference to the flower colour.

Illustration: A.B.Cribb & J.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 163 (1985), as *B. tetrandra*.

Perennial, glabrous or glandular-hairy herb; stems prostrate or decumbent, to 1 m long. Leaves ovate; lamina 1–4 cm long; petiole to 2 cm long. Inflorescence axillary, usually corymb-like; peduncle 3–10 cm long; basic unit a compact many-flowered glomerule; flowers subsessile. Perianth base sparsely glandular-hairy; limb broadly campanulate, c. 2 mm long, usually white, rarely pink. Stamens 2, rarely 3. Fruit ±fusiform, 3.5–5 mm long; ribs narrow, not mucous; furrows wide, sparsely glandular-hairy. Fig. 35G–I.

Cocos (Keeling) Is., Ashmore Reef, Coral Sea Is. Grows in herbfield and openings in strand shrub communities in coralline sand. Widespread on the islands of the tropical Pacific Ocean from Wake Is. S to the Great Barrier Reef, Qld, and in the NE Indian Ocean.

C.K.Is.: North Keeling Is., *I.R.Telford 10018 & C.Howard* (AD, CBG, K); settlement, top of beach, West Is., *I.R.Telford 9989 & C.Howard* (AD, CBG, K, PERTH). A.R.: Middle Is., 22 Feb. 1984, *D.B.Carter* (CBG). C.S.Is.: Mellish Reef, *K.Keith 19* (CANB); Anne Cay, Lihou Reef, *S.Hogg 57* (BISH, CBG); SW Is., Coringa Is., *I.R.Telford 11529* (BISH, BRI, CBG, NSW, US).

This species was included in a broadly circumscribed *B. tetrandra* G.Forst. in Meikle & Hewson, *op. cit.* 8 (1984), where fig. 3A–D of a Phoenix Is. (central Pacific Ocean) plant, shows the glandular hairy ribs on the fruit of *B. tetrandra sens. str. Boerhavia albiflora* has glabrous fruit ribs and differs as well in usually having white flowers. Some populations from the Cocos (Keeling) Is. have consistently smaller leaves, rarely exceeding 15 mm long.

2. Boerhavia repens L., *Sp. Pl.* 1: 3 (1753) *sens. lat.*

T: 'Nubia inter Mocho & Tangos', coll. unknown; *n.v.* Epithet is Latin for creeping, in reference to the habit.

Perennial, glandular-hairy herb; stems herbaceous, prostrate from a thickened taproot. Leaves ovate, usually oblique at base, undulate, obtuse or acute; lamina 4–23 mm long; petiole 1–12 mm long. Inflorescence axillary; peduncle 1.5–5 cm long; basic unit a several-flowered glomerule; flowers subsessile. Perianth base sparsely glandular-hairy; limb broadly campanulate, c. 1.5 mm long, white. Stamens 4. Fruit ellipsoidal, 2.5–3 mm long; ribs and furrows sparsely glandular hairy.

Cocos (Keeling) Is., Ashmore Reef. On Cocos (Keeling) Is. recorded from both atolls in herbfield and under *Argusia* shrubs at tops of lagoon and ocean beaches in coralline sand. Recorded for 2 cays of Ashmore Reef in herbfield in coralline sand.

C.K.Is.: at settlement, West Is., *I.R.Telford 9989 & C.Howard* (AD, CBG, K, PERTH); southern ocean shoreline, North Keeling Is., *D.G.Williams 149* (BISH, BRI, CBG). A.R.: East Is., 12 Mar. 1986, *A.Grant* (CBG).

An extremely variable species. Some collections from Cocos (Keeling) Is. are apparently close to *B. repens* var. *maris-indici* Fosberg ex Fosberg from islands of the central and W Indian Ocean.

3. Boerhavia diffusa L., *Sp. Pl.* 1: 3 (1753)

T: from India; *n.v.* Epithet from the Latin *diffusus* (spread out), in reference to the habit.

B. caespitosa Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 214 (1906). T: Flying Fish Cove, Christmas Is., 1904, *H.N.Ridley 145*; holo: SING; iso: K.

[*B. diffusa* var. *pubescens auct. non* Choisy: C.W.Andrews, *Monogr. Christmas Is.* 185 (1900)]

[*B. repens* var. *diffusa auct. non* (R.Br.) Fosberg: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 214 (1906)]

Annual or perennial, subglabrous or glandular-hairy herb; stems decumbent to erect, to 80 cm tall. Leaves ovate or elliptic, usually sinuate, obtuse or acute, ±oblique; lamina to 6 cm long; petiole to 2.5 cm long. Inflorescence terminal, compound, diffuse, to over 60 cm long; basic unit a 3–10-flowered glomerule or umbel c. 7 mm diam. Perianth glandular-hairy throughout; limb campanulate, 2–3 mm long, bright purple-pink. Stamens 2 or 3. Fruit ellipsoidal to clavate, c. 4 mm long; ribs 5, prominent, glandular-hairy, sometimes sparsely so; furrows narrow, not glandular-hairy.

Christmas Is., Cocos (Keeling) Is. On Cocos (Keeling) Is. grows in disturbed sites such as roadsides and around settlements in calcareous sand. On Christmas Is. occurs in rocky, sandy or disturbed soil, often in dry, open places or as a weed of habitation. Widespread through the tropics.

Ch.Is.: Winifreds Beach, Christmas Is. Natl Park, *B.A.Mitchell 11* (CBG, K); Poon Saan, *N.M.Wace C10* (CBG, K); opposite hospital, Settlement, *D.J. & B.P.Du Puy CI47* (CBG, K). C.K.Is.: settlement, West Is., *I.R.Telford 9945 & C.Howard* (AD, CBG, K); kampong, Home Is., *D.G.Williams 165 & Amat Noor* (CBG, K, PERTH).

Probably a species complex, requiring further investigation. Some island collections included here are similar to *B. glabrata* but differ in fruit characters.

4. **Boerhavia glabrata** Blume, *Bijdr.* 788 (1826)

T: Java, from the garden of Zippelius, near Batavia, *C.Blume s.n.*; *n.v.* Epithet from the Latin *glabratus* (becoming hairless), in reference to the indumentum of the plant.

Perennial, glabrous or glandular-hairy herb or subshrub; stems prostrate or decumbent, to 80 cm or more long, thickened and woody towards base. Leaves ovate to broadly ovate; lamina to 4 cm long; petiole to 3 cm long. Inflorescences axillary and terminal, often compound; basic unit a few-flowered umbel, sometimes a glomerule, rarely a single flower; pedicels to 10 mm long or flowers subessile. Perianth base glandular in furrows; limb campanulate, 1–2 mm long, usually white or pale pink. Stamens 2–4. Fruit ±fusiform, c. 4 mm long; ribs 5, mucous; furrows usually densely glandular-hairy. Fig. 35D–F.

Ashmore Reef, Coral Sea Is. On Ashmore Reef grows in herbfield in coralline sand. On the Coral Sea Is. grows in herbfield and openings in shrub communities. Also in Indonesia and north-eastern Australia.

A.R.: East Is., 28 Oct. 1987, *M.D.Hinchley* (CBG); West Is., *K.F.Kenneally 6354* (CBG, K, PERTH). C.S.Is.: SE Cay, Magdelaine Cays, 6 Oct. 1987, *T.Scotney & W.Jeffs* (CBG); SW Is., Coringa Is., *I.R.Telford 11523* (BISH, BRI, CBG, NSW, US).

A species complex, involving *B. mutabilis* R.Br. and *B. dominii* Hewson, requiring further investigation.

5. **Boerhavia burbidgeana** Hewson, *Fl. Australia* 4: 319 (1984)

T: junction of Neville Ck and Calder R., W.A., 5 May 1983, *K.F.Kenneally 8711*; holo: PERTH. Epithet in honour of Nancy T.Burbidge (1912–1977), a prominent Australian botanist who first recognised this taxon as a distinct species.

Illustration: R.D.Meikle & H.J.Hewson, *Fl. Australia* 4: 7 fig. 2C–D (1984).

Perennial, sparsely glandular-hairy herb or subshrub; stems prostrate, to 1 m or more long. Leaves narrowly ovate; lamina to 30 mm long, less than 5 mm wide; petiole to 1 cm long. Inflorescences axillary and terminal, often compound; basic unit a solitary flower or few-flowered glomerule; peduncle of basic unit slender, to 1.5 cm long. Perianth base glandular; limb tubular to campanulate, c. 1 mm long, pale pink. Stamens 1 or 2. Fruit ±fusiform, c. 4 mm long; ribs 5, prominent, mucous.

Ashmore Reef. Grows in herbfield in coralline sand. Also in NW Australia and adjacent offshore islands.

A.R.: Middle Is., Feb. 1983, *N.Sarti* (PERTH); Middle Is., *D.B.Carter 4* (CANB, CBG).

The relationship of this species to *B. angustifolia* L., which occurs in Java, should be investigated.

14. AIZOACEAE

I.R.H.Telford (Ch.Is., C.K.Is.)

Herbs or shrubs. Leaves opposite or alternate, simple, usually succulent, exstipulate. Inflorescence an axillary or terminal, solitary flower, cluster or thyrse. Flowers actinomorphic, bisexual. Perianth segments 4 or 5, often coloured inside. Stamens 4–many; staminodes absent or (not in our area) many, petal-like. Ovary superior or inferior, 1–many-locular; placentation axile, apical, basal or parietal; ovules usually several to many per locule; styles as many as locules. Fruit a capsule or indehiscent, 1–many-seeded. Seeds lacking true endosperm.

An almost cosmopolitan family of c. 150 genera and over 2000 species, the centre of diversity in southern Africa; 18 genera and 60 species in Australia, of which 1 species occurs on Christmas and Cocos (Keeling) Islands.

G.Bentham, Ficoideae *p.p.*, *Fl. Austral.* 3: 322–334 (1866); A.Prescott and J.Venning, Aizoaceae, *Fl. Australia* 4: 19–62 (1984).

SESUVIUM

Sesuvium L., *Syst. Nat.* 10th edn, 1058 (1759); in memory of the Sesuvii, a Gallic tribe of Roman Gaul (application obscure).

Type: *S. portulacastrum* (L.) L.

Succulent, glabrous, perennial herbs. Leaves opposite, sessile, connate at base. Flowers solitary, axillary, pedicellate, lacking bracts. Perianth segments 5, triangular with scarious margins, dorsally mucronate. Stamens 5–many; staminodes absent. Ovary superior, 2–5-locular; placentation axile; ovules several per locule; styles 2–5. Fruit a circumscissile, several-seeded capsule. Seeds pea- to comma-shaped, smooth.

A genus of 6 species, mostly African; 1 pantropical coastal species on Christmas and Cocos (Keeling) Islands and in northern Australia.

Sesuvium portulacastrum (L.) L., *Syst. Nat.* 10th edn, 1058 (1759)

Portulaca portulacastrum L., *Sp. Pl.* 1: 466 (1753). T: Curacao, S America, *P.Hermann*; iso: probably BM-SL *n.v.* Epithet from *Portulaca* (a genus of the family Portulacaceae) and the Latin *-astrum* (inferior to, or partial resemblance to) in reference to the similarity between this taxon and members of the genus *Portulaca*.

Illustrations: C.Jeffrey, *Fl. Trop. E. Africa*, Aizoaceae: 21, fig. 7 (1961); A.Prescott, *Fl. Australia* 4: 43, fig. 11N, O (1984).

Decumbent herb; stems to 1 m. Leaves linear, lanceolate or oblanceolate, 10–70 mm long, 2–15 mm wide, glossy green. Pedicels 3–15 mm long, thickening towards apex. Perianth tube c. 3 mm long; lobes 6–9 mm long, green outside, pink to purple inside, with a fleshy mucro c. 1.5 mm long behind apex. Stamens many; filaments c. 6 mm long. Ovary ovoid, 3-locular; styles 3, c. 4 mm long. Capsule ovoid; operculum c. 8 mm long, smooth. Seeds c. 1.5 mm diam., black.

Christmas Is., Cocos (Keeling) Is. Recorded from cracks in coralline limestone sea cliffs on Christmas Is. and lagoon margins on calcareous sand and coral rock on North (Keeling) Is.

Pantropical; including coasts of tropical and subtropical Australia.

Ch.Is.: Lily Beach, *B.A.Mitchell 211* (CBG, K); North East Point, *D.A.Powell 309* (K); Grotto, *R.Shivas 861* (PERTH). C.K.Is.: lagoon margin, North Keeling Is., *I.R.Telford 10014* & *C.Howard* (AD, CBG, K).

15. AMARANTHACEAE

R.M.Barker (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R., C.S.Is.)

Herbs or shrubs; stems usually angled. Leaves opposite or alternate, exstipulate. Flowers bisexual or unisexual, small, terminal or axillary, often clustered, usually each subtended by a bract and 2 persistent bracteoles; bracts and bracteoles scarious or membranous. Perianth parts 3–5, equal or not, frequently with scarious margins, often persisting on fruit. Stamens 3–5; filaments free or joined into a cup at base, often alternating with variably shaped staminodes; anthers 1- or 2-locular. Ovary superior, 1-locular; ovules 1–many. Fruit a utricle or berry, sometimes circumscissile, sometimes indehiscent. Seeds 1–many, frequently discoid, smooth or ornamented; endosperm little or none.

A family of c. 65 genera and 850 species; 7 genera in our area: 6 genera (12 species) on Christmas Is. mostly found as weeds in waste places; 2 genera (2 species) on Cocos (Keeling) Is.; 1 genus (1 species) on Ashmore Reef; 1 genus (1 species) on the Coral Sea Is. Species of *Amaranthus* are cultivated for their ornamental foliage or eaten as a vegetable.

C.A.Backer, Amaranthaceae, *Fl. Males.* ser. I, 4: 69–98 (1949); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Amaranthaceae, *Fl. Java* 1: 232–239 (1963); A.Kanis, A review of the Amaranthaceae in Papuasia, *Contr. Herb. Austral.* 1: 1–18 (1972); C.G.G.J. van Steenis, Amaranthaceae, *Fl. Males.* ser. I, 6: 915 (1972); A.Kanis, Further Notes on the Amaranthaceae in Papuasia, *Contr. Herb. Austral.* 7: 8 (1974); C.C.Townsend, Amaranthaceae, in M.D.Dassanayaka & F.R.Fosberg (eds), *Revised Handb. Fl. Ceylon* 1: 1–57 (1980).

KEY TO GENERA

1 Leaves alternate

- **2** Plant climbing; fruit a red berry — **1. DEERINGIA**
- **2:** Plant not climbing; fruit not fleshy
  - **3** Perianth woolly outside — **4. AERVA**
  - **3:** Perianth glabrous
    - **4** Flowers bisexual; fruit circumscissile, 2–10-seeded — **2. CELOSIA**
    - **4:** Flowers unisexual; fruit circumscissile or indehiscent, 1-seeded — **3. AMARANTHUS**

1: Leaves opposite

- **5** Flowers in dense axillary heads — **6. ALTERNANTHERA**
- **5:** Flowers in axillary or terminal spikes or terminal heads
  - **6** Woody herb to 150 cm high; leaves petiolate, ovate to elliptic, 3.5–21 cm long; inflorescence a spike 3–19 cm long, spiny; fruit reflexed against rachis — **5. ACHYRANTHES**
  - **6:** Soft herb, prostrate or ascending; leaves sessile, spathulate, 1–4 cm long; inflorescence a sessile head, shortly elongating into spike up to 4 cm long, not spiny; fruit erect — **7. GOMPHRENA**

1. DEERINGIA

Deeringia R.Br., *Prodr.* 413 (1810); named in honour of Caroli Deering, author of *Flora of Nottingham*.

Type: *D. celosioides* R.Br.

Herbs or scandent shrubs; stems furrowed longitudinally. Leaves alternate, simple. Flowers bisexual, in terminal or axillary, often branched, racemes or spikes. Perianth parts 5, rarely 4, 1-nerved, margins scarious. Stamens 5, rarely 4; filaments united at base into a shallow cup, slender where free; anthers 2-locular. Ovary sessile; ovules few to many; style short, thick; stigmas usually 3, persistent in fruit. Fruit a thin-walled berry. Seeds 1–many, smooth, discoid with emarginate base, shiny black or brown with paler reniform funicle at base.

A genus of c. 7 species found in tropical regions of the Old World; 1 species on Christmas Is.; 2 in north-eastern Australia.

Deeringia amaranthoides (Lam.) Merr., *Interpr. Rumph. Herb. Amboin.* 211 (1917)

Achyranthes amaranthoides Lam., *Encycl.* 1: 548 (1785). T: 'Java & Moluccas' *P.Sonnerat*; syn: P-LA 547/16, 547/17, 547/18. Epithet from the Greek *amarantos* (name of an everlasting flower) and *-oides* (resembling), in reference to the appearance of the flowers.

Celosia baccata Retz., *Obs. Bot.* 5: 23 (1788); *Deeringia baccata* (Retz.) Moq. in A.de Candolle, *Prodr.* 13: 236 (1849). T: Ceylon, *J.G.Koenig*; *n.v.*

D. celosioides R.Br., *Prodr.* 413 (1810). T: banks of Hawkesbury River, Port Jackson, N.S.W., *R.Brown Iter Australiense 3045*; syn: K; Hunter River, N.S.W., *R.Brown s.n.*; syn: K.

Sprawling shrub. Stems somewhat angular above, sparsely pubescent, ±terete and glabrous in older parts, green, blackening when crushed. Leaves ovate, rounded at base, entire, acuminate, thinly pubescent on both surfaces; lamina 3.5–15 cm long, sometimes smaller in floral parts; petiole 1.5–3 cm long. Flowers many in branched racemes; pedicels 0.5–1 mm long; bracts triangular, 1–1.5 mm long; bracteoles ovate, c. 1 mm long. Perianth segments c. 2 mm long, reflexed in open flower, white. Stamens with filaments c. 2 mm long, reflexed under fruit. Stigmas 3, recurved on fruit. Berry globose, 2–3 mm diam., green ripening red. Seeds 1 or 2, c. 1.2–1.5 mm diam., black. Figs 13, 36A.

Christmas Is. Grows in limestone areas associated with coastal cliffs and rocky areas on most sides of the island. Also from India, China and Malesia to Australia.

Ch.Is.: E end of Flying Fish Cove, 7 Oct. 1887, *E.J.Lister* (K); Rocky Point, *A.Pearson P42* (K); South Point, 2nd terrace, *B.Molesworth Allen P16* (K); cliffs overlooking North East Point, *D.A.Powell 82* (K); Smithson Bight, *B.A.Mitchell 186* (CBG, K).

The date of publication by A.J.Retzius of *Celosia baccata* needs to be clarified as this was possibly published earlier than indicated in the synonymy (possibly *Fasc. Obs. Bot.* (1774); *n.v.*).

2. CELOSIA

Celosia L., *Sp. Pl.* 1: 205 (1753); from the Greek *kelos* (burned), in reference to the colour and shape of the inflorescence.

Type: *C. argentea* L.

Erect, glabrous annual herbs; stems indistinctly angled, often furrowed longitudinally. Leaves alternate, simple. Flowers bisexual, in dense, axillary or terminal spikes, these rarely interrupted at base; each flower subtended by a bract and 2 bracteoles. Perianth segments 5, scarious, free, ±equal, spreading at anthesis, otherwise erect, acute, longitudinally nerved. Stamens 5; filaments united at base into a cup, sometimes with minute teeth between; anthers 2-locular. Ovary with many ovules; style long, persistent; stigma 2-lobed

or capitate. Fruit thin-walled, circumscissile. Seeds 1–many, lens-shaped.

A genus of c. 60 species from temperate and subtropical parts of Africa and America; 1 species naturalised on Christmas Is. and in Australia.

T.N.Khoshoo & M.Pal, The probable origin and relationship of the garden cockscomb, *Bot. J. Linn. Soc.* 66: 127 (1973).

***Celosia argentea** L., *Sp. Pl.* 1: 205 (1753)

T: America, Herb. C.Linnaeus 288.1; lecto: LINN *n.v.*, *fide* C.C.Townsend, *Revis. Handb. Fl. Ceylon* 1: 3 (1980). Epithet from the Latin *argentus* (silvery) in reference to the spikes of the wild form of this species.

Branched herb to 150 cm high; lower stems often red. Leaves ovate to linear, attenuate at base, entire, acute; lamina 4–11 cm long; petiole 0–2 cm long; small pair of linear leaves often present in leaf axils. Spike solitary, erect, usually 2–7 cm long, elongating to 20 cm in fruit (excluding peduncle); peduncle ribbed, 0.5–20 cm long; bracts c. 8 mm long, scarious, 1-nerved, mucronate, persistent; bracteoles similar to bracts, c. 5 mm long. Perianth segments c. 8 mm long, mucronate, basally 3–5-nerved, initially tinged pink, finally white. Staminal filaments triangular at base, 2–3 mm long. Style red, c. 5 mm long. Fruit enclosed in persistent perianth. Seeds c. 10, basally emarginate, c. 1.8 mm diam., shiny, black.

Christmas Is. Naturalised and common in all open cleared areas and occasionally recorded as an initial regrowth species in mining areas. Probably originally from the Indian subcontinent (T.N.Koshoo & M.Pal, *Bot. J. Linn. Soc.* 66: 127, 1973) but for some time widespread throughout Malesia. First collected and already recorded as common on Christmas Is. by C.W.Andrews in 1897, while H.N.Ridley noted it as cultivated at the Cove in 1904.

Ch.Is.: Flying Fish Cove, *C.W.Andrews 21* (K); Cove (cult.), *H.N.Ridley 134* (SING); Phosphate Hill, *B.A.Mitchell 14* (CBG, K); Waterfall Rd, blowhole, *A.Pearson 27* (K); Old Mine site, 0.5 km N of airport, *R.Shivas 935* (PERTH).

Garden forms with coloured spikes are usually referred to as *C. cristata* L. and are commonly cultivated.

3. AMARANTHUS

Amaranthus L., *Sp. Pl.* 2: 989 (1753); *Gen. Pl.* 5th edn, 427 (1754); from the Greek *amarantos*, an everlasting flower.

Type: *A. caudatus* L.

Erect or decumbent, usually unarmed, annual herbs; stems indistinctly angled, grooved longitudinally. Leaves alternate, simple. Inflorescences dense axillary clusters below, passing into axillary and terminal spikes above; flowers unisexual. Perianth segments 3 or 5, rarely 4, free, ±equal, membranous, sometimes hardening at base in fruit. Stamens 3 or 5; filaments free, slender; teeth or staminodes lacking; anthers 2-locular. Ovary sessile; ovule 1; style short or lacking, stigmas 2–4, usually 3, erect or recurved, persistent. Utricle membranous, usually circumscissile, rarely splitting irregularly. Seed ±discoid, more compressed about rim, shining, black or brown.

A genus of c. 75 species, predominantly temperate; in Australia 5–8 endemic and 6 or 7 naturalised species; 5 species on Christmas Is.; 1 species on Ashmore Reef; 1 unsubstantiated record for the Coral Sea Is. A number of species have become weeds in tropical areas, while some are cultivated and used as a green vegetable, others as ornamentals.

J.D.Sauer, The grain amaranths and their relatives: a revised taxonomic and geographic survey, *Ann. Missouri Bot. Gard.* 54: 103–107 (1967).

1 Plant spiny (Ch.Is.) **1. A. spinosus**

1: Plant not spiny

2 Fruit breaking irregularly or indehiscent, not circumscissile

3 Female flowers with 3 perianth segments (Ch.Is.) **5. A. viridis**

3: Female flowers with 5 perianth segments (A.R.) **6. A. interruptus**

2: Fruit circumscissile

4 Perianth segments 3, with an awn c. 2 mm long; male and female flowers intermixed in spike (Ch.Is.) **4. A. tricolor**

4: Perianth segments 3–5, with a mucro less than 2 mm long; flowers predominantly female with a few male at base and apex of spike

5 Perianth segments slightly shorter than bracts; bracts mucronate; stigma c. 1 mm long (Ch.Is.) **2. A. dubius**

5: Perianth segments much shorter than bracts; bracts aristate; stigma c. 0.5 mm long (Ch.Is.) **3. A. cruentus**

1. Amaranthus spinosus L., *Sp. Pl.* 2: 991 (1753)

T: India, Herb. C.Linnaeus 1117.27; lecto: LINN, *fide* C.C.Townsend, *Revis. Handb. Fl. Ceylon* 1: 9 (1980), as Linn. 117/27. Epithet from the Latin *spina* (a spine) and *-osus* (abundance), in reference to the many spines born by the plant.

Erect, much-branched herb to 1 m high; stems somewhat angular, glabrous, with paired axillary spines 5–10 mm long. Leaves ovate, rounded at base, entire, usually mucronate (particularly young leaves), glabrous or very sparsely pubescent; lamina 2.5–6.5 cm long; petiole to 5 cm long. Flowers in lower parts of plant in axillary clusters often subtended by paired spines, usually wholly female, those in upper 2/3 in spikes, usually male; bracts ovate, spiny at apex, shorter than perianth. Perianth segments 5, ovate-oblong, mucronate; margins transparent; midrib green; segments of female flowers slightly shorter than male (c. 2 mm long) and ±spathulate at base. Stigmas 3, slender, c. 1 mm long. Utricle circumscissile; upper half 3-lobed. Seed c. 1 mm diam., black.

Christmas Is. Probably a spontaneous weed. D.A.Powell notes the species as always among the first to appear in new gardens. Probably originated in the tropical regions of the New World and now spread throughout Malesia.

Ch.Is.: without precise locality, *D.A.Powell 7* (K).

D.A.Powell's collection, made in 1968, is only in the very early stages of flowering and the description of floral parts above is based on Javan material.

2. *Amaranthus dubius Mart. ex Thell., *Fl. Adv. Montpellier* 203 (1912)

T: grown from seed at Erlangen, ex Herb. Schwaegrichen; neo: M *n.v.*, *fide* C.C.Townsend, *Kew Bull.* 29: 471 (1974). Epithet is the Latin for doubtful, referring to the generic placement of the plant.

Erect herb to 1 m high, unarmed; stems somewhat angled, glabrous, green. Leaves ovate, somewhat oblique at base, entire, glabrous; lamina (larger leaves) 4–7 cm long; petiole to 5 cm long. Flowers all female in specimens seen. Bracts ovate, long mucronate, c. 2 mm long overall; margins transparent; midrib and mucro green. Perianth segments 3–5, somewhat unequal, shortly mucronate, slightly shorter than bract. Stigmas 3, c. 1 mm long. Utricle circumscissile; upper part c. 1–1.5 mm long, 3-lobed. Seed c. 0.8 mm diam., black.

Christmas Is. Known from a single collection. Native of tropical America but now spread throughout the Old World tropics.

Ch.Is.: no precise locality, *D.A.Powell 374* (K).

Cultivated as a vegetable. *Amaranthus dubius* is the only known polyploid of the genus (J.D.Sauer, *Ann. Missouri Bot. Gard.* 54: 103–107, 1967), with some of its gene

complement considered to have come from *A. spinosus* with which it crosses readily to produce sterile hybrids.

3. *Amaranthus cruentus L., *Syst. Nat.* 10th edn, 2: 1269 (1759)

T: Herb. C.Linnaeus 1117.25; possible syn: LINN. Epithet from the Latin *cruentus* (blood-stained).

A. paniculatus L., *Sp. Pl.* 2nd edn, 2: 1406 (1763). T: America, Herb. C.Linnaeus 1117.20; possible syn: LINN.

Erect herb, height unknown, unarmed; stems angled, glabrous. Leaves ovate, oblique at base, entire, mucronate, glabrous; lamina to 25 cm long; petiole to 15 cm long. Flowers predominantly female, few male at base and apex of clusters; bracts ovate, aristate, to 3 mm long overall. Perianth segments 3–5, somewhat unequal, shortly mucronate, 1–2 mm long. Stigmas 3, c. 0.6 mm long. Utricle circumscissile, the upper part c. 1.5 mm long, 3-, rarely 2-lobed, apically. Seed c. 1 mm diam., black.

Christmas Is. Known from a single collection. Apparently not persistent.

Ch.Is.: Flying Fish Cove, *H.N.Ridley 112* (SING).

There is much controversy about the name of this taxon and it has been treated at specific, subspecific and varietal level. At varietal level the correct name according to A.Kanis, *Contr. Herb. Austral.* 7: 10 (1974), is *A. hybridus* subsp. *incurvatus* var. *cruentus* (L.) Mansf. but at subspecific level it becomes *A. hybridus* subsp. *cruentus* (L.) Thell. according to C.C.Townsend (*Revised Handb. Fl. Ceylon* 1: 14, 1980). Cultivated for ornamental purposes (often with leaves and flowers tinged purple), this may have been the reason for its introduction to Christmas Is. It is not markedly different from *A. dubius*.

4. *Amaranthus tricolor L., *Sp. Pl.* 2: 989 (1753)

T: India, Herb. C.Linnaeus 1117.7; lecto: LINN, *fide* C.C.Townsend, *Revis. Handb. Fl. Ceylon* 1: 15 (1980), as Linn. 117/7. Epithet from the Latin *tri-* (three-) and *color* (colour).

Erect or decumbent herb to 50 cm high, unarmed; stems angular, glabrous. Leaves ovate to ±deltoid, often decurrent, ±entire, obtuse or emarginate, glabrous, entirely green or with area around main venation red; lamina 3.5–9.5 cm long; petiole to 4 cm long. Flowers in clusters and spikes with mixed female and male; bracts and bracteoles long-awned from broad base; awn slender, c. 2 mm long. Perianth segments 3, ±equal to bracts and with similar awns; margins transparent; midrib and mucro green or sometimes purple. Stigmas 3, c. 0.5 mm long. Utricle circumscissile; surface granular; lid contracted apically, 3-lobed. Seed c. 1.2 mm diam., black.

Christmas Is. Known from only 2 recent collections (1981). Worldwide distribution but possibly originating in Asia.

Ch.Is.: no precise locality, *D.A.Powell 375, 376* (K).

Of the 2 collections, one has entirely green leaves, the other coloured.

5. Amaranthus viridis L., *Sp. Pl.* 2nd edn, 2: 1405 (1763)

T: Herb. C.Linnaeus 1117.15; lecto: LINN, *fide* E.D.Merrill, *Amer. J. Bot.* 23: 609 (1936). Epithet is the Latin for green.

Herb to 100 cm high, usually branched, erect, ascending or rarely creeping, unarmed; stems somewhat angular, glabrous. Leaves ovate, cuneate to rounded at base, entire, obtuse or emarginate, glabrous; midrib frequently extended into a small mucro; lamina 3–8 cm long; petiole to 5.5 cm long. Flowers predominantly female, those at apex of spikes usually male. Bract and bracteoles smaller than perianth parts, mucronate; margins transparent; midrib green. Perianth segments 3, c. 1 mm long, similar to bracts and bracteoles. Stigmas 2 or 3,

Figure 36. **A–E**, AMARANTHACEAE. **A**, *Deeringia amaranthoides*, part of flowering branchlet X0.5 (B.Mitchell 186, CBG). **B**, *Achyranthes aspera*, flowering stem X0.5 (C.Darwin, Apr. 1836, CGE). **C**, *Amaranthus viridis*, flowering branchlet X0.5 (B.Mitchell 157, CBG). **D**, *Amaranthus interruptus*, flowering branchlet X0.5 (D.Carter, 22 Feb. 1984, CBG). **E**, *Aerva lanata*, flowering stem X0.5 (D.Williams 204, CBG). Drawn by D.Boyer.

c. 0.25 mm long, initially erect. Utricle contracted apically, corrugated, not circumscissile, falling with persistent perianth. Seed c. 1 mm diam., black. Fig. 36C.

Christmas Is. Common on waste ground. Weedy species found throughout Malesia.

Ch.Is.: without precise locality, *C.W.Andrews 193* (BM); Phosphate Hill, *H.N.Ridley 115* (K); throughout all settlements on waste ground, *D.A.Powell 5* (K); coastal limestone pinnacles at Andrews Point, western side of South Point, *D.A.Powell 518* (K); Toms Ridge mining area, *B.A.Mitchell 157* (CBG).

Often gathered for use as a vegetable, although possibly not cultivated deliberately for such a purpose.

6. **Amaranthus interruptus** R.Br., *Prodr.* 414 (1810)

T: Arnhem N Bay and neighbouring parts of N coast, Australia, *R.Brown*; syn: probably BM *n.v.* Epithet is the Latin for interrupted in reference to the form of the inflorescence.

Erect or decumbent herb to 70 cm high, unarmed. Leaves ovate to rhomboidal, cuneate at base, obtuse, glabrous; lamina 0.5–5 cm long; petiole 0.3–6 cm long. Flowers predominantly female; bracts ovate, subacute, equal to or shorter than perianth. Perianth segments shortly mucronate, c. 1.5 mm long; margins scarious, white. Male flowers: perianth segments 3, narrowly ovate. Female flowers: perianth segments 5, narrowly spathulate; stigmas 2 or 3. Utricle breaking irregularly, not circumscissile, the upper part c. 1.5 mm long, rugose or with few ribs. Seed c. 1 mm diam., black. Fig. 36D.

Ashmore Reef. Recorded from the three islands in herbfield in coralline sand, often forming dense patches towards the middle of the islands; also northern Australia and New Guinea.

A.R.: Middle Is., *D.B.Carter 5* (CANB, CBG); East Is., 12 Mar. 1986, *A.Grant* (CBG).

4. AERVA

Aerva Forssk., *Fl. Aegypt.-Arab.* 170 (1775), *nom. cons.*; name possibly derived from *Erona*, the Arabic name for a member of the genus.

Type: *A. tomentosa* Forssk., *typ. cons.*

Erect or decumbent herbs or subshrubs; stems grooved longitudinally. Leaves alternate or opposite, simple. Flowers bisexual or unisexual in axillary or terminal spikes sometimes forming terminal panicles. Perianth segments 5, free, pilose or woolly outside. Stamens 5; filaments united at base into a cup, the free parts alternating with staminode-like teeth; anthers 2-locular. Ovary sessile; ovule 1; style short; stigmas 1 or 2. Utricle membranous, ±compressed, breaking irregularly. Seed 1, ±kidney-shaped.

A genus of 10 species of Africa and southern Asia; 1 species on Cocos (Keeling) Is., probably introduced; 2 species naturalised in tropical Australia.

Aerva lanata (L.) Schult., *Syst. Veg.* 5: 564 (1819)

Achyranthes lanata L., *Sp. Pl.* 1: 204 (1753). T: from India; *n.v.* Epithet from the Latin *lanatus* (woolly), in reference to the appearance of the inflorescence.

Erect or decumbent herb to 1 m, woody at base; stems pilose. Leaves alternate, obovate, elliptic or spathulate, cuneate at base, entire, shortly acuminate, pilose; lamina 4–45 mm long; petiole 2–15 mm long. Spikes 5–15 mm, sometimes elongating to 25 mm, woolly. Flowers bisexual. Perianth segments narrowly obovate, c. 1 mm long, white pilose outside, green inside; stigmas 2. Utricle c. 1 mm long. Seed c. 1 mm long, shining, black. Fig. 36E.

Cocos (Keeling) Is. Recorded once from a disturbed site in coralline sand. Native to southern Asia and Malesia.

C.K.Is.: adjacent to kampong, Home Is. (Pulu Selma), *D.G.Williams 204* (AD, CBG, K, PERTH).

5. ACHYRANTHES

Achyranthes L., *Sp. Pl.* 1: 204 (1753); from *achyron* (chaff) and *anthos* (a flower), in reference to the chaff-like flowers.

Type: *A. aspera* L.

Herbs; stems 4-angled, somewhat furrowed. Leaves opposite, simple. Flowers bisexual, in elongated terminal or axillary spikes; each flower subtended by a bract and two spiny bracteoles. Perianth segments 5, free, ±equal, acute, spreading at anthesis, otherwise erect. Stamens 5; filaments joined at base into a cup, the free parts alternating with short staminodes; anthers 2-locular. Ovary with a single ovule; style with capitate stigma at similar height to perianth. Fruit indehiscent, ellipsoidal with truncate apex, falling with persistent perianth and bracteoles. Seed tiny.

A genus of only a few species, predominantly of the Old World; 1 species in Australia and on Christmas Is., Cocos (Keeling) Is. and the Coral Sea Is.; 1 species endemic on Norfolk Is.

C.C.Townsend, Notes on Amaranthaceae 2, *Kew Bull.* 29: 473–474 (1974).

Achyranthes aspera L., *Sp. Pl.* 1: 204 (1753)

T: Ceylon, Herb. P.Hermann 2:69.105 right hand specimen; lecto: BM, *fide* C.C.Townsend, *Revis. Handb. Fl. Ceylon* 1: 38 (1980). Epithet from the Latin *asper* (rough), in reference to the leaf surface.

A. velutina Hook. & Arn., *Bot. Beechey Voy.* 68 (1832); *A. aspera* var. *velutina* (Hook. & Arn.) C.C.Towns., *Kew Bull.* 29: 473 (1974). T: Bow Is. [Hao Atoll, Tuamotu group], F.W.Beechey; holo: K *n.v.*, *fide* D.M.Porter, *Kew Bull.* 37: 334 (1982).

A. argentea (?var. *villosior*) Hensl., *Ann. Nat. Hist.* 1: 341 (1838); *A. aspera* var. *villosior* (Hensl.) D.Porter, *Kew Bull.* 37: 334 (1982). T: Keeling Is., East Indies, Apr. 1836, *C.Darwin*; holo: CGE.

Sprawling, woody herb to 150 cm high; stems usually densely pubescent in young parts. Leaves ovate to elliptic, acute at base, entire, acuminate or acute, usually ±scabrous; lamina 3.5–21 cm long; petiole 0.5–2 cm long. Spikes 3–19 cm long, elongating in fruit; rachis densely beset with white hairs. Bracts triangular, acute c. 2 mm long, membranous. Bracteoles ovate, with midrib hardened and extended into a long, apically curved spine, c. 4 mm long; lamina membranous, fimbriate or ciliate at apex. Perianth segments lanceolate, very acute, 4–5 mm long, glabrous, hardening in fruit. Staminodes 5, long, fimbriate. Style c. 2.5 mm long. Fruit c. 2.5 mm long, glabrous, somewhat roughened, deflexed, falling with persistent bracteoles and perianth. Fig. 36B.

Christmas Is., Cocos (Keeling) Is., Coral Sea Is. On Christmas Is. grows on all the terraces, but more particularly the shore terraces. On Cocos (Keeling) Is., occurs on North Keeling Is. where recorded under *Pisonia grandis* and on the main southern atoll on Horsburgh Is. in shrubland with *Scaevola taccada* in coralline sand. Common on the vegetated Coral Sea islands in herbfield in coralline sand. Widespread on tropical islands of the Indian and W Pacific Oceans.

Ch.Is.: shore cliffs, *C.W.Andrews 11* (K); coastal terrace between West White Beach and North West Point, *B.A.Mitchell 208* (AD, CBG, K). C.K.Is.: Horsburgh Is., *D.G.Williams 211* (CBG, K). C.S.Is.: Anne Cay, Lihou Reef, *S.Hogg 52* (CBG, MEL); Cato Is., 30 Apr. 1980, *A.Stokes & A.Skeat* (CBG).

This extremely variable species has several named varieties that are difficult to separate except on a regional basis. Dispersed by the spiny bracteoles which persist in fruit.

6. ALTERNANTHERA

Alternanthera Forssk., *Fl. Aegypt.-Arab.* 28 (1775); name from the Latin *alternans* (alternating) and *anthera* (an anther), in reference to the staminodes alternating with the fertile stamens.

Type: *A. sessilis* (L.) DC.

Annual or perennial herbs, often pubescent; hairs often minutely barbed. Leaves opposite, with pairs frequently unequal, or in whorls of 3, entire. Flowers bisexual or female, usually clustered in axils. Perianth segments 5, free, equal or unequal, glabrous or pubescent. Stamens usually 5, some of these lacking anthers; filaments united at base, the free part sometimes alternating with staminode-like teeth or larger appendages; anthers 1-locular. Ovary with a single ovule; style short; stigma capitate. Fruit indehiscent, dispersed with perianth, and sometimes bracteoles, attached. Seed 1.

A genus of c. 200 species, predominantly American; 8 or 9 species in Australia; 3 species on Christmas Is., apparently introduced.

R.Melville, Notes on *Alternanthera*, *Kew Bull.* 13: 171 (1958); J.A.Mears, The nomenclature and type collections of the widespread taxa of *Alternanthera* (Amaranthaceae), *Proc. Acad. Nat. Sci. Philadelphia* 129: 1–21 (1977); J.Veldkamp, Some notes on *Alternanthera* Forssk., *Taxon* 30: 208 (1981).

1 Perianth segments ±equal, glabrous, 1-nerved; fruit heart-shaped; hairs on stems not minutely barbed **1. A. sessilis**

1: Perianth segments unequal, outer larger than the inner, pubescent at least at base, 3-nerved; fruit lacking or, if present, not heart-shaped; hairs on stems minutely barbed

2 Outer perianth segments with dense clumps of white hairs either side of base and extending onto petiole of subtending leaf, the backs of the perianth segments glabrous; inner perianth segments with clumps of hairs on the outer midrib **2. A. pungens**

2: Outer perianth segments without clumps of hairs at base but with white hairs on their backs in rows alongside the midrib; inner perianth segments glabrous **3. A. bettzichiana**

1. *Alternanthera sessilis (L.) DC., *Cat. Pl. Horti. Monsp.* 77 (1813)

Gomphrena sessilis L., *Sp. Pl.* 1: 225 (1753). T: India, Suratt in Herb. C.Linnaeus 290.24; syn: LINN; Hort. Uppsal. in Herb. C.Linnaeus 290.25; syn: LINN; ex Herb. P.Hermann 2:78; lecto: BM, *fide* C.C.Townsend, *Revis. Handb. Fl. Ceylon* 1: 49 (1980). Epithet is the Latin for sessile, in reference to the inflorescence.

Herb of variable habit; stems glabrous except for localised unbarbed hairs. Leaves often in unequal pairs, lanceolate to ovate, attenuate at base, undulate, acute or obtuse, ±glabrous; lamina 2–2.5 cm long; very shortly petiolate. Inflorescence an axillary, sessile, head-like cluster; bract and bracteoles ovate, very shortly mucronate, 0.5–1 mm long, white, 1-nerved, glabrous, persistent. Perianth segments ±equal, similar to bracts and bracteoles, c. 2 mm long, persistent. Stamens 5; 2 or 3 with anthers; filaments with free part c. 0.1 mm long; staminodes tiny triangular teeth. Fruit heart-shaped, red-tinged; persistent style in notched apex. Seed discoid, emarginate, c. 1.2 mm diam., pale brown with darker centre, shining.

Christmas Is. The only specimen seen was from a rainwater runoff area associated with a quarry. Common throughout Malesia, possibly also extending into Australia, although the status of the Australian material is undecided (A.Kanis, *Contr. Herb. Austral.* 1: 7, 1972).

Ch.Is.: no precise locality, *D.A.Powell 511* (K).

2. *Alternanthera pungens Kunth, *Nov. Gen. Sp.* 2: 206 (1818)

T: Orinoco R., Maipures (Colombia), *F.W.H.A.Humboldt & A.J.A.Bonpland*; syn or iso: P *n.v., fide* R.Melville, *Kew Bull.* 13: 174 (1958). Epithet is the Latin for pungent, in reference to the perianth segments.

Prostrate or ascending herb; stems white pubescent; hairs minutely barbed. Leaves sometimes unequally paired, sometimes in whorls of 3, ovate, attenuate to obtuse at base, undulate, mucronate, glabrous or sparingly pubescent; lamina c. 1.5–2 cm long; petiole c. 0.5 cm long. Inflorescence an axillary sessile cluster; bracts lanceolate, 5–6 mm long, 1-nerved, spine-tipped; bracteoles smaller. Perianth segments unequal, outer 2 c. 4.5 mm long, spine-tipped, white pubescent basally; adaxial segment c. 3 mm long, spine-tipped or obtuse; innermost segments c. 2.5 mm long, arching either side of ovary, with pubescent midrib. Stamens not seen. Ovary sessile, glabrous. Fruit thin-walled; perianth and sometimes bracteoles persistent. Seed discoid, c. 1 mm diam., pale brown with darker centre. Fig. 37H.

Christmas Is. D.A.Powell recorded on his collection that it first appeared at the golf club in 1959–60. Since then it has become island-wide by its adherence to tyres and footwear.

Ch.Is.: no precise locality, *D.A.Powell 345* (K); at edge of road and lawn at entrance to golf course, *R.Shivas 834* (PERTH).

A species of American origin now found as a weed in many parts of Malesia. A.Kanis, *Contr. Herb. Austral.* 1: 1–18 (1972), suggested the source of the plant in Papua New Guinea as Australia where it has occurred since early this century, and is known as khaki weed. It may also have been introduced to Christmas Is. from Australia.

3. *Alternanthera bettzichiana (Regel) Voss in A.Siebert & A.Voss, *Vilmorin's Blumengart.* 869 (1896)

Telanthera bettzichiana Regel, *Index Sem. Hort. Petrop.* 28 (1862); *Gartenfl.* 11: 178 (1862). T: St Petersburg Botanic Gardens; holo: LE *n.v., fide* J.A.Mears, *Proc. Acad. Nat. Sci. Philadelphia* 129: 1–21 (1977). Epithet named in honour of the German gardener Bettzick or Bettzich.

Small herb developing into a sprawling clump; branches decumbent, furrowed, glabrescent, with dense, minutely barbed hairs at nodes. Leaves ovate to spathulate, undulate, mucronate, often dark pinkish red or variegated; lamina 1–1.5 cm long; petiole to 1.5 cm long. Inflorescence an axillary sessile cluster; bracts and bracteoles long-acuminate, c. 2 mm long, glabrous, 1-nerved, white. Perianth segments unequal; outer 2 c. 4 mm long, strongly 3-ribbed, spine-tipped, pubescent basally on back along outer 2 ribs; inner 3 segments smaller, c. 3 mm long, ±glabrous. Stamens 5; 3 with anthers; staminodes apically 3-lobed ±equal or longer than filaments. Fruit not seen (not produced in Malesia, C.A.Backer, *Fl. Males.* ser. I, 4: 93, 1949).

Christmas Is. First recorded on Christmas Is. by D.A.Powell c. 1969. Cultivated extensively as a border plant in Chinese and Malay gardens.

Ch.Is.: no precise locality, *D.A.Powell 502* (K).

There is some confusion with the nomenclature of *A. bettzichiana*. Christmas Is. specimens have been annotated as *A. tenella* Colla var. *versicolor* (Lem.) Veldkamp but the ±spathulate leaves, coloured foliage and lobed staminodes would seem to preclude this (J.A.Mears, *Proc. Acad. Nat. Sci. Philadelphia* 129: 1–21, 1977). J.Veldkamp (*Blumea* 19: 167 (1971) and *Taxon* 27: 310 (1978) treated this taxon as var. *bettzichiana* of *A. tenella* Colla.

7. GOMPHRENA

Gomphrena L., *Sp. Pl.* 1: 224 (1753); *Gen. Pl.* 5th edn, 105 (1754); name said to have been derived by C.Linnaeus from the ancient Greek, *gromphaena*, a plant with leaves alternately green and pink along the stem (i.e. *Amaranthus tricolor*) but more likely from *gomphos* (a club), referring to the globose heads of the type species.

Type: *G. globosa* L.

Herb. Stems furrowed longitudinally. Leaves opposite, sessile or shortly petiolate. Flowers bisexual, in terminal sessile or subsessile heads or short spikes; each flower subtended by a bract and 2 non-spiny, apically crested bracteoles. Perianth parts 5, ±free, equal or unequal, long woolly at least at base. Stamens 5; filaments connate into a 5-toothed staminal tube; teeth entire or deeply lobed, sometimes alternating with pseudo-staminodes; anthers 1-locular. Ovary with a single ovule; style short or long with 2 erect or diverging stigmas. Fruit thin-walled, irregularly rupturing, compressed. Seed compressed-ovoid.

A genus of c. 90 species, mostly tropical American but with a few Australian natives; 1 introduced species on Christmas Is.

***Gomphrena celosioides** Mart., *Beitr. Amarantac.* 93 (1825), preprint of *Nova Acta Phys.-Med. Acad. Caes. Leop. -Carol. Nat. Cur.* 13: 301 (1826)

T: Brazil, *F.Sello* (sometimes erroneously *Sellow*); syn: K, probably in many other herbaria, particularly BR and R. Epithet presumably from a resemblance to the genus *Celosia*.

Small sprawling herb; young stems densely long white hairy. Leaves spathulate, sessile, those subtending inflorescence abruptly narrowed at base, acute, mucronate, ±glabrous above; lamina c. 1–4 cm long, 0.5–1 cm wide. Inflorescence initially a sessile, ±globose head, c. 1 cm diam., eventually elongating into short spike. Bracts white, ovate, c. 2 mm long, shortly mucronate. Bracteoles ovate, c. 5 mm long, shortly mucronate, white; upper dorsal midrib crested. Perianth parts unequal; outer 3 white, flat, narrowly lanceolate, c. 4 mm long, pubescent at base; inner 2 slightly longer, their green thickened midribs arching either side of ovary, densely villous dorsally. Staminal tube slightly less than perianth; teeth bilobed, c. equal to anthers; pseudo staminodes absent. Style c. 0.5 mm long, deeply divided. Fruit not seen; bracteoles and perianth persistent.

Christmas Is. Only a single collection from Christmas Is. in 1989 suggesting a recent introduction. A species of American origin now found as a weed in many parts of Malesia.

Ch.Is.: Settlement area, north shore terrace, *D.A.Powell 1207* (AD, K).

16. PORTULACACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R., C.S.Is.)
A.E.Orchard (M.Is., H.Is.)

Annual or perennial herbs or shrubs. Leaves opposite, alternate or basal, simple, entire, subsessile, often fleshy, stipulate or exstipulate. Flowers bisexual or unisexual, usually actinomorphic, usually in cymes, terminal or also axillary, clustered, occasionally solitary. Sepals usually 2, free or connate at base. Petals usually 4–6, free or connate at base. Stamens as many as and opposite petals, or in multiples of the petal number; anthers dehiscing longitudinally. Ovary superior or half inferior, usually of 3 united carpels, unilocular, with free-central, basal placentation. Stigma 2–8-lobed or styles free. Fruit usually a capsule dehiscing by a deciduous operculum or by 2 or 3 valves. Seeds few or many; embryo circular; without endosperm.

An almost cosmopolitan family of c. 18 genera, 300 species, with greatest diversity in Africa and America; in Australia 5 or 6 genera with c. 60 species; 1 genus with 3 species on Christmas Is., 1 species on Cocos (Keeling) Is. and the Coral Sea Is.; 2 species on Ashmore Reef; 1 genus and 1 species extends to the subantarctic islands including Macquarie Is. and Heard Is. Many species are succulent herbs.

G.Bentham, Portulaceae, *Fl. Austral.* 1: 167–178 (1863); T.F.Cheeseman, Portulacaceae, *Vasc. Fl. Macquarie Is.* 21 (1919); B.W.Taylor, Portulacaceae, *Fl. Veg. Soils Macquarie Is.* 116–117 (1955); H.H.Allan, *Fl. New Zealand* 1: 219–220 (1961); C.A.Backer and R.C.Bakhuizen van den Brink Jr, Portulacaceae, *Fl. Java* 1: 216–218 (1963); R.Geesink, Portulacaceae, *Fl. Males.* ser. I, 7: 121–133 (1971); C.J.Webb *et al.*, Portulaceae, *Fl. New Zealand* 4: 988–991 (1988); J.J.Scott, New records of vascular plants from Heard Island, *Polar Record* 25: 37–42 (1989).

KEY TO GENERA

Capsule circumscissile (tropical–subtropical islands)	**1. PORTULACA**
Capsule valvate (subantarctic islands)	**2. MONTIA**

1. PORTULACA

Portulaca L., *Sp. Pl.* 1: 445 (1753); *Gen. Pl.* 5th edn, 204 (1754); probably from the Latin *portare* (to bear) and *lac* (milk), referring to the sap.

Type: *P. oleracea* L.

Annual or perennial, succulent, much-branched, often creeping herbs. Leaves linear to orbicular, usually with axillary hairs or scales. Flowers ephemeral, solitary or clustered in heads, usually sessile, mostly surrounded by bracteoles and hairs, and a whorl of 3–30 involucral bracts, rarely in pedunculate cymes (not on Australia's oceanic islands). Sepals usually 2, usually connate at base. Petals usually 4–6, obovate, connate at base. Stamens usually 4–25, in a single whorl, usually connate at base. Ovary half inferior; stigma usually 5–7-lobed. Capsule with a dome-shaped circumscissile operculum. Seeds many, usually reniform, compressed, tuberculate, shiny.

This genus contains between 40 and 200 species, mainly in the southern hemisphere; c. 15 in Australia, 14 of which are endemic; 3 species recorded from Christmas Is.; 1 species also from Cocos (Keeling) Is. and the Coral Sea Is., and 2 species also from Ashmore Reef. Many species are self-pollinating, giving rise to locally distinct populations and the proliferation of names linked to these minor variants. The flowers only open at certain periods during the day, usually in the morning.

R.Geesink, An account of the genus *Portulaca* in Indo-Australia and the Pacific (Portulacaceae), *Blumea* 17: 275–301 (1969).

1 Stem with a few inconspicuous hairs c. 1 mm long only on young nodes, soon glabrescent; leaves wide, obovate or spathulate; stamens 7–12; annual **1. P. oleracea**

1: Stem nodes and inflorescences with many persistent hairs 3–5 mm long; leaves narrow, oblong or elliptic; stamens 20–25; perennial

2 Plant of strong, dense growth forming low mats; densely hairy especially around the inflorescence; leaves acute; inflorescence usually 3-flowered; sepals acute; flowers pink **2. P. pilosa**

2: Plant of weak, straggling growth; sparsely hairy; leaves obtuse; inflorescence usually 1-flowered; sepals obtuse, hooded; flowers bright yellow **3. P. tuberosa**

1. *Portulaca oleracea L., *Sp. Pl.* 1: 445 (1753)

T: Herb. Hort. Cliff. 207, *Portulaca* 1; syn: BM; Herb. C.Linnaeus 625.1; syn: LINN. Epithet from the Latin *oleraceus* (pertaining to kitchen gardens).

Annual herb to 40 cm tall, glabrescent; hairs c. 1 mm long. Leaves alternate, fleshy, the larger leaves obovate to spathulate, obtuse or notched. Head 2–5-flowered; secondary shoots below head terminating in secondary head. Flowers surrounded by inconspicuous hairs and several bracteoles; hairs c. 1 mm long. Sepals keeled. Petals usually 5, broadly obovate, 3–5 mm long, yellow. Stamens c. 7–12. Seeds 0.5–1.2 mm diam., dull black; testa cells stellate, with many fine tubercles.

Christmas Is., Cocos (Keeling) Is., Ashmore Reef, Coral Sea Is. Grows in sparse herb communities in coral sand or in disturbed open sites. A pantropical weedy species.

Ch.Is.: in settlements, *H.N.Ridley 50* (K). C.K.Is.: North Keeling Is., *I.R.Telford 10011 & C.Howard* (CBG, K, PERTH); c. 1 km N of settlement, West Is., *I.R.Telford 9982 & C.Howard* (CBG). A.R.: material unavailable. C.S.Is.: Cato Is., 15 Dec. 1981, *A.Skeat & N.Henry* (CBG); Nellie Cay, Lihou Reef, *S.Hogg 45* (CBG).

Recorded on Christmas Is. by H.N.Ridley as an introduced species, abundant around Flying Fish Cove and at Waterfall, but not collected since then and may no longer occur on the island. H.N.Ridley records that this species closes its leaves at night. It can be eaten as a vegetable, perhaps explaining the decline or loss of this species on Christmas Is.

2. *Portulaca pilosa L., *Sp. Pl.* 1: 445 (1753)

T: Herb. C.Linnaeus 625.2; lecto: LINN *n.v.*, *fide* D.O.Wijnands, *Bot. Commelins* 175 (1983). Epithet from the Latin *pilosus* (hairy), in reference to the indumentum of the plant.

Mat-forming perennial herb, to c. 10 cm tall, with dense hairs c. 4 mm long in axils; roots fibrous. Leaves alternate, narrowly elliptic to oblong, fleshy, acute. Head terminal with c. 3 flowers, sometimes up to 10. Flowers surrounded by a dense cover of hairs; hairs c. 4 mm long. Sepals acute. Petals usually 5, obovate, c. 7 mm long, pink. Stamens c. 20–25. Seeds c. 0.5 mm diam., shining black; testa cells stellate, pointed, smooth.

Christmas Is. A common adventive species in gardens, around habitation, and occasionally found on beaches. Probably a tropical American species but now widespread.

Ch.Is.: in gardens, *D.A.Powell 344* (K); Lily Beach, *B.A.Mitchell 212* (CBG).

Sometimes cultivated as a garden ornamental.

3. Portulaca tuberosa Roxb., *Fl. Indica* (ed. Carey) 2: 464 (1832)

T: India, 'Circars', Roxb. Icon. *2493*; K. Epithet from the Latin *tuberosus* (producing tubers).

Sparsely straggling perennial herb with a sparse cover of hairs in axils; main root swollen. Leaves alternate, narrowly elliptic to oblong, fleshy, obtuse. Flowers usually solitary, terminal, surrounded by sparse hairs c. 4 mm long. Sepals obtuse, hooded. Petals usually 5, less than 5 mm long, obovate, bright yellow. Stamens c. 20–25. Seeds c. 0.7 mm diam., shiny, brown-black; testa cells elliptic or elliptic with lobes, rounded, smooth.

Christmas Is., Ashmore Reef. Probably native on Christmas Is. where it occurs among weathered limestone pinnacles on the sea cliffs. On Ashmore Reef grows in herb communities on coralline sand. Widespread in E Asia, through Malesia to the Pacific islands.

Ch.Is.: sea cliffs on western side of island, *D.A.Powell 387* (K). A.R.: West Is., *J.Hicks 25* (CBG); Middle Is., 22 Feb. 1984, *D.B.Carter* (CBG).

The two species *P. pilosa* and *P. tuberosa* are distinguished only as races of *P. pilosa* subsp. *pilosa* by R.Geesink, *Fl. Males.* ser. I, 7: 131 (1971). He stated that self-pollination in the bud seems to be the rule, allowing variant populations to reproduce themselves in isolation from adjacent populations of the same species. On Christmas Is., however, there appear to be two distinct taxa which are readily differentiated on the basis of several

characters. Furthermore, these taxa correspond with the same two species recognised by C.A.Backer and R.C.Bakhuizen van den Brink Jr in Java, (*Fl. Java* 1: 218, 1963). They occupy different ecological niches on Christmas Is., and *P. tuberosa* appears to be native, while *P. pilosa* is introduced. They are therefore treated here as distinct species. The seeds of these species are illustrated by R.Geesink, *Fl. Males.* ser. I, 7: 285–286, pls 18, 19, 21, 22 and 25 (1971), and differences in size and testa cell-shape are shown.

2. MONTIA

Montia L., *Sp. Pl.* 1: 87 (1753); *Gen. Pl.* 5th edn, 38 (1754); after the Italian botanist Guisseppe Monti (1682–1760).

Type: *M. fontana* L.

Annual or perennial herbs; stems prostrate or erect, sometimes rooting at nodes. Leaves alternate or opposite, sessile, stem clasping, entire, glabrous. Inflorescence a sparsely flowered cyme. Sepals 2. Petals 5, fused at base to form short tube. Stamens 3 or 5. Ovary of 3 carpels; ovules 3; style 1; stigmas 3, free. Capsule 3-valved; seeds 3 or fewer.

One subantarctic species on Macquarie and Heard Islands.

G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Research Notes* 18: 31 (1984).

Montia fontana L., *Sp. Pl.* 1: 87 (1753)

subsp. **fontana**

T: from Europe; *n.v.* Epithet from the Latin *fontanus* (growing in or by springs), in reference to the habitat.

Illustration: V.H.Heywood, *Fl. Pl. World* 75 (1978).

Perennial, glabrous herb forming loose mats, to 20 cm thick, usually 2–10 cm thick. Lower stems prostrate, rooting at nodes; upper stems ascending. Leaves opposite, with long internodes, linear to narrowly lanceolate, sometimes narrowly oblanceolate, obtuse, weak midrib; lamina 5–10 mm long, 1–2 mm wide, rarely larger. Inflorescence of 1 or 2 flowers axillary in upper leaves; bract 1, hyaline, ovate, 2–2.3 mm long; pedicels 3.5–7.5 mm long. Sepals green, orbicular, 1.5–1.7 mm long. Petals white, oblanceolate, 2–3.3 mm long. Stamens 3, 1.4–2 mm long. Ovary brown, ovoid, 0.5–0.8 mm long. Capsule orbicular, 1.5–2 mm diam. Seeds suborbicular 1.1–1.3 mm diam., flattened, minutely papillose, glossy, black.

Macquarie Is., Heard Is. On Macquarie Is. occurs in wet to inundated sites at most altitudes except in very exposed areas. On Heard Is. confined to pools at S end of island (Long Beach to Fairchild Beach), and at Hoseasons Beach in the north. Almost cosmopolitan, in cool temperate, tropical alpine and subantarctic regions. Subspecies *fontana* (in the Australasian and subantarctic region) is found in Tasmania and New Zealand (North, South and Stewart Islands) and on Auckland, Campbell, Macquarie and Heard Islands, while subsp. *chondrosperma* is found in mainland Australia and the North and South Islands of New Zealand. Flowers Nov.–Feb., fruits Dec.–Feb.

M.Is.: N side of Handspike Corner, *R.D.Seppelt 11296* (CANB, CHR, HO); 200 m W of Handspike Corner, *R.D.Seppelt 12224* (HO, MEL); 2 km SW of Mt Ifould, 300 m SE of lake at eastern end of Skua Lake, *R.D.Seppelt 12372* (HO). H.Is.: Skua Beach, *A.I.McGregor 6* (HO); Fairchild Beach, 23 Dec. 1986, *J.J.Scott s.n.* (HO).

Subspecies *fontana* has almost smooth, glossy black seeds, while subsp. *chondrosperma* has dull, tuberculate seeds.

17. BASELLACEAE

D.J.Du Puy (Ch.Is.)

Climbing herbs, often succulent, glabrous; rhizome or tubers often present. Leaves alternate, simple, entire, often rather fleshy; stipules absent. Inflorescence an axillary or terminal spike, raceme or panicle. Flowers bisexual or unisexual, actinomorphic (except bracteoles), subtended by a small bract; bracteoles 2 or 4, often adnate to perianth base, sometimes wing-like. Perianth deeply to shallowly 5-lobed, imbricate, persistent and often enlarging. Stamens 5, inserted near top of perianth tube; anthers usually longitudinally dehiscent. Ovary superior, unilocular; ovule 1; style usually 1, often 3-fid, sometimes 3 free styles. Fruit a utricle, surrounded by the often fleshy perianth or by winged bracteoles. Seed solitary, spherical, without endosperm.

A family of 4 or 5 genera with c. 15 species, mainly from the New World tropics and subtropics with one genus, *Basella*, apparently native to Africa and Madagascar; the 1 species naturalised on Christmas Is. was probably introduced as a cultivated vegetable. *Anredera cordifolia* (Ten.) Steenis is cultivated as an ornamental and naturalised in temperate Australia and Lord Howe Is. The perianth may be homologous with either the calyx or the corolla, and in the latter case the bracteoles would be interpreted as sepaloid.

C.G.G.J. van Steenis, Basellaceae, *Fl. Males.* ser. I, 5: 300–304 (1957); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Basellaceae, *Fl. Java* 1: 239–240 (1963); B.Verdcourt, Basellaceae, *Fl. Trop. E. Africa,* Basellaceae: 1–4 (1968); A.C.Smith, Basellaceae, *Fl. Vit. Nova* 2: 280–281 (1981).

BASELLA

Basella L., *Sp. Pl.* 1: 272 (1753); *Gen. Pl.* 5th edn, 133 (1754); from the Malabar name *basella-kira* for the type species.

Type: *B. rubra* L.

Succulent, climbing herbs, with underground rhizomes. Inflorescence axillary, spicate, occasionally branched. Flowers sessile, not opening widely, bisexual; bracteoles 2, fleshy, adnate to perianth. Perianth shallowly to deeply 5-lobed, fleshy, persistent in fruit. Stamens 5, inserted near top of perianth tube; anthers longitudinally dehiscent. Ovule 1; style 3-fid; stigmas linear. Fruit berry-like with a solitary seed, enclosed in the fleshy perianth and bracteoles.

An Old World genus of c. 5 species, 3 of which are endemic on Madagascar. One species is cultivated and often naturalised throughout the tropics, including Christmas Is.

*Basella alba L., *Sp. Pl.* 1: 272 (1753)

T: type of 'Basella flore albo. foliis & caulibus viridibus', in C.Thran, *Hort. Carolsruh.* 11 (1747); not located. Epithet from the Latin word for white, indicating the flower colour of the original specimen.

Illustrations: C.G.G.J. van Steenis, *Fl. Males.* ser. I, 5: 301, fig. 1 (1957); B.Verdcourt, *Fl. Trop. E. Africa,* Basellaceae: 3, fig. 1 (1968).

Twining or creeping herb, glabrous; stems 2–10 m long, succulent. Leaves broadly ovate to circular, cuneate to cordate at base, entire, obtuse to shortly acuminate, glabrous; lamina 5–15 cm long; petiole 1–3 cm long. Spikes long-pedunculate, 5–28 cm long, succulent; bracts small, acute, persistent. Flowers fleshy, white to purple-pink; bracteoles 2, obtuse, adnate to the perianth, persistent. Perianth 3–4 mm long, tubular with an inflated base, shallowly 5-lobed; lobes rounded. Stamens inserted near top of perianth. Stigmas 3, linear. Fruit globose, 4–8 mm diam., shallowly 4-lobed, black, glossy. *Ceylon Spinach, Remajong*.

Christmas Is. Cultivated as a vegetable, and naturalised in shrubland. It is salt-tolerant, and has been collected from habitats that are open to sea-spray. Probably native to the Old World tropics but now so widely cultivated throughout the tropics that its precise origin has been obscured.

Ch.Is.: Smithson Bight, *A.Pearson P47* (K); Smithson Bight, *D.A.Powell 718* (K).

The leaves and stem tips are eaten as spinach or as a pot herb and are of high nutritional value. The berries contain a violet juice that can be used as a food colorant. The sap is used to treat acne. Specimens with purple-pink, rather than white and pink, flowers and purplish stems with dark green leaves are sometimes distinguished as a separate species, *B. rubra* L. Both variants occur on Christmas Is.

18. CARYOPHYLLACEAE

A.E.Orchard (M.Is., H.Is.)

Annual or perennial herbs, rarely shrubs; leaves usually opposite, simple, entire, exstipulate (at least in subantarctic species). Inflorescence a dichasial cyme or solitary head. Flowers actinomorphic, usually bisexual, 5-merous or rarely 4-merous. Sepals free or connate. Petals present or absent, entire or bifid. Stamens in 1 or 2 whorls, sometimes reduced in number or with some present as staminodes. Gynoecium of 2–5 united carpels; styles more or less fused at least at base; ovary superior with free central placentation and usually with many ovules. Fruit a capsule dehiscing by apical teeth, rarely indehiscent. Endosperm scant or absent.

A family of about 80 genera and 2000 species, cosmopolitan but concentrated in temperate and warm temperate regions. About 24 genera and 90 species occur in Australia, of which 3 genera and 7 species are found on the subantarctic islands.

G.Bentham, Caryophylleae, *Fl. Austral.* 1: 153–167 (1863); T.F.Cheeseman, Caryophyllaceae, *Vasc. Fl. Macquarie Is.* 18–21 (1919); B.W.Taylor, Caryophyllaceae, *Fl. Veg. Soils Macquarie Is.* 110–116 (1955); H.H.Allan, Caryophyllaceae, *Fl. New Zealand* 1: 205–218 (1961); C.J.Webb *et al.*, Caryophyllaceae, *Fl. New Zealand* 4: 474–510 (1988).

KEY TO GENERA

1	Petals absent; plant cushion-forming	**3. COLOBANTHUS**
1:	Petals present; plant erect, not cushion-forming	
2	Styles 3; flowers solitary or in pairs	**1. STELLARIA**
2:	Styles 5; inflorescence cymose	**2. CERASTIUM**

1. STELLARIA

Stellaria L., *Sp. Pl.* 1: 421 (1753); *Gen. Pl.* 5th edn, 193 (1754); from the Latin *stella* (a star), referring to the conspicuous radiating petals.

Type: *S. holostea* L.

Annual or short-lived perennial herbs. Leaves ovate, sessile or petiolate. Flowers solitary or paired in axils of upper leaves. Sepals 5, free, green. Petals 5, bifid, white. Stamens 3–10. Styles 3. Capsule opening by 3–6 valves. Seeds c. 5–20.

About 120 species world-wide; 2 on Macquarie Is., to which the above description refers.

G.R.Copson, An Annotated Atlas of the Vascular Flora of Maquarie Island, *ANARE Res. Notes* 18: 30, 65 (1984).

Stems glabrous; flowers in pairs in leaf axils **1. S. parviflora**

Stems with a line of hairs on internodes; flowers solitary in leaf axils **2. S. media**

1. Stellaria parviflora Banks & Sol. ex Hook.f., *Fl. Nov.-Zel.* 1: 25 (1852)

T: North Is., N.Z., *J.Banks & D.Solander*; syn: *n.v.*; North Is., N.Z., *W.Colenso*; syn: *n.v.*; Middle Is., *Raoul*; syn: *n.v.*; Middle Is., *Lyall*; syn: *n.v.* Epithet from the Latin *parvus* (small) and *flos* (a flower), in reference to flower size.

[*S. decipiens auct. non* Hook.f.: H.H.Allan, *Fl. New Zealand* 1: 208 (1961)]

Prostrate, perennial herb; stems glabrous, rooting at nodes, sparingly branched. Leaves ovate, petiolate, glabrous; lamina 4–13 mm long, 2.8–11 mm wide; petiole to 8 mm long, winged, shortly sheathing at base, with sparse hairs on margins. Flowers paired in axils of leaves, the pair of flowers subtended by 2 broadly lanceolate green to hyaline hooded bracts, sessile or on peduncle to 3.5 mm long. Pedicels glabrous, unequal, 4.2–6 mm long, one naked, one with a pair of bracts just above its midpoint. Sepals 2.5–2.8 mm long, glabrous. Petals divided almost to base.

Macquarie Is. Widespread and abundant in sheltered positions in hollows and between tussocks. Occurs also in New Zealand (North, South, Stewart and Chatham Islands). Flowers Dec.–Feb.; fruits begin to form in late Feb.

M.Is.: Gadgets Gully, 28 Nov. 1948, *N.R.Laird* (HO); Langdon Point, *G.Leaman & D.Montgomery 35* (HO); 150 m W of Green Gorge Huts, *R.D.Seppelt 12306* (HO); 2 km SW of Mt Ifould, *R.D.Seppelt 12373* (HO); coastal slopes E of Boiler Rocks, *R.D.Seppelt 12527* (HO, MEL).

This taxon on Macquarie Is. has been treated by all previous authors as *Stellaria decipiens* Hook.f. However, it differs from that species in having leaves widest near the base and abruptly contracted to the petiole, instead of obovate-rhomboidal and gradually tapering (see J.D.Hooker, *Icon. Pl.* 7: pl. 680, 1844). The sepals are usually under 3 mm long, narrow, with a distinct, white, hyaline margin. In all these respects the Macquarie Is. plants come closer to *S. parviflora* than to *S. decipiens*. Unfortunately no ripe capsules or seeds of the Macquarie Is. plants, which would provide useful characters, are available. This species complex is currently under revision by A.Galletly, University of Canterbury. C.J.Webb *et al.*, *Fl. New Zealand* 4: 474–510 (1988), recorded both *S. parviflora* and *S. decipiens* from Macquarie Is., but not *S. media*.

2. *Stellaria media (L.) Vill., *Hist. Pl. Dauphin* 3: 615 (1789)

subsp. **media**

Alsine media L., *Sp. Pl.* 1: 272 (1753). T: from Europe; *n.v.* Epithet from the Latin *medius* (middle), in reference to size compared with other species originally described by C.Bauhin, 1623.

Illustrations: S.Ross-Craig, *Drawings Br. Pl.* 5: pl. 35 (1951); G.M.Cunningham *et al.*, *Pl. W. New South Wales* 307 (1982).

Erect, annual herb; stems rooting at lower nodes, with a single line of multicellular hairs on middle and upper internodes, sparsely branched. Leaves ovate, glabrous or with occasional hairs near base; lower leaves petiolate, those of middle and upper stem sessile; lamina 6–32 mm long, 5–14 mm wide; petiole to 14 mm long, shortly sheathing at base, with sparse marginal hairs. Flowers solitary in axils of upper leaves, on reflexed pedicels slighty shorter than leaves. Pedicels with a line of hairs as on stems. Sepals 5–6.2 mm long, with spreading, multicellular, glandular, dorsal hairs. Petals divided 3/4 to the base.

Macquarie Is. Apparently confined to more or less disturbed sites in the northern half of the island. Originally native to Europe, now an almost cosmopolitan weed. Flowers Sept.–Jan.; fruits Dec.–Feb.

M.Is.: Bauer Bay, *G.R.Copson 6* (HO); Island Lake, 16 Jan. 1982, *S.Cronin* (AD, AK, CANB, CHR, HO, MEL); Gadgets Gully, 14 Feb. 1949, *N.R.Laird* (CHR, HO, MEL); Green Gorge, *R.D.Seppelt 11989* (HO,

MEL); Bauer Bay, edge of Bauer Ck, *R.D.Seppelt 12537* (AD, AK, CANB, CHR, HO, MEL, NSW, PERTH).

Probably introduced by sealers in the 19th Century. The N.R.Laird specimen above is a dwarf form 12–15 cm tall, virtually lacking the upper sessile leaves, and with seeds only 0.9 mm diam. instead of the normal 1.2 mm.

2. CERASTIUM

Cerastium L., *Sp. Pl.* 1: 437 (1753); *Gen. Pl.* 5th edn, 199 (1754); from the Greek *kerastes* (horned), in reference to the jagged valves of the capsule.

Type: *C. arvense* L.

Annual or short-lived perennial herbs; basal stems prostrate, becoming erect, pilose with multicellular, eglandular hairs. Leaves narrowly ovate, ovate or obovate, sessile. Inflorescence compactly cymose. Sepals 5. Petals 5, white, deeply bifid. Stamens 10 in 2 whorls, 1 long, 1 short. Styles free for most of their length. Capsule opening by 10 valves. Seeds many.

About 60 species, virtually cosmopolitan; 7 species in Australia, of which 1 occurs on Macquarie Is.

G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 66 (1984).

***Cerastium fontanum** Baumg., *Enum. Stirp. Transilv.* 1: 425 (1816)

subsp. **fontanum**

T: from Europe; *n.v.* Epithet from the Latin *fontanus* (growing in or by springs), in reference to the habitat.

[*C. triviale auct. non* Link: B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* 112–113 (1955)]

All hairs eglandular. Sepals ovate, 5–7 mm long, green with purplish tips, and wide hyaline margins in upper half, pilose. Petals 5–7 mm long, equalling or just exceeding the sepals. Capsule pale golden brown, 9–12 mm long. Seeds red-brown, 0.7–0.9 mm long.

Macquarie Is. Confined mainly to the northern half of the island. Originally European, now widespread. Flowers Nov.–Feb.; fruits Jan.–Feb.

M.Is.: Sandy Bay, *G.R.Copson 3* (HO); Gadgets Gully, 18 Feb. 1949, *N.R.Laird* (AD, CHR, HO, MEL); Handspike Point *G.Leaman & D.Montgomery 11* (HO); Hasselborough Bay, *R.D.Seppelt 12234* (AD, HO, MEL); Bauer Bay, *R.D.Seppelt 12538* (AD, AK, CANB, HO, MEL).

T.F.Cheeseman, *Vasc. Fl. Macquarie Is.* 19 (1919) and B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* 112 (1955) treated this species under the name *Cerastium triviale* Link, which is now usually reduced to a subspecies of *C. fontanum*. The latter is a very variable and widespread species. Comparison of the Macquarie Is. specimens with the treatment by J.Jalas, *Fl. Europ*. 1: 142 (1964), suggests that they more closely resemble *C. fontanum* subsp. *fontanum* than *C. fontanum* subsp. *triviale*, but further detailed comparisons with other populations are still required, particularly as L.Adams (*pers. comm.*) points out that much of the material from the island, besides other subtle differences, has bracts almost entirely herbaceous, i.e. lacking the broad scarious margins of typical *C. fontanum*.

3. COLOBANTHUS

Colobanthus Bartl., *Ord. Nat. Pl.* 305 (1830); from the Greek *kolobos* (stunted), and *anthos* (a flower).

Type: *C. quitensis* (Kunth) Bartl.

Perennial glabrous herbs forming cushions, mats or loose clumps. Leaves linear, connate at the base, forming a short cup, usually ±fleshy. Flowers solitary, terminal, pedunculate.

Sepals 4 or 5. Petals absent. Stamens same number as sepals and alternating with them. Styles 4 or 5, free for most of their length. Capsule opening by terminal valves, equal in number to sepals. Seeds numerous.

About 20 species, in S America, South Georgia, the Antarctic Peninsula, New Zealand, Australia and the subantarctic islands; 5 species on mainland Australia and Tasmania; 3 species on Macquarie Is. and 1 on Heard Is.

G.R.Copson, Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 28–29 (1984).

1 Plant forming a tight cushion; leaves usually less than 4 mm long (rarely to 5 mm); fruit overtopped by leaves **1. C. muscoides**

1: Plant forming a mat or loose clump; leaves 5 mm or more long, often more than 15 mm; fruit held at or above level of upper leaves

2 Leaves to 1.5 m wide

3 Sepals more or less blunt, shorter than or subequalling capsule; leaf-tip mucro 0.1–0.2 mm long **2. C. affinis**

3: Sepals attenuate and shortly mucronate at tip, usually clearly exceeding capsule; leaf-tip mucro 0.4–0.5 mm long **3. C. apetalus**

2: Leaves 2–3.5 mm wide **4. C. kerguelensis**

1. Colobanthus muscoides Hook.f., *Fl. Antarct.* 1: 14 (1844)

T: Lord Aucklands group [Auckland Is.], Nov.–Dec. 1840, *J.D.Hooker*; syn: *n.v.*; Campbell Is., Dec. 1840, *J.D.Hooker*; syn: K *n.v.*, *fide* H.H.Allan, *Fl. New Zealand* 1: 210 (1961). Epithet from the Latin *muscus* (a moss) and *-oides* (resembling), in reference to the growth habit.

Illustrations: B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* pls 9, 10 (1955).

Perennial herb forming a dense solid cushion or mat to 25 cm thick and sometimes many metres in extent. Stems slender, freely branching, with adventitious roots. Leaves linear-subulate, fleshy, triquetrous near acute tip, with or without a mucro to 0.1 mm long; free lamina 3–3.5 (rarely to 5) mm long, 0.8–1 mm wide. Flowers 4- or 5-merous even on same plant, terminal on short shoots in upper leaf axils. Both flowers and fruits overtopped by leaves. Fig. 80.

Macquarie Is. Widespread in coastal areas, forming individual cushions on sand, peat and rock in the sea spray zone and extensive mats in bog communities. Also found on Chatham, Snares, Auckland, Campbell and Antipodes Islands. Flowers Sept.–Mar.; fruits Oct.–May.

M.Is.: Gadgets Gully, 22 Feb. 1949, *N.R.Laird* (HO); Garden Cove, 8 Nov. 1948, *N.R.Laird* (HO); rock stack at sea edge on west side of The Isthmus, *R.D.Seppelt 11334* (HO); Hasselborough Bay, *R.D.Seppelt 12199* (HO); Handspike Corner to Handspike Point, *R.D.Seppelt 12220* (HO).

The cushions are formed from the tightly packed adventitious roots, stems and persistent leaf sheaths.

2. Colobanthus affinis (Hook.) Hook.f., *Fl. Tasman.* 1: 45 (1855)

Spergula affinis Hook., *Icon. Pl.* 3: t. 266 (1840). T: Hampshire Hills, Tas., *R.C.Gunn n. 967*; iso: HO. Epithet from the Latin *affinis* (neighbouring, akin to), because of a perceived affinity to *Colobanthus apetalus*.

Illustrations: W.J.Hooker, *Icon. Pl.* 3: t. 266 (1840); H.H.Allan, *Fl. New Zealand* 1: fig. 10 (1961); A.F.Mark & N.M.Adams, *New Zealand Alpine Pl.* pl. 14 (1973).

Perennial herb forming loose clumps 5–10 cm diam., 3–5 cm high. Stems slender, freely branching, lacking adventitious roots. Leaves erect or ±spreading, linear, fleshy, concave above, shortly apiculate at acute tip; free lamina 5–9 mm long, 1.5 mm wide. Flowers 4- or 5-merous but predominantly 4-merous. Sepals blunt with a very short apiculum; stamens inserted on a prominent disc. Capsule barely exceeding sepals at maturity.

Macquarie Is. Recorded from scree slopes and from a *Poa foliosa*/*Stilbocarpa* association on a creek bank, both localities in the northern part of the island. Also in mountainous areas

of New Zealand (North and South Islands), Tas. and the Australian Alps. Flowers Jan.; fruits Jan.–Feb.

M.Is.: northern lower slopes of plateau, 14 Feb. 1949, *N.R.Laird* (HO); coastal slopes east of Boiler Rocks, *R.D.Seppelt 12528* (HO, MEL).

Colobanthus species are difficult to distinguish because of the plasticity of their vegetative characters and their relatively simple flowers. This species has not previously been reported from the subantarctic, but the cited specimens match Tasmanian collections currently treated under this name. D.M.Moore, *Bull. Brit. Antarct. Surv.* 23: 63–80 (1970) discussed the close relationships between *C. quitensis*, *C. affinis* and *C. apetalus*, and it is clear that a detailed study of at least these species (if not the whole genus) in Australia and New Zealand is overdue.

3. **Colobanthus apetalus** (Labill.) Druce, *Bot. Soc. Exch. Club. Brit. Isles Rep. 1916* 616 (1917)

var. **alpinus** (Kirk) L.B.Moore in H.H.Allan, *Fl. New Zealand* 1: 214 (1961)

C. billardieri var. *alpinus* Kirk, *Trans. New Zealand Inst.* 27: 356 (1895); *C. crassifolius* var. *alpinus* (Kirk) Cheeseman, *Man. New Zealand Fl.* 425 (1925). T: ?Spenser Mtns, N.Z., *T.Kirk*; holo: probably WELT *n.v.*, *fide* H.H.Allan, *loc. cit.*

[*C. crassifolius auct. non* Hook.f.: B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* 115 (1955)]

[*C. quitensis auct. non* (Kunth) Bartl.: G.R.Copson, *ANARE Res. Notes* 18: 29 (1984)]

Illustration: H.H.Allan, *Fl. New Zealand* 1: fig. 10 (1961).

Mat-forming perennial herb, 5–7 cm tall; stems erect, moderately branching, adventitiously rooting in lower parts. Leaves subulate, spreading, triquetrous towards apex, soft, the lowermost often recurved; apex abruptly contracted with a stiff mucro 0.4–0.5 mm long; margins white-hyaline at base and decurrent in a cup 2.5–4 mm deep; lamina 8–25 mm long, 0.6–1 mm wide. Peduncle 2–3 mm long, lengthening to 20–25 mm in fruit and overtopping leaves. Flowers 5-merous, sometimes 4-merous. Sepals ovate, slightly attenuate towards tip, usually very shortly mucronate. Capsule shorter than sepals.

Macquarie Is. Widespread but not abundant, forming mats in bog communities, occasional elsewhere. Also found on Auckland and Campbell Islands, and on North and South Islands of N.Z. Flowers late July–Mar.; fruits Sept.–May.

M.Is.: Handspike Point, 22 Dec. 1948, *N.R.Laird* (AD, CANB, CHR, HO, MEL); Boiler Rocks area, *R.D.Seppelt 12156* (HO); Hasselborough Bay, *R.D.Seppelt 12244* (AD, AK, CANB, HO, MEL); Bauer Bay, *R.D.Seppelt 12535* (HO); Gadgets Gully, *R.D.Seppelt 12774* (HO).

This taxon requires further investigation. The Macquarie Is. plants differ from *C. apetalus* of Tas. in their softer leaves, unribbed and herbaceous sepals and in having erect or reflexed capsule valves (incurved in Tasmanian plants). They differ from *C. quitensis* in their deeper leaf sheath, attenuate tip to the sepals and in the capsule being shorter than the sepals.

4. **Colobanthus kerguelensis** Hook.f., *Fl. Antarct.* 2: 249 (1845)

T: Kerguelens Land [Kerguelen Is.], May–July 1840, *J.D.Hooker*; *n.v.* Epithet from the island where the type was collected.

Illustrations: J.D.Hooker, *Fl. Antarct.* pl. 92 (1845); A.Chastain, *Mém. Mus. Natl Hist. Nat. (Paris)* 9: pl. 9 (1958).

Perennial herb forming loose clump or cushion to 6.5 cm diam. Stems slender, freely branching, lacking adventitious roots. Leaves linear, spreading, ±fleshy, navicular, acute and often shortly apiculate; margins hyaline; lamina 5–10 mm long, 2–3.5 mm wide. Peduncle 2 mm long, lengthening to 3.5–4 mm in fruit, holding flowers at or just above level of leaf tips. Flowers strictly 4-merous. Sepals dimorphic with 2 large outer ones, and 2 smaller inner ones, ovate, acute, often with a very short apiculum. Capsule only seen immature but ±equalling the sepals.

Heard Is. Recorded from gravel in the sea spray zone, in well-drained sand-peat soils with *Azorella selago*, and in feldmark, to altitudes of c. 30 m. Also found on Kerguelen, Crozet, Marion and Prince Edward Islands. Flowers Dec.–Mar.; fruits from Mar.

H.Is.: 100 m from old ANARE Stn, Atlas Cove, *G.R.Copson 106* (HO); 300 m from old ANARE Stn, Atlas Cove, *G.R.Copson 116* (HO); Fairchild Beach, 23 Dec. 1986, *J.J.Scott* (HO); Schmidt Valley, 1 Feb. 1988, *J.J.Scott* (HO).

Kerguelen Is. collections in HO differ from the Heard Is. plants in being more compact in habit, and more coriaceous in their leaves and sepals, and in having possibly larger capsules. However, A.Chastain, *loc. cit.*, described 3 ecotypes on Kerguelen Is., and it would be useful to carefully compare these with Heard Is. plants.

19. POLYGONACEAE

D.J.Du Puy (Ch.Is.)
A.E.Orchard (M.Is.)

Mostly annual or perennial herbs, sometimes shrubs, climbers or occasionally trees; stems often swollen at nodes; axillary tendrils sometimes present. Leaves mostly alternate, simple, usually with a membranous sheath (ochrea) around stem above base of petiole. Inflorescences axillary and terminal, usually racemes or panicles, with flowers sometimes clustered. Flowers actinomorphic, small, usually bisexual. Perianth segments usually 5 or 6, in 1 or 2 series, often enlarged in fruit. Stamens 4–9, free or connate at base; anthers longitudinally dehiscent. Disc often annular or glandular. Ovary superior, unilocular; ovule 1; styles usually 2 or 3, free or connate at base. Fruit a dry nut or achene, compressed or 3-angled, often enclosed in the dry, fleshy or wing-like perianth. Seeds with endosperm.

A cosmopolitan family of 30–35 genera, with 750–1000 species, with greatest density in the northern temperate regions; 1 genus and 1 species naturalised on Christmas Is.; 1 genus and 1 species naturalised on Macquarie Is. This family includes many weedy species. Ornamental species occur in the genera *Rheum* L., *Polygonum* L., and the tropical genera *Antigonon* Endl. and *Coccoloba* P.Browne. *Coccoloba uvifera* (L.) L. also provides edible fruit (Seaside Grape). Temperate food plants include *Rheum rhaponticum* L. (Rhubarb), *Fagopyrum esculentum* Moench (Buckwheat), and *Rumex acetosella* L. (Sorrel).

G.Bentham, Polygonaceae, *Fl. Austral.* 5: 261–276 (1870); B.H.Danser, Die Polygonacean Niederlandisch-Ostindiens, *Bull. Jard. Bot. Buitenzorg*, ser. 3, 8: 117–261 (1927); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Polygonaceae, *Fl. Java* 1: 219–226 (1963); A.C.Smith, Polygonaceae, *Fl. Vit. Nova* 2: 296, 305–307 (1981); C.J.Webb *et al.*, Polygonaceae, *Fl. New Zealand* 4: 965–987 (1988).

KEY TO GENERA

1 Perianth segments 6 (subantarctic islands) **2. RUMEX**

1: Perianth segments 5 (tropical islands)

2 Leaves sagittate, deeply cordate at base; ochreae absent; pseudoracemes with flowers in clusters, the rachis extended into a tendril; tepals 4–8 mm long; fruit dry, nut-like, enclosed in the enlarged, membranaceous tepal **1. ANTIGONON**

2: Leaves ovate to oblong, truncate at base; ochreae present; inflorescences sparsely branched, the flowers in small terminal heads, without tendrils; tepals c. 2 mm long; fruit berry-like, the tepals becoming fleshy and blue-black **+POLYGONUM**

+*Polygonum chinense* L. is cultivated on Christmas Is. by the Chinese, probably as a medicinal herb. It has a foetid smell, and is used in China to treat diarrhoea and as a poultice for boils.

1. ANTIGONON

Antigonon Endl., *Gen. Pl.* 310 (1837); from the Greek *anti* (in place of) and *gonon*, a Greek transcription of the second half of the name *Polygonum*, indicating the close relationship between these two genera.

Type: *A. leptopus* Hook. & Arn.

Perennial, climbing herbs, with axillary tendrils. Leaves alternate, ovate to triangular, cordate at base, without an ochrea. Inflorescences axillary and terminal, racemose, sometimes combined into large, terminal panicles of few-flowered, bracteate clusters; rachis frequently ending in a branched tendril. Flowers bisexual. Perianth segments 5, enlarging and persistent; outer 3 ovate with a cordate base; inner 2 narrower. Stamens 7–9, basally connate. Ovary 3-angled; styles 3; stigmas capitate. Fruit ovoid, 3-angled, acute, enclosed by the enlarging, membranous perianth segments. Seed 1, longitudinally grooved.

A genus of c. 8 species from tropical America; 1 species widely cultivated as an ornamental, and naturalised on Christmas Is.

***Antigonon leptopus** Hook. & Arn., *Bot. Beechey Voy.* 308, t. 69 (1838)

T: Mexico, *Lay & Collie for F.W.Beechey*; iso: K. Epithet from the Greek *leptos* (thin, slender) and *pous* (a stem), descriptive of the fine stems of this vine.

Illustrations: W.Fitch, *Bot. Mag.* 96: t. 5816 (1870); A.B.Graf, *Tropica* 825, 827 (1978).

Climbing herb; stems to 6 m, angular, minutely pubescent; roots with ellipsoidal, tuberous swellings. Leaves ovate to sagittate, acute, mucronate, often undulate, sunken veins above, pubescent especially on veins beneath; lamina 5–15 cm long; petiole 11–16 mm long. Tendrils 5–15 cm long, branched. Inflorescence 5–20 cm long, extending into a tendril, often combined into terminal panicles. Pedicels 5–10 cm long, articulated c. 3 mm from base. Perianth segments ovate with cordate base, 4–8 mm long, the 2 inner narrower, pink to white. Stamens usually 8. Fruit nut-like, ovoid, trigonous, acute, c. 1 cm long, enclosed in enlarging perianth; perianth to c. 18 mm long, membranous, greenish with distinct venation. *Coral Vine*.

Christmas Is. Grows strongly, and can cover small shrubs in open ground, especially near Settlement. Native to Mexico.

Ch.Is.: Waterfall Rd, *A.Pearson P52* (K); on road to Waterfall at end of North Settlement [sic], *P. van Tets 34* (CBG, GAUBA).

An attractive garden ornamental, cultivated throughout the tropics, and can become naturalised in sunny situations, especially along roadside and in waste ground.

2. RUMEX

Rumex L., *Sp. Pl.* 1: 333 (1753); *Gen. Pl.* 5th edn, 156 (1754); from the Latin name for a javelin or dart, and probably referring to the leaf shape of some species; also used by Pliny in reference to sorrel.

Type: *R. patientia* L.

Perennial (rarely annual) herbs. Leaves linear, lanceolate or ovate, cuneate, hastate or sagittate at base. Inflorescence elongate, with clusters of pedicellate flowers in pseudo-whorls. Perianth segments 6, the inner 3 being enlarged and persistent in fruit, often developing marginal spines or hooks to aid in the dispersal of the enclosed seed.

A cosmopolitan genus of about 160 species; 8 native and 9 naturalised species in Australia; 1 species on Macquarie Is.

G.R.Copson & E.L.Lealman, *Rumex crispus* L. (Polygonaceae) – a new record for Macquarie Island, *New Zealand J. Bot.* 19: 401–404 (1981); K.H.Rechinger, *Rumex* (Polygonaceae) in Australia: a reconsideration, *Nuytsia* 5: 75–122 (1984); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 67 (1984).

***Rumex crispus** L., *Sp. Pl.* 1: 335 (1753)

T: from Europe; *n.v.* Epithet is Latin for irregularly waved, probably referring to the margins of the leaves.

Perennial herb, 30 cm tall; stems reddish, erect, unbranched, weakly ribbed, glabrous; rootstock a stout taproot. Leaves alternate, narrowly lanceolate to oblong, cuneate at base, finely serrate and undulate, acute; ochrea 7 mm long, yellowish hyaline with brown veins; lamina 8–9 cm long, 1–1.5 cm wide; petiole to 12 cm long, slender, broadening at base. Inflorescence a terminal panicle. Outer tepals oblong-lanceolate, keeled; inner tepals broadly ovate-cordate, reticulate, with basal tubercle and entire margins. Stamens 6. Ovary 3-winged with 3 recurved styles. Fruits not seen on subantarctic plant.

Macquarie Is. A single plant recorded for Macquarie Is. on a boggy raised beach terrace in a *Juncus*/*Montia*/*Drepanocladus*/*Breutelia*/*Hydrocotyle* association, with the water table at or just below the vegetation surface. A species widespread in temperate Australia; almost cosmopolitan. Flowers Feb.

M.Is.: Boiler Rocks, *R.D.Seppelt 12784* (AD, HO, MEL).

20. PLUMBAGINACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.S.Is.)

Perennial herbs or shrubs. Leaves alternate, simple, sometimes stem-clasping, glandular; stipules present or absent. Inflorescence a terminal or axillary raceme, spike, cyme or panicle, bracteate. Flowers actinomorphic, bisexual. Calyx tubular, shortly 5-lobed; tube 5–10-ribbed. Corolla tubular, 5-lobed, or petals 5, connate at base. Stamens 5, epipetalous towards base of corolla or free, opposite corolla lobes; anthers dehiscing longitudinally. Ovary superior, 1-locular; placentation basal; ovule 1, anatropous; style 1, 5-branched or styles 5; stigmas 5. Fruit a nut, dehiscent or indehiscent. Seed 1; endosperm mealy.

An almost cosmopolitan family of 19 genera and c. 775 species, mainly of coastal or saline habitats; 1 genus with 1 species native on Christmas Is. and the Coral Sea Is. Many species are cultivated as ornamentals, particularly in the genera *Limonium* Mill. (Sea Lavender or Statice), *Armeria* (DC.) Willd. (Sea Pink), *Ceratostigma* Bunge and *Plumbago* L. Extracts from *Limonium vulgare* Mill. and *Plumbago* spp. have been used medicinally.

C.G.G.J. van Steenis, Plumbaginaceae, *Fl. Males.* ser. I, 4: 107–112 (1949); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Plumbaginaceae, *Fl. Java* 2: 443–445 (1965); A.C.Smith, Plumbaginaceae, *Fl. Vit. Nova* 2: 307–309 (1981).

PLUMBAGO

Plumbago L., *Sp. Pl.* 1: 151 (1753); *Gen. Pl.* 5th edn, 75 (1754); the Latin name for the type species, the Leadwort, from *plumbum* (lead).

Type: *P. europaea* L.

Perennial herbs or shrubs. Leaves stem-clasping, sessile or petiolate. Inflorescence a raceme, spike or panicle. Flowers sessile or subsessile, with 2 small bracteoles. Calyx 5-ribbed, glandular, persistent. Corolla long-tubular; limb rotate. Stamens free, hypogynous. Style 1, 5-branched, stigmatic from base. Fruit enclosed in persistent calyx; pericarp membranous, basally circumscissile, upper part dehiscing by 5 valves.

A genus of 12 species of tropical and temperate regions; 1 species on Christmas Is. and the Coral Sea Is. Several species cultivated as ornamentals.

Plumbago zeylanica L., *Sp. Pl.* 1: 151 (1753)

T: Herb. C.Linnaeus 216.2; syn: LINN; Herb. Hort. Cliff. 53, *Plumbago* 2; syn: BM; Herb. P.Hermann 1: fol. 56; syn: BM; Herb. P.Hermann 3: fol. 21; syn: BM. Epithet from the name Zeylon, for Sri Lanka (Ceylon), the origin of the specimen described by Linnaeus.

Illustrations: B.D.Morley & H.R.Toelken, *Fl. Pl. Australia* 86, fig. 48a, b (1983); A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 178 (1985).

Herb or subshrub to 1 m. Leaves ovate, acute to acuminate, glabrous; lamina 2–8 cm long; petiole 2–10 mm long with 2 basal auricles. Inflorescence 4–20 cm long. Calyx 9–12 mm long, viscid with glandular bristles. Corolla white or pale blue; tube 14–18 mm long; lobes obovate, 6–7 mm long. Nut oblong, 5-angled, c. 8 mm long. *Leadwort*.

Christmas Is., Coral Sea Is. Cultivated and naturalised on the shore terrace and at Ross Hill Gardens on Christmas Is. Native on several of the Coral Sea cays in shrub or herb communities in coralline sand. Widespread from subtropical Africa, southern Asia to northern Australia and the Pacific islands, N to the Hawaiian islands, S to Norfolk Is.

Ch.Is.: Smithson Bight, *A.Pearson P4* (K); Smithson Bight, *D.A.Powell* (K). C.S.Is.: Northeast (Chilcott) Is., Coringa Is., *S.Hogg 20* (CBG); SE Cay, Magdelaine Cays, *S.Hogg 1* (CBG).

A salt tolerant species which can survive in habitats subject to sea-spray.

21. CLUSIACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees, shrubs or herbs; bisexual, monoecious, dioecious or polygamous; resiniferous, often with coloured sap. Leaves usually opposite, simple, entire, often with translucent oil-glands; stipules absent. Flowers actinomorphic, solitary or in racemes, cymes, pseudopanicles or thyrses, axillary or terminal. Sepals 2–10, free or fused, sometimes 2 or all petaloid. Petals usually present, 4–6, free or connate, imbricate. Disc often present. Stamens many, free or united, frequently in clusters, often partly staminodal; anthers usually 2-locular, dehiscing through longitudinal slits or pores. Ovary superior, with 1–5 fused carpels, 1–5-locular; ovules 1–many; placentation axile, parietal or basal. Styles free, united or absent; stigmas as many as locules, lobed or entire. Fruit a drupe or (not in our area) a capsule dehiscing along valves. Seeds 1–many, sometimes winged or with an aril, without endosperm.

A family of c. 40 genera and 1000 species; cosmopolitan but with most diversity in the tropics; 2 genera (2 species) on Christmas Is. of which 1 genus (1 species) also on Cocos

(Keeling) Is. and the Coral Sea Is. The family is alternatively known as the Guttiferae. The tropical fruit Mangosteen (*Garcia mangostana* L.) is commercially important and is cultivated in the Drumsite gardens on Christmas Is.

KEY TO GENERA

Leaves closely pinnately parallel-veined, glossy; flowers in racemes; style filiform, exceeding anthers; fruit globose **1. CALOPHYLLUM**

Leaves with reticulate venation; flowers often single, from axillary tubercles; style thick, shorter than anthers; fruit obliquely ellipsoidal, acute at both ends **2. MAMMEA**

1. CALOPHYLLUM

Calophyllum L., *Sp. Pl.* 1: 513 (1753); *Gen. Pl.* 5th edn, 229 (1754); from the Greek *kalos* (beautiful) and *phyllon* (a leaf).

Type: *C. calaba* L.

Trees, bisexual. Leaves opposite, coriaceous, glabrous, with translucent dots and very close, parallel secondary venation. Flowers in racemes or pseudopanicles, rarely solitary. Sepals 4, free, often petaloid, glabrous. Petals 0–8, free. Stamens free or filaments shortly connate at base, filiform. Ovary 1-locular, with basal placentation; ovule 1. Style long, filiform; stigma peltate or funnel-shaped. Fruit a drupe. Seed 1.

A genus of c. 110 species, mostly from SE Asia to the Pacific islands although the type species is from tropical America; 6 species including 4 endemic species in Australia; 1 species on Christmas Is., Cocos (Keeling) Is. and the Coral Sea Is.

M.R.Henderson and J.Wyatt-Smith, *Calophyllum* Linn., *Gard. Bull. Singapore* 15: 285–375 (1956).

Calophyllum inophyllum L., *Sp. Pl.* 1: 513 (1753)

T: near Colombo, Sri Lanka [Ceylon], Herb. P.Hermann 201, 2: fol. 82; lecto: BM, *fide* P.Bamps, N.Robson & B.Verdcourt, *Fl. Trop. E. Africa*, Guttiferae: 3 (1978). Epithet from the Greek *is* (fibre) and *phyllon* (a leaf), referring to the closely nerved leaves.

Illustrations: N.K.B.Robson in V.H.Heywood (ed.), *Fl. Pl. World* 86, fig. 4a–c (1978); B.D.Morley and H.R.Toelken (eds.), *Fl. Pl. Australia* 91, fig. 5a–c (1983).

Tree 4–13 m high, resiniferous; bark grey, with diamond-shaped fissures; exudate clear golden yellow, sticky. Leaves obovate or obovate-oblong, cuneate at base, obtuse, emarginate or rounded, coriaceous, glabrous, glossy; lamina 6–20 cm long, 4–10 cm wide; petiole 1–2 cm long. Racemes solitary in axils of upper leaves, 6–12 cm long, 9–13-flowered. Flowers c. 2 cm diam., very fragrant; buds globose; pedicels 1.5–3 cm long, white. Sepals 4, obovate, the inner 2 white. Petals 4, obovate 1–1.4 cm long, white. Stamens with filaments united basally into 4–6 clusters, yellow. Ovary globose, pink. Style 5–7 mm long, exceeding anthers. Drupe globose, 2.5–3 cm diam., green. *Nyamplon*. Fig. 70.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. it commonly occurs in dense, low scrub on the shore terrace but is also found at about 300 m on Phosphate Hill. On Cocos (Keeling) Is. it grows with *Argusia argentea* in strand forest. Native to Madagascar and SE Asia from India to Melanesia and Australia; a widely distributed tree of rocky and sandy shores.

Ch.Is.: east coast, 1898, *C.W.Andrews* (K); Waterfall, *H.N.Ridley 69* (K); open land on shore terrace, *A.Pearson P21* (K); Phosphate Hill, *B.A.Mitchell 13* (CBG, K). C.K.Is.: lagoon edge E of airport terminal, West Is., *A.S.George 16244* (CBG, K). C.S.Is.: Herald Cay, Sept. 1967, *H.Heatwole* (BRI).

The Heatwole specimen from Herald Cay is a seedling, presumably from a drift seed. No collections of mature trees have been made from the Coral Sea cays. The timber has been

used in house construction and for fences on Cocos (Keeling) Is. Often cultivated in the tropics as a shade tree or ornamental for its large, lustrous, dark green leaves and scented flowers. In India an oil is extracted from the seed.

2. MAMMEA

Mammea L., *Sp. Pl.* 1: 512 (1753); *Gen. Pl.* 5th edn, 228 (1754); from the vernacular West Indian name *Mamei* or *Mamey* as recorded by Plumier in 1703. The name refers to the breast-like shape of the fruit, and the nipple-like stigma. Perhaps also from the Latin *mamma* (a breast or teat).

Type: *M. americana* L.

Bisexual, dioecious or polygamous trees. Leaves opposite or subverticillate, thick and coriaceous, glabrous, with translucent dots and reticulate venation. Flowers axillary or terminal, usually solitary, bisexual or unisexual. Calyx thick and fleshy, entire before anthesis, splitting into 2 concave valves, persistent in fruit. Petals 4–6, free or connate. Staminal filaments free, filiform. Ovary 2–4-locular; ovules 4, basal. Style short; stigma peltate or 2–4-lobed. Fruit fleshy, indehiscent, drupaceous. Seeds usually 1, occasionally up to 4.

A genus of about 50 species, with greatest diversity in SE Asia and in Madagascar; 1 species on Christmas Is.; 1 endemic in Australia. The genus *Ochrocarpos* is sometimes also included in this genus.

J.J.F.E. de Wilde, A Delimitation of Mammea L., *Acta Bot. Neerl.* 5: 177–178 (1956); A.J.G.H.Kostermans, A monograph of the Asiatic and Pacific species of Mammea L. (Guttiferae), *Comm. For. Res. Inst., Indonesia* 72 (1961).

Mammea odorata (Raf.) Kosterm., The genera *Mammea* L. and *Ochrocarpos* Thou. 13 (1956)

Lolanara odorata Raf., *Fl. Tellur.* 2: 34 (1837). T: based on Lolanwaran, *Lignum clavorum* Rumph., *Herb. Amboin.* 3: 97, t. 64 (1743); *fide* E.D.Merrill, *Index Rafin.* 138 (1947). Epithet from the Latin *odoratus* (scented).

Calysaccion ovalifolium Choisy, *Mém. Soc. Phys. Genève* 12: 425 (1850) [Guttif. Ind. 45]; *Ochrocarpos ovalifolius* (Choisy) T.Anderson ex Hemsl., *Bot. Challenger Exped.* 1(3): 122, 234 (1885). T: Pulu Sangian, Sunda Straits, *coll. unknown*; *n.v.*

Illustrations: A.J.G.H.Kostermans, *Comm. For. Res. Inst., Indonesia* figs 9, 10 (1961).

Trees to 10 m high; polygamous-dioecious; bark brown, smooth. Leaves obovate or obovate-oblong, cuneate at base, obtuse or rounded, rigid, coriaceous; lamina 16–26 cm long; petiole 0.5–1.5 cm long. Flowers 1–3 on tubercles in the axillary position where leaves have fallen, 1.5 cm diam., bisexual or male; buds globose, conspicuously mucronate; pedicel 1–2 cm long. Sepals 2. Petals 4–6, oblong-obovate, 6–10 mm long, white. Stamens many in male flowers, fewer or staminodal in bisexual flowers; filaments free, white. Ovary subglobose in bisexual flowers. Style thick, shorter than anthers; stigma large, bilobed. Drupe obliquely ellipsoidal, 7–9 cm long, 2.5–3 cm wide, acute at both ends. Seed 1. Fig. 37F–G.

Christmas Is. Grows on all the terraces and occasionally on the plateau. A widely distributed littoral species in Malesia, Micronesia and Polynesia.

Ch.Is.: east coast, 1897, *C.W.Andrews* (K); Steep Point, *H.N.Ridley 68, 68A* (K); 300 ft terrace above Waterfall, *D.A.Powell 60* (K); NE coast, between Waterfall road and coast, *B.A.Mitchell 178* (CBG, K).

Appears to tolerate salinity and often grows with its roots and bark regularly washed by sea water. The fruits are probably well adapted to dispersal by floating in salt water. The wood is hard, heavy, dense and durable in sea water, and is used in the construction of boats and for house-posts. A dye may be obtained from the heartwood.

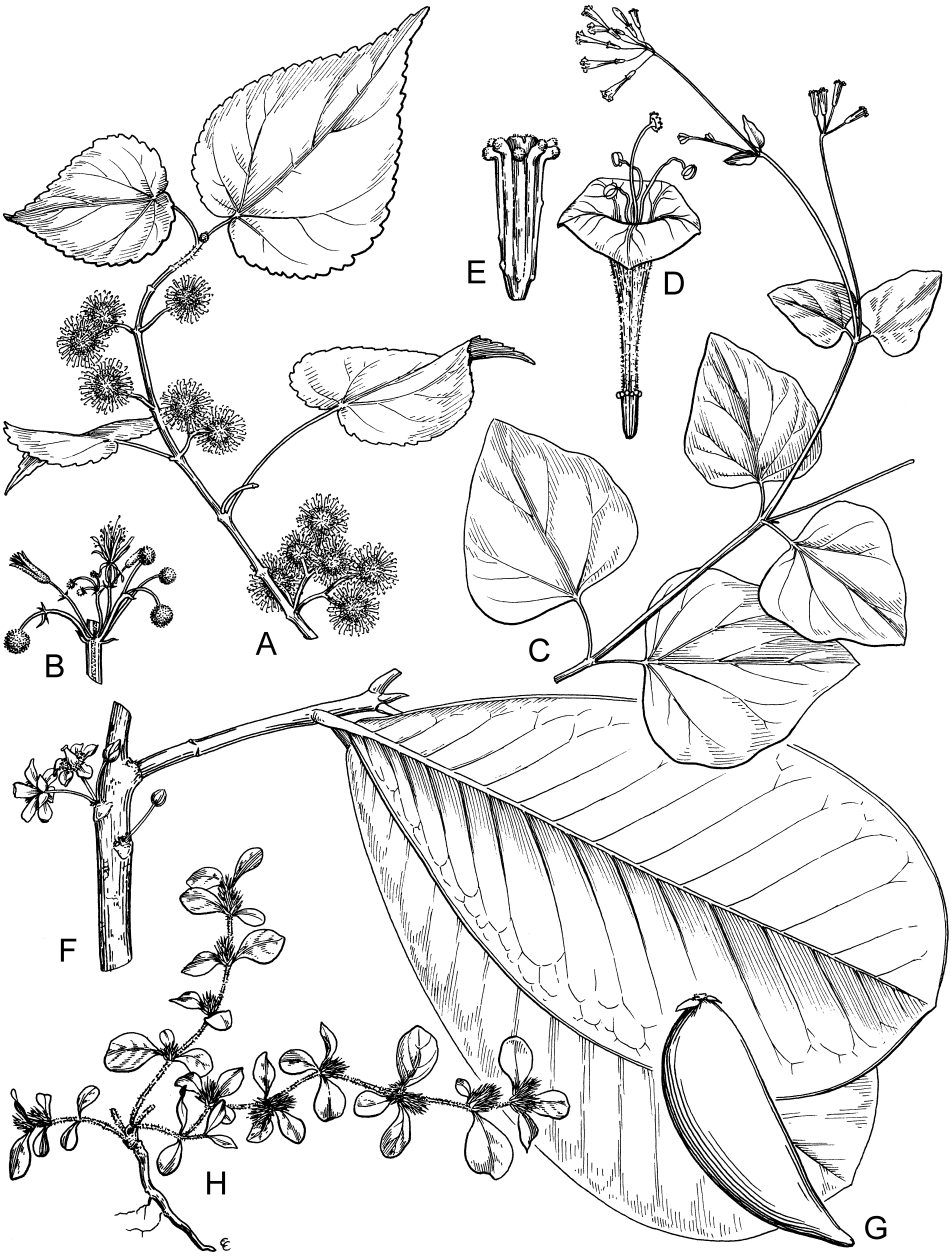

Figure 37. **A–B**, TILIACEAE: *Triumfetta suffruticosa*. **A**, fruiting branchlet, ×0.5 (D.Powell 266, K); **B**, inflorescence ×1 (H.Robinson & C.Kloss, 25 May 1914, K). **C–E**, NYCTAGINACEAE: *Commicarpus chinensis* subsp. *chinensis*. **C**, flowering shoot ×0.5; **D**, flower ×3; **E**, fruit ×3 (**C–E**, D.Powell 652, K). **F–G**, CLUSIACEAE: *Mammea odorata*. **F**, flowering branchlet ×0.5; **G**, fruit ×0.5 (**F–G**, D.Powell 60, K). **H**, AMARANTHACEAE: *Alternanthera pungens*, flowering plant ×0.5 (D.Powell 345, K). Drawn by E.Catherine.

22. TILIACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees, shrubs or rarely herbs (*Corchorus*), usually with stellate hairs; bark often fibrous, slimy when crushed. Leaves alternate to distichous, usually simple, often 3-nerved at base; stipules usually present. Flowers in axillary, extra-axillary or leaf-opposed bracteate cymes, usually bisexual, actinomorphic, small, nectar-producing, green, yellow or white. Sepals usually 4 or 5, free or connate, valvate. Petals 4 or 5, with glandular hairs at base. Disc often present. Stamens many, very shortly connate into clusters of 5–10 at petal bases, or on an androgynophore; anthers 2-locular, dehiscing by longitudinal slits. Ovary superior, with axile placentation, of 2–10 or more locules, each with 1–many ovules. Style simple; stigma lobed, capitate or simple. Fruit various, including berries, drupaceous fruits with 1–several pyrenes or capsules which are sometimes winged or covered with prickles. Seeds with endosperm.

This largely tropical family contains c. 60 genera and over 1000 species; 5 genera and c. 60 species in Australia; 4 genera (6 species) on Christmas Is.; 1 genus (1 species) on Cocos (Keeling) Is. The north temperate genera include *Tilia* (Lime, Linden or Basswood) which contains useful timber tree species which have been widely planted as ornamental or shade trees. *Corchorus* species are the source of jute, and many of the tropical woody species have fibrous bark which can be used as a source of fibres for rope-making. The fruits of the various genera and species vary considerably and are often highly characteristic.

M.Burret, Beitrage zur Kenntnis der Tiliaceen, *Notizbl. Bot. Gart. Berlin* 9: 592–880 (1926); C.A.Backer and R.C.Bakhuizen van den Brink Jr, Tiliaceae, *Fl. Java* 1: 388–396 (1963).

KEY TO GENERA

1 Leaf margins entire; flowers in large panicles; sepals fused, forming a campanulate calyx; capsule subglobose, usually 3-valved, each valve with 2 divergent wings 2–3 cm long **1. BERRYA**

1: Leaf margins serrate to serrulate; flowers solitary or up to 5 in cymules; sepals free or very shortly connate; fruits various, not as above

2 Lowest serrations of leaf margin often extended, subulate; sepals c. 3 mm long; petals longer than sepals; capsule linear-oblong, 6–10-angled, with a narrow wing on each angle and a 3–5-branched, apical beak **3. CORCHORUS**

2: Lowest leaf serrations not extended; sepals 5–22 mm long; petals shorter than sepals; fruit not as above

3 Petiole slender, 15–80 mm long; sepals hooded, with a sub-apical mucro; fruit a globose capsule, 2–3 cm diam. including the many, 8–10 mm long, hooked bristles **2. TRIUMFETTA**

3: Petiole 3–15 mm long; sepals linear, not as above; fruit drupaceous, somewhat fleshy, with 1–4 woody pyrenes **4. GREWIA**

1. BERRYA

Berrya Roxb., *Pl. Coromandel* 3: 62 (1820); after H.Berry, doctor and botanist in Madras, India, c. 1800, and a friend of W.Roxburgh.

Type: *B. cordifolia* (Willd.) Burret

Trees with sparse to dense, stellate hairs. Leaves alternate, cordate; stipules linear, caducous. Panicles large, terminal and axillary. Sepals united into a 3–5-lobed, campanulate calyx. Petals usually 4 or 5, without glandular hairs, often oblique. Stamens many, almost free, in clusters, all fertile. Ovary 3-, rarely to 5-locular, occasionally on a short androgynophore (not on Christmas Is.); ovules 1–6 per locule. Style filiform; stigma peltate. Capsule subglobose, usually loculicidally 3-valved, each valve with 2 divergent wings. Seeds pilose, usually 1 or 2 in each locule.

This genus includes c. 5 species and is distributed from southern India to Polynesia, through Malesia, the Philippines and New Guinea; 1 widespread species (*B. cordifolia*) occurs in Australia and on Christmas Is., and is cultivated in Africa.

Berrya cordifolia (Willd.) Burret, *Notizbl. Bot. Gart. Berlin-Dahlem* 9: 606 (1926)

Espera cordifolia Willd., *Ges. Naturf. Freunde Berlin Neue Schriften* 3: 450 (1801). T: protologue *n.v.*; specimen *n.v.* Epithet from the Latin *cordatus* (heart-shaped) and *folium* (leaf) in reference to the shape of the leaves.

B. ammonilla Roxb., *Pl. Coromandel* 3: 62, t. 264 (1820), as *Berria*. T: Herb. N.Wallich 1068E; syn: K-W.

Illustration: H.M.Lecomte, *Fl. Indo-Chine* 1: 530, fig. 53 (1910).

Tree; stem almost glabrous, with a few stellate hairs. Leaves ovate, deeply cordate at base, entire, often long-acuminate, stellate-hairy when young, glabrescent; lamina 6–25 cm long; petiole 2–10 cm long. Buds spherical. Inflorescence congested, paniculate, terminal and axillary, stellate-hairy; flowers c. 8 mm across. Calyx c. 4 mm long, irregularly splitting, often 3-lobed. Petals usually 4 or 5, narrowly oblong, c. 7 mm long, emarginate, white or pale pink. Androgynophore absent. Ovary 3-, rarely 4-locular, 6- or 8-lobed; ovules 4 in each locule. Stigma peltate, 3-lobed. Capsule with 3 or rarely 4 pairs of 2–3 cm long wings. Seeds with many caducous bristles. Fig. 55.

Christmas Is. Common on the northern and eastern terraces, less frequent on the plateau. Distributed from southern India to Polynesia and northern Australia; uncommon in Malesia.

Ch.Is.: without precise locality, 1897, *C.W.Andrews* (K); northern end of the terrace below Ross Hill Gardens, *D.A.Powell 27* (K); North East Point, Cemetery Rd, *B.A.Mitchell 38* (AD, CBG, K); Settlement to Drumsite Rd, *D.J. & B.P.Du Puy CI93* (CBG, K).

The wood of this tree is of very good quality, resembling teak. The stiff bristles on the seeds may penetrate skin and can cause irritation.

2. TRIUMFETTA

Triumfetta L., *Sp. Pl.* 1: 444 (1753); *Gen. Pl.* 5th edn, 203 (1754); after G.B.Triumfetti, a 17th century Italian botanical author.

Type: *T. lappula* L.

Creeping or erect herbs or shrubs with stellate and simple hairs. Leaves alternate to distichous, entire, lobed, serrate or crenate; stipules subulate, caducous. Flowers 1–3 in axillary or leaf-opposed, bracteate cymules. Sepals 5, free, hooded. Petals 5, with a ciliate claw, shorter than calyx, rarely absent. Disc cup-shaped, with 5 glands. Stamens 8–many, free, inserted inside disc. Ovary 2–5-locular, each with 2 ovules. Style filiform; stigma 5-toothed or entire. Fruit globose, 2–5-locular, indehiscent or loculicidally dehiscent, setose, echinate or rarely tuberculate.

A genus of c. 160 species distributed throughout the tropics and subtropics, especially in the

New World; 17 or 18 species in Australia (of which 13 or 14 are endemic); 1 species on Christmas Is.; 1 species on Cocos (Keeling) Is.

Stems erect, hairy in bands; leaves ovate, 4–12 cm long **1. T. suffruticosa**

Stems creeping, hairy throughout; leaves ovate to 3-lobed, less than 5 cm long **2. T. repens**

1. Triumfetta suffruticosa Blume, *Bijdr.* 113 (1825)

T: Mt Salak, Java, *coll. unknown*; *n.v.* Epithet from the Latin *suffruticosus* (somewhat woody).

Illustration: E.J.H.Corner and K.Watanabe, *Ill. Guide Trop. Pl.* 463 (1969).

Shrub to 3 m tall; branchlets with a pubescent stripe. Leaves ovate, cordate at base, serrate, acuminate, with sparse stellate hairs below and simple hairs above; lamina 4–12 cm long; petiole slender, 1.5–8 cm long. Flowers usually 2 or 3 in axillary cymules, with 1–3 cymules per axil. Sepals 10–15 mm long, with a subapical mucro. Petals narrowly obovate, 8–10 mm long, yellow. Stamens 18–30. Stigma and style filiform. Fruit 2–3 cm diam. (including prickles), 4- or 5-locular, breaking up at maturity, densely covered in 8–10 mm long, hooked prickles with glabrous apices and many spreading, whitish hairs towards base. Seeds ovoid, 2 mm long, flattened. Fig. 37A–B.

Christmas Is. Occurs in sunny or lightly shaded positions in open and secondary forest and in grassy areas, often in disturbed soil or on roadsides; also throughout the Malay Islands (excl. Philippines) to Polynesia, predominantly at lower altitudes.

Ch.Is.: North East Point, *H.N.Ridley 195* (K); on disused drill line, *D.A.Powell 266* (K).

The hooked prickles on the fruit ensure a tenacious hold for animal dispersal, and probably adhere to the feathers of birds. Collected by H.N.Ridley from the shore terrace, but is now known from higher altitudes.

2. Triumfetta repens (Blume) Merr. & Rolfe, *Philipp. J. Sci.* 3: 111 (1908)

Porpa repens Blume, *Bijdr.* 117 (1825). T: from Java *n.v.* Epithet is the Latin for creeping in reference to the growth habit.

Shrub with creeping, rooting stems to 3 m long; branchlets erect, short, stellate-hairy throughout. Leaves elliptic, ovate or circular in outline, the larger 3- or 5-lobed, rounded to cordate at base, serrate, obtuse, stellate-hairy; lamina 5–50 mm long; petiole 2–45 mm long. Flowers 1–3 in solitary leaf-opposed or axillary cymules. Sepals 7–11 mm long. Petals narrowly obovate, 6–11 mm long, yellow. Stamens 20–30. Stigma 3- or 4-lobed. Fruits 10–15 mm diam. including prickles, 2–4-locular, indehiscent, stellate-hairy, grey to black. Fig. 15.

Cocos (Keeling) Is. Grows at the top of sandy beaches in herbfield with *Ipomoea pes-caprae* and grasses and in open *Cocos* plantations in coralline sand; also through coastal areas of the northern Indian Ocean.

C.K.Is.: near jetty, Ujong Tanjong, West Is., *I.R.Telford 10003 & C.Howard* (CBG, MEL, PERTH); Tanjong Klikil, West Is., *I.R.Telford 9986 & C.Howard* (AD, CBG, K); 2 km S of jetty, West Is., *D.G.Williams 109* (BRI, CBG).

Similar to the western Pacific *T. procumbens* G.Forst., in which it has sometimes been included, e.g. F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 70 (1980).

3. CORCHORUS

Corchorus L., *Sp. Pl.* 1: 529 (1753); *Gen. Pl.* 5th edn, 234 (1754); from *korchoros*, the classical Greek name for *C. olitorius*.

Type: *C. olitorius* L.

Herbs or undershrubs with simple or stellate hairs. Leaves alternate, serrate, the lowest serrations often extended, subulate; stipules linear. Inflorescence cymose with 1–several

flowers, usually leaf-opposed. Sepals 4 or 5, free, hooded, mucronate. Petals 4 or 5, obovate, with a short, ciliate claw. Stamens many, all fertile, sometimes united at base forming an androgynophore. Ovary usually 3–6-locular; ovules many. Style thick; stigma peltate. Capsule erect, linear to globose, often with an apical, entire or 3–5-lobed beak, loculicidally 3–6-valved. Seeds many.

A genus of c. 100 species throughout the tropics and subtropics, often in cultivated places; c. 25 species in Australia; 1 species on Christmas Is. *Corchorus capsularis* L. and *C. olitorius* L. are cultivated widely in India and Africa respectively, for their fibre from which jute is obtained. *Corchorus olitorius* is widely grown in northern Africa and the Middle East for its edible leaves.

Corchorus aestuans L., *Syst. Nat.* 10th edn, 2: 1079 (1759)

T: Jamaica, *P.Browne s.n.* in Herb. C.Linnaeus 691.4; lecto: LINN, *fide* W.Fawcett & A.B.Rendle, *Fl. Jamaica* 5: 88 (1926). Epithet is the Latin for moving to and fro or oscillating; application obscure.

C. acutangulus Lam., *Encycl.* 2: 104 (1786). T: India, *P.Sonnerat* s.n.; *n.v.*

Illustration: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 406 (1939).

Erect to spreading, annual herb or subshrub; branchlets with a pubescent strip, reddish. Leaves ovate, rounded to obtuse at base, serrate, the lowest serrations often subulate, acute, scattered simple hairs especially on veins; lamina 4–8 cm long; petiole 1–2.5 cm long, pubescent above; stipules acuminate, 4–10 mm long, persistent. Flowers usually solitary. Sepals c. 3 mm long. Petals spathulate, 4–6 mm long, yellow. Androgynophore short, cup-shaped. Ovary 3–5-locular, ribbed. Stigma cup-shaped, fimbriate. Capsule linear-oblong, c. 2–2.5 cm long, 4–5 mm diam., 3–5-locular, with 6–10 acute angles, with a narrow wing on each angle, and a 3–5-branched apical beak. Seeds up to 20 per locule, black.

Christmas Is. A pantropical species usually in dry soil, often in sandy or grassy areas including beaches.

Ch.Is.: Waterfall Rd to blowhole, *A.Pearson P26* (K); Waterfall area, *D.A.Powell 329* (K); above sea cliffs at Waterfall, *D.J. & B.P.Du Puy CI64* (CBG, K)

This species can be used as a source of fibre for textiles.

4. GREWIA

Grewia L., *Sp. Pl.* 2: 964 (1753); *Gen. Pl.* 5th edn, 412 (1754); after the 17th century scientist Nehemiah Grew, who was the first to postulate sexuality in plants.

Type: *G. occidentalis* L.

Trees, shrubs or rarely climbers; often stellate-hairy. Leaves alternate, often distichous, trinerved at base, entire or toothed; stipules caducous. Inflorescence cymose, usually axillary, few-flowered, solitary or clustered, or (not on Christmas Is.) leaf-opposed or terminal; flowers subtended by caducous bracts. Sepals 5, free, pubescent. Petals 5, free, usually shorter than sepals, glandular or hairy towards base. Stamens many, on a short androgynophore. Ovary 2–4-locular; ovules 2–8 per locule. Style usually slender; stigma peltate or lobulate. Fruit fleshy, often much reduced, drupaceous, 1–4-locular, lobed or almost entire, with 1–4 pyrenes, each with 1–several seeds.

A genus of 100–150 species, mostly in the tropics and subtropics, c. 12 species in Australia, including 8 endemic species; 3 species on Christmas Is., 1 endemic. The wood is moderately hard and light, valuable for small items where toughness is required, such as handles, poles and shafts; it may also be useful for pulping. The fibrous bark can be used to make rough ropes. The fruit of many species are juicy and edible, although acidic.

1 Woody climber; sepals 17–22 mm long; petals 6–10 mm long **1. G. acuminata**

1: Tree or shrub; sepals 5–9 mm long; petals less than 4 mm long

2 Leaves narrowly ovate to narrowly elliptic, glabrescent; leaf-base obtuse; stipules to 5 mm long; inflorescence usually solitary; branchlets, petioles and inflorescences sparsely stellate-hairy or glabrous **2. G. glabra**

2: Leaves oblong to ovate, veins pubescent beneath; leaf-base cordate or truncate, strongly oblique; stipules 7–8 mm long; inflorescences usually several in each axil; branchlets, inflorescences and petioles densely stellate-hairy **3. G. insularis**

1. Grewia acuminata Juss., *Ann. Mus. Natl Hist. Nat.* 4: 91, t. 48, fig. 2 (1804)

T: Java, *coll. unknown*; *n.v.* Epithet from the Latin *acuminatus* (acuminate) in reference to the shape of the leaf tip.

Scandent, woody climber, 3–10 m tall; branchlets, petioles and inflorescences with dense, brown, stellate hairs. Leaves oblong-elliptic, obtuse and slightly decurrent at base, serrulate, acuminate, sparse stellate hairs especially on nerves; lamina 7–16 cm long; petiole 0.5–1 cm long; stipules subulate, 7–8 mm long. Flowers usually 1–5 in an axillary umbel; peduncle c. 10–17 mm long; pedicel 12–20 mm long. Sepals linear, 17–22 cm long, pubescent, white inside. Petals narrowly ovate, 6–10 mm long. Androgynophore c. 3 mm long. Fruit subglobose, slightly lobed, 1–1.5 cm diam., pubescent, with 1–4 pyrenes.

Christmas Is. Infrequent, but has been collected in open marginal forest at North East Point and on exposed sites on the upper terrace cliffs; also from Indo-China to New Guinea.

Ch.Is.: North East Point, Apr. 1980, *D.A.Powell* (K); high terraces overlooking golf course, *D.A.Powell 474* (K); adjacent to Settlement, Poon Saan road, *B.A.Mitchell 152* (CBG, K); Ross Hill trig., *D.J. & B.P.Du Puy CI45* (CBG, K); Settlement to Drumsite road, *D.J. & B.P.Du Puy CI92* (CBG, K).

2. Grewia glabra Blume, *Bijdr.* 115 (1825)

T: Java, 1904, *coll. unknown*; *n.v.* Epithet from the Latin *glaber* (glabrous, without hairs).

G. osmoxylon Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 180 (1906). T: North East Point, Christmas Is., 1904, *H.N.Ridley 59*; iso: K.

[*G. laevigata auct. non* Vahl: C.W.Andrews, *Monogr. Christmas Is.* 174 (1900)]

Illustration: D.Brandis, *Indian Trees* 97, fig. 47 (1906), as *G. laevigata*.

Tree or shrub, sparsely stellate-hairy or glabrous. Leaves narrowly ovate to elliptic, obtuse and slightly oblique at base, serrulate, acute to shortly acuminate, glabrescent; lamina 10–18 cm long; petiole 10–15 mm long; stipules filiform, to 5 mm long, quickly caducous. Flowers usually 1–3 in an axillary umbel; peduncle 7–12 mm long; pedicel 6–10 mm long. Sepals linear, 5–9 mm long, pubescent, green outside, white inside. Petals ovate, c. 1.5 mm long, cream. Androgynophore c. 1 mm long. Fruit of 2, bilobed, divergent parts; each lobe with 1 or 2 pyrenes; parts, lobes and pyrenes usually suppressed, often reduced to a single, subglobose, purple lobe c. 5 mm long, containing 1 or 2 pyrenes. Fig. 14.

Christmas Is. Occurs on the lower terraces, and recorded on limestone talus slopes on the northern side of the island; occurs from India to New Guinea, usually in scrubland and secondary vegetation.

Ch.Is.: near beach, 1897, *H.N.Ridley* (K); North East Point, *D.A.Powell 80* (K); North West Point, *D.A.Powell 365* (K); Phosphate Hill, Poon Saan road, *B.A.Mitchell 15* (BRI, CBG, MEL, PERTH); road to golf course, North East Point, *D.J. & B.P.Du Puy CI96* (CBG, K).

3. Grewia insularis Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 181 (1906)

T: Christmas Is., 1898, *C.W.Andrews 72*; iso: K. Epithet is the Latin for insular in reference to the island locality of the type collection.

Tree or shrub; branchlet tips, petioles and inflorescences stellate-hairy. Leaves oblong to ovate, cordate to truncate at base, usually distinctly oblique, serrulate, acute to acuminate, leaf veins pubescent below, somewhat glabrescent; lamina 4–11 cm long; petiole 4–12 mm long; stipules 7–8 mm long, subulate, caducous. Flowers usually 1–3 in an umbel, often

with several umbels from 1 leaf-axil; peduncle 7–10 mm long; pedicel 6–10 mm long. Sepals linear, 6–8 mm long, pubescent, yellow. Petals ovate, c. 3 mm long. Androgynophore c. 1 mm long. Fruit purple, often reduced to a subglobose drupe c. 3 mm long, containing 1 or 2 pyrenes. Fig. 38G–I.

Christmas Is. Appears to be endemic. Occurs on the terraces on the northern coast.

Ch.Is.: no precise locality, *C.W.Andrews 72* (K); North East Point, *H.N.Ridley 60* (K); terraces below the 500 ft (156 m) contour, *D.A.Powell 370* (K); coast, *D.A.Powell 467* (K); northern terraces below Toms Ridge, NW promontory, *B.A.Mitchell 214* (AD, CBG, K, MEL).

The flowers and fruit of *G. insularis* are similar to those of *G. glabra*, but these species differ as indicated in the key. It closely resembles *G. eriocarpa*, especially in its leaf-shape, but *G. insularis* is much less densely pubescent, and has a longer androgynophore. This species was treated as *Grewia* sp. by C.W.Andrews, *Monogr. Christmas Is.* 174 (1900).

23. STERCULIACEAE

D.J.Du Puy (Ch.Is.)

Trees, shrubs or woody herbs; indumentum usually stellate, sometimes with scales. Leaves alternate, simple, palmatifid or palmate; stipules usually present. Inflorescence axillary, usually with many, bisexual or unisexual, usually actinomorphic flowers. Sepals 3–5, usually partly connate. Petals 5 or absent, contorted or imbricate, free or adnate to base of staminal tube. Stamens 4–many, usually connate into a narrow tube, often with staminodes; anthers 2-locular, usually dehiscing by longitudinal slits. Ovary superior; carpels usually 2–5, united or free; ovules 2–many per carpel; placentation axile. Style simple, lobed or rarely styles free. Fruit usually dry, woody, coriaceous or sometimes inflated, usually a deeply 5-lobed, loculicidal capsule, or sometimes splitting into mericarps which may be woody; seeds usually 1 per carpel, occasionally winged, usually with endosperm.

A family with pantropical and subtropical distribution, containing 60–70 genera and 700–1100 species; 3 genera occur on Christmas Is. Cocoa (*Theobroma cacao* L.), a native of tropical S America, is chiefly used in making chocolate. It occurs on Christmas Is. as a cultivated plant, growing and fruiting well, and may possibly be a substitute source of income for the island once mining has finished. It can be recognised by its cauline flowers and fruit, which are large, many-seeded and fleshy. The China-chestnut (*Sterculia monosperma* Vent.) is introduced to Christmas Is. and grows near Drumsite. It is a tree with small, apetalous, unisexual flowers in delicate racemes, and the fruit are tough, 2-valved, red capsules which are often in pairs and open to reveal 1 or 2 black, shiny, sticky seeds. The seeds are boiled and the skins removed; they have a pleasant taste, resembling chestnuts, although slightly mealy.

C.A.Backer and R.C.Bakhuizen van den Brink Jr, Sterculiaceae, *Fl. Java* 1: 401–415 (1963).

KEY TO GENERA

1 Trees 10–20 m tall, with buttresses; leaves elliptic, rounded at base, silvery lepidote below; flowers unisexual, apetalous, with a somewhat petaloid calyx; fruit 1-seeded, nut-like, woody, keeled; a mangrove growing in areas of water seepage **1. HERITIERA**

1: Shrubs or small trees less than 10 m tall, without buttresses; leaves ovate, cordate at base, pubescent; flowers bisexual, with sepals and petals; fruit a 5-lobed capsule with 5 seeds; usually growing in drier areas, often in secondary vegetation

2 Leaf margin entire; stipules sublinear, inconspicuous; inflorescence lax; flowers zygomorphic; petals shorter than sepals; capsule turbinate, inflated, membranous, glabrous; seed round, whitish **2. KLEINHOVIA**

2: Leaf margin serrate; stipules ovate, conspicuous on young twigs; inflorescence dense; flowers actinomorphic; petals exceeding sepals; capsule oblong, not inflated, rigid, pubescent; seed with a 5 mm membranous wing, brown **3. MELOCHIA**

1. HERITIERA

Heritiera Aiton, *Hort. Kew.* 3: 456 (1789); named after C.L. l'Héritier de Brutelle, the French botanist who was sent to England to seek the help of Sir Joseph Banks in preventing Joseph Dombey's collections from going to Spain.

Type: *H. littoralis* Aiton

Monoecious trees; buttresses thin, well-developed; young twigs, petioles and leaves lepidote. Leaves simple or palmate, entire, often congested near apex of shoots, papery to rigid and leathery; petiole swollen apically; stipules small, caducous. Inflorescence a much-branched, small, axillary panicle; pedicels short, jointed. Calyx campanulate, 4- or 5-lobed, stellate-hairy, petaloid. Corolla absent. Disc usually well-developed, densely papillose. Male flowers usually with 4 or 5 anthers on an androphore. Female flowers fewer, slightly larger; carpels usually 5, subsessile on disc; styles free, usually recurved, short. Fruit of 2–5 free, indehiscent, 1-seeded samaras with a ±well-developed longitudinal keel or wing; epicarp woody.

A tropical genus of 29 species, mostly SE Asian, distributed from India to the Pacific islands; 2 species in Australia, 1 of which is a widespread species also on Christmas Is.

A.J.G.H.Kostermans, A monograph of the genus *Heritiera* Aiton (Sterculiaceae) *Reinwardtia* 4: 465–583 (1959).

Most species have very hard timber and the more common species are commercially important.

Heritiera littoralis Aiton, *Hort. Kew.* 3: 546 (1789)

T: Ceylon [Sri Lanka], *F.G.Koenig s.n.*; syn: BM; Pulo Condore Islands [Vietnam], *D.Nelson s.n.*; syn: BM. Epithet is the Latin for pertaining to the sea-shore.

Illustration: A.J.G.H.Kostermans, *op. cit.* figs 1, 2.

Tree 10–20 m tall; buttresses plank-like. Leaves elliptic, rounded at base, entire, rounded to acuminate, coriaceous, glossy, lower surface with many whitish scales; lamina 10–25 cm long; petiole 2–7 cm long. Panicle to 18 cm long, lepidote; terminal branchlets stellate-hairy. Calyx usually 4-lobed, stellate-hairy, dull white or pink, deep red in centre. Male flowers 3–5 mm long; androphore 2 mm long; anthers 4, in an apical ring of 8 thecae. Female flowers 3–7 mm long, usually with 4 sessile carpels; styles coherent at base, curved outwards. Fruit ellipsoidal, 5–6.5 cm long, woody, glossy, light brown, nut-like; dorsal keel usually extended into short apical wing. Seed 1. *Dungu*.

Christmas Is. Occurs on basalt/limestone junctions in areas of fresh water seepage, forming dense stands with the two *Bruguiera* species (e.g. at Hosnies Spring). These inland mangrove swamps have remained since the last tectonic rise of the island which elevated the first terrace from sea level. A coastal species found in SE Asia from India and Taiwan through Indo-China and Malesia to the Pacific islands and northern Australia, and also in eastern Africa. It is typically found in drier and less saline areas of mangrove swamps or on

beaches. They are of high scientific interest and have been documented by C.G.G.J. van Steenis (Mangroves in freshwater, *Blumea* 29: 395–397, 1984).

Ch.Is.: S of Ross Hill Gardens, *D.A.Powell 33* (K); S of Dolly Beach, *D.A.Powell 863* (K); between Ross Hill Gardens and Dolly Beach, *B.A.Mitchell 3* (AD, CBG, K).

The hollow, waterproof fruit is dispersed by the sea. It floats with its keel uppermost and remains this way on its arrival on the beach. The radicle eventually ruptures the lower surface. The wood is hard, strong, elastic and durable, and is valuable for local use such as boat construction, the buttresses may be used as rudders. The seed, although bitter, is edible and is occasionally used as a fish spice. The seeds are used in the Moluccas as a cure for diarrhoea and dysentery.

2. KLEINHOVIA

Kleinhovia L., *Sp. Pl.* 2nd edn, 2: 1365 (1763); *Gen. Pl.* 6th edn, 468 (1764); after C.Kleynhoff, a physician who maintained a garden of medicinal plants at Batavia (now Djakarta), Java, during the middle of the 18th century.

T: *K. hospita* L.

Shrubs or small trees with pubescent twigs, petioles and leaves; bark fibrous. Leaves alternate, simple; stipules sublinear, caducous. Flowers bisexual, zygomorphic, in a large, terminal panicle; pedicel jointed. Sepals 5, free. Petals 5, free. Disc present. Anthers in 5 groups of 3, alternating with tooth-like staminodes, sessile at the apex of an androgynophore. Ovary of 5 fused carpels; ovules c. 4 per carpel. Style short, slender, capitate, becoming divided. Fruit of 5 fused carpels, loculicidally dehiscent.

A monotypic genus of the Old World tropics, including N Australia and tropical Africa.

H.N.Ridley, *Kleinhovia*, Sterculiaceae, *Fl. Malay Penins.* 1: 280 (1922).

Kleinhovia hospita L., *Sp. Pl.* 2nd edn, 2: 1365 (1763)

T: Java, ?cult. *C.Kleynhoff*, Herb. C.Linnaeus 1073.1; LINN. Epithet from the Latin *hospes* (host).

Illustration: E.Blatter, W.S.Millard & W.T.Stearn, *Some Beautiful Indian Trees* t. 19, fig. 31 (1954).

Tree to over 20 m tall. Leaves ovate, cordate at base, entire, acuminate, pubescent; lamina to 16 cm long; petiole to 10 cm long. Flowers 8–10 mm across, many in terminal or axillary panicles. Sepals 5–8 mm long, unequal, longer than the petals, rose pink, pubescent. Petals unequal, red or pink, the upper longer, clawed, subsaccate, with a yellow apex. Ovary 5-lobed, inserted within the dilated apex of the androgynophore. Fruit turbinate, c. 20 mm across, 5-lobed, membranous and inflated; each carpel usually with a single, round, whitish seed. *Laban, Temahau*.

Christmas Is. A prominent species in the marginal and open forests on the terraces, where the soils are shallow and well-drained. An attractive tree, locally common in Malesia, preferring watersides and humid situations, but confined to regions with a pronounced dry season. It is also a vigorous component of secondary forest.

Ch.Is.: no precise locality, *C.W.Andrews 57* (K); Phosphate Hill, *H.N.Ridley 52* (K); near Settlement, *B.A.Mitchell 139* (CBG, K).

Occasionally cultivated as an ornamental. The bark and leaves are poisonous and may be used to remove ectoparasites. The knotted parts of the wood are used in Malaya for ornamental carving, such as knife handles. The inflated fruit may be spread by water.

3. MELOCHIA

Melochia L., *Sp. Pl.* 2: 674 (1753); *Gen. Pl.* 5th edn, 304 (1754); from the Arabic *Melochieh* (*Corchorus olitorius* L.), probably from the Greek *Mallache*, the mallow.

Type: *M. corchorifolia* L.

Usually perennial shrubs or subshrubs with simple, stellate or glandular hairs. Leaves alternate, simple, usually crenate or serrate; stipules suborbicular to linear. Inflorescence axillary or terminal, cymose or paniculate, sometimes clustered, with bracts subtending the flowers; pedicels not jointed. Calyx 5-lobed, campanulate. Petals 5, free or adnate to base of staminal tube. Disc present. Flowers usually heterostylous. Stamens 5, antipetalous, connate forming a tube at base. Carpels 5, fused; ovules 2 per carpel. Styles 5, free or basally united. Fruit a schizocarp or capsule. Seeds 1 or 2 per carpel, occasionally winged.

A genus of 54 species throughout the tropics and subtropics; 2 species in N Australia; 1 on Christmas Is.

A.Goldberg, The genus *Melochia* L. (Sterculiaceae), *Contr. U.S. Natl. Herb.* 34: 191–363 (1967).

Melochia umbellata (Houtt.) Stapf, *Bull. Misc. Inform.* 1913: 317 (1913)

Visenia umbellata Houtt., *Handl. Pl.-Kruidk.* 8: 309, t. 46 (1777). T: East Indies; ?L *n.v.* Epithet from the Latin *umbellatus* (umbel-like) in reference to the inflorescence.

[*M. arborea auct. non* Blanco: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 178 (1906)]

Shrubs or small trees to 10 m tall; softly brown-pubescent. Leaves broadly ovate, cordate at base, serrate, acute, glabrescent; lamina to 27 cm long; petiole to 12 cm long; stipules c. 6 mm wide, conspicuous on young twigs, ovate, caducous. Inflorescence axillary, cymose, corymbiform, with dimorphic flowers in densely clustered, 3–5-flowered umbels, subtended by several ovate bracts; pedicels 2–4 mm long. Calyx campanulate with 5 acute lobes. Petals 5, obovate, 6–8 mm long, longer than sepals, usually pink. Disc flat. Stamens 5, connate to the middle, adnate to base of petals. Ovary sessile, silky pubescent. Styles 5, filiform. Capsule oblong, 8–10 mm long, 5-valved, strongly 5-lobed, pubescent. Seed winged, 1 per locule. Fig. 38D–F.

Christmas Is. Occurs in secondary vegetation and on rocky slopes or inland cliffs; also from India, Indo-China, Malesia, the Philippines, New Guinea and NW Australia, in clearings, secondary vegetation, rocky slopes, edges of forests and rivers, often in periodically dry soil.

Ch.Is.: Waterfall, *H.N.Ridley 56* (K); Phosphate Hill, *A.Pearson P45* (K); Phosphate Hill, *A.Pearson P63* (K); 200 yds [c. 180 m] NE of Rocky Point, *D.A.Powell 76* (K); Murray Hill, *B.A Mitchell 85* (CBG, K).

Often planted as a shade tree in SE Asia. Its preference for open situations, rapid growth and good ground cover suggest it may be useful in reducing erosion.

24. MALVACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R., C.S.Is.)

Annual or perennial herbs, shrubs or trees, usually with stellate and simple hairs. Leaves alternate, simple, entire to variously lobed; stipules present. Inflorescence an axillary or terminal, raceme or panicle, or flowers solitary. Flowers usually actinomorphic, 5-merous, bisexual, often protandrous. Calyx often connate, 5-lobed, often subtended by an epicalyx. Petals free to near base, often asymmetrical, convolute. Stamens many, fused into a column

which is adnate to corolla at base; anthers 1-locular, dehiscing by longitudinal slits. Pollen echinate. Ovary superior, usually of 5 or more fused carpels, multilocular; placentation axile. Style usually branched. Fruit a capsule, dehiscing by slits or valves, or a schizocarp breaking up at maturity, rarely a berry (in *Malvaviscus*). Seeds usually many, pubescent; endosperm present.

A large, cosmopolitan family of c. 50 genera and 1000 species, mainly in the tropics and subtropics and with greatest diversity in S America; 8 genera in our area. *Gossypium* provides cotton and is of major economic importance. Several other genera and species are grown as ornamentals.

J. van Borssum Waalkes, Malesian Malvaceae Revised, *Blumea* 14: 1–213 (1966).

KEY TO GENERA

1 Petals longer than 25 mm, usually 50 mm or more; epicalyx present; fruit a 3–5-valved capsule or indehiscent, not splitting into mericarps

2 Stems and pedicels densely covered in stiff bristles c. 4 mm long; calyx spathe-like, splitting on one side as the flower opens, adnate to and falling with the corolla **2. ABELMOSCHUS**

2: Stems and pedicels glabrous, minutely hairy or scaly, not bristly; calyx symmetrical, persistent after the corolla falls

3 Epicalyx segments 8–12; style 5-branched; stigmas 5 **1. HIBISCUS**

3: Epicalyx segments 3; style not branched; stigma clavate, 5-ribbed

4 Plant with black oil glands; epicalyx persistent, foliose, deeply laciniate; fruit capsular; seeds white-cottony **4. GOSSYPIUM**

4: Plant lacking black oil glands; epicalyx caducous, neither foliose nor laciniate; fruit indehiscent; seeds shortly rusty hairy **3. THESPESIA**

1: Petals shorter than 25 mm, usually less than 20 mm long; epicalyx present or absent; fruit a verticillate schizocarp, splitting into 5–15 mericarps

5 Epicalyx present; pedicel not jointed

6 Mature leaves mostly deeply lobed with rounded sinuses, the upper leaves with strongly sinuate margins; flowers pink; schizocarp splitting into 5 mericarps, each with many barbed bristles **5. URENA**

6: Mature leaves not lobed or sinuate; flowers yellow; schizocarp splitting into 10–15 mericarps, each with 3 curved awns **6. MALVASTRUM**

5: Epicalyx absent; pedicel and peduncle jointed

7 Leaves large, usually 6–16 cm long, ovate, cordate at base; calyx more than 10 mm diam.; mericarps 6–12 mm long, 2-valved, dehiscent, not awned but with 1 or 2 apical beaks, with 2 or 3 seeds **7. ABUTILON**

7: Leaves small, usually less than 6 cm long, narrowly elliptic, tapering at base; calyx less than 8 mm diam.; mericarps 2–4 mm long, indehiscent, 1 or 2 awned, with 1 seed **8. SIDA**

1. HIBISCUS

Hibiscus L., *Sp. Pl.* 2: 693 (1753); *Gen. Pl.* 5th edn, 310 (1754), *nom. cons.*; from the Greek *Hibiskos*, the name of a Malvaceous plant (now *Althaea officinalis* L.) in Dioscorides and Pliny, perhaps after the Egyptian god Ibis.

Type: *H. syriacus* L.

Herbs, shrubs or trees, usually with stellate hairs. Leaves palmatifid to entire, often with extrafloral nectaries; stipules filiform to foliaceous. Flowers axillary, solitary, often in

racemes or panicles through reduction of the upper leaves; pedicel usually jointed. Epicalyx free or shortly connate, persistent. Calyx campanulate, 5-lobed. Corolla usually large and showy; petals free, usually obovate, obtuse to rounded, often yellow with contrasting basal colour spot. Staminal column as long as or shorter than petals. Ovary 5- or apparently 10-locular with 5 false septa; ovules usually 3–many per locule. Style distally 5-branched; stigmas capitate. Capsule loculicidally dehiscent, 5-valved. Seeds reniform, hairy or glabrous.

A genus of over 250 species, mostly in the tropics; c. 50 species in Australia; 2 species on Christmas Is., 1 of which also on Cocos (Keeling) Is. The herbaceous species are often found in disturbed soil, and the tree species occur in secondary forest. The genus is divided into 9 sections; the 2 species on the tropical oceanic islands belong to different sections. Several very showy cultivars of *H. rosasinensis* L. are grown on Christmas Is. and Cocos (Keeling) Is.; *H. schizopetalus* (Mast.) Hook.f. with deeply laciniate red petals is also cultivated.

Leaves orbicular, entire; stipules foliaceous; epicalyx segments broad, fused; ovary 10-locular; capsule not winged **1. H. tiliaceus**

Leaves palmatifid with 3–5 lobes, irregularly dentate; stipules filiform; epicalyx segments filiform, free; ovary 5-locular; capsule winged **2. H. vitifolius**

1. Hibiscus tiliaceus L., *Sp. Pl.* 2: 694 (1753)

subsp. **tiliaceus**

T: Sri Lanka, Herb. P.Hermann 259, Vol. 3, fol. 51; lecto: BM, *fide* J. van Borssum Waalkes, *Blumea* 14: 31 (1966). Epithet from *Tilia* (a genus of plants) and the Latin suffix *-aceus* (resembling).

Illustration: F.R.Fosberg & S.A.Renvoize, *The Flora of Aldabra and neighbouring islands* 59, fig. 3(4, 5) (1980).

Tree to 15 m tall; trunk with tough, fibrous bark; twigs ±glabrous. Leaves orbicular to broadly ovate, cordate at base, cuspidate, entire; lamina 3–22 cm long, 1.5–22 cm wide; petiole 3–13 cm long; stipules foliaceous, ovate to oblong, leaving annular scars. Pedicels not jointed. Epicalyx cup-shaped; segments 8–11, fused in basal half. Petals obovate, obtuse or rounded, 5–7 cm long, 4–5.5 cm wide, yellow with purple base. Staminal column 2.5–3 cm long. Ovary 10-locular. Stigmas capitate. Capsule globose to obovoid, acuminate. Seeds 5–7 per locule, usually stellate-hairy.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. it grows on the shore terrace from very near the shore to the base of the inland cliff; on Cocos (Keeling) Is. recorded only for the main atoll on lagoon margins, often in thickets. A common pantropical species which is usually coastal but also occurs along river and lake margins and in marshes.

Ch.Is.: North East Point, 1898, *C.W.Andrews* (K); Flying Fish Cove, shore terrace, *A.Pearson P91* (K); coastal terrace near Greta Beach, *B.A.Mitchell 4* (CBG, K). C.K.Is.: North Lagoon, West Is., *I.R.Telford 10039 & C.Howard* (AD, CBG, K, MEL); lagoon shore E of airstrip, West Is., *A.S.George 16243* (CBG, K).

The seeds will float in water for many weeks suggesting that this species is dispersed by water.

The subspecies are distinguished on the basis of their leaf shape, the size of the stellate hairs on the leaves, the epicalyx length and segment shape and the seed indumentum (J. van Borssum Waalkes, *Blumea* 14: 30, 1966).

2. Hibiscus vitifolius L., *Sp. Pl.* 2: 696 (1753)

T: Sri Lanka, Herb. P.Hermann, Vol. 4, fol. 39, *C.Linnaeus 265*; lecto: BM, *fide* J.P.M.Brenan & A.W.Exell, *Bol. Soc. Brot.* ser. 2, 32: 73 (1958). Epithet from *Vitis* (a genus of vine plants) and the Latin *folius* (-leaved).

Illustration: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 420 (1940).

Herb or undershrub to 2 m tall. Leaves mostly 3–5-lobed with acute to acuminate segments, irregularly dentate to serrate; lamina 4–12 cm long, 2–12 cm wide; petiole 1–12 cm long; stipules filiform. Pedicels jointed. Epicalyx segments 8–12, free, linear to filiform. Petals

obovate, obtuse, 2.5–5 cm long, 1.5–3 cm wide, yellow, purple at base. Staminal column 1–1.5 cm long. Ovary 5-locular. Stigmas clavate. Capsule globular, with 5 broad wings. Seeds 2–4 in each locule, glabrous.

Christmas Is. Collected on the shore terrace on North East Point, but has not been recollected since 1904.

Ch.Is.: shore platform, *C.W.Andrews 156* (K); North East Point, *H.N.Ridley 38, 39* (K).

This is an Old World tropical species requiring an annual dry period and is only common in Malesia in regions where the climate is seasonal. It is a species of disturbed ground and open vegetation.

2. ABELMOSCHUS

Abelmoschus Medik., *Malvenfam.* 46 (1787); from the Arabic *abu-l-mosk* (father of musk), in allusion to the smell of the seeds.

Type: *A. moschatus* Medik.

Herbs or undershrubs, sometimes small trees; often prickly. Leaves palmatifid, often hastate or sagittate, often with pinnatifid segments, rarely entire. Flowers axillary, solitary, often in racemes by reduction of upper leaves. Pedicel not jointed. Epicalyx segments usually free. Calyx spathe-like, 5-toothed, splitting on one side as corolla expands, adnate to and falling with corolla. Corolla showy, usually yellow with purple centre. Staminal column much shorter than petals. Ovary 5-locular; ovules many per locule. Style 1, 5-branched; stigmas discoid. Capsule oblong or cylindrical, loculicidally dehiscent, 5-valved. Seeds reniform, glabrous or hairy, stellate-hairy, glabrescent.

A genus of 6 SE Asian species, 2 of which occur in tropical Australia (N.T.); 1 species on Christmas Is. They have been widely introduced in tropical Africa and America as weeds or cultivated plants. *Abelmoschus manihot* subsp. *manihot* is widely cultivated as a vegetable in SE Asia, and in other regions as an ornamental. *Abelmoschus esculentus* is cultivated throughout the tropics and in warm temperate regions; the young fruit are the vegetable Okra or Ladies Fingers.

Abelmoschus manihot (L.) Medik., *Malvenfam.* 46 (1787)

subsp. **tetraphyllus** (Roxb. ex Hornem.) Borss. Waalk., *Blumea* 14: 97 (1966)

var. **pungens** (Roxb.) Hochr., *Candollea* 2: 87 (1924)

Hibiscus pungens Roxb., *Fl. Ind.* 2nd edn, 3: 213 (1832). T: Bot. Gard. Calcutta (from Nepal?), India, *W.Roxburgh s.n.*, N.Wallich Cat., n. 1924–2; lecto: BR-Herb. Mart., *fide* J. van Borssum Waalkes, *Blumea* 14: 99 (1966). Epithets from the Brazilian name for Cassava, which this species resembles; from the Latin *tetra-* (four-) and *-phyllus* (-leaved), possibly in reference to the leaves of the subspecies being 4-lobed; and from the Latin *pungens* (terminating in a hard, sharp point), possibly in reference to the stiff bristles.

Hibiscus vrieseanus Hassk., *Tijdschr. Natuurl. Gesch. Physiol.* 5: 263 (1838). T: cultivated, Bogor Botanic Gardens, Indonesia, as *H. vitiifolius*; *n.v.*

Erect shrub or small tree with widely spaced branches, to 7 m tall on Christmas Is.; stems and pedicels densely covered in coarse, stiff bristles when young, glabrescent. Leaves orbicular to broadly ovate, palmatifid, shallowly to deeply 3–7-lobed, cordate at base, usually coarsely dentate, somewhat bristly especially on the veins; lamina 3–30 cm wide; petiole 3–25 cm long, bristly, soon glabrescent; stipules narrowly lanceolate, acuminate. Pedicel covered in stiff bristles. Epicalyx segments free, usually 5 or 6, ovate, acute, to 3 cm long; margin with stiff hairs. Corolla large, yellow with small purple centre. Petals obovate to orbicular, 5–8 cm long, rounded. Capsule 4–7 mm long, densely bristly.

Christmas Is. Occurs at all altitudes along recently cleared tracks. Distributed from India and southern China, through Malesia to northern Australia. Var. *pungens* is restricted to Sumatra, the Lesser Sunda Islands, Philippines and Christmas Is. It occurs in regions with a

seasonal climate, usually in young secondary vegetation, and on disturbed land.

Ch.Is.: centre of the island, Murray Hill road, *H.N.Ridley 87* (K); south coast, Taits Vale, *D.A.Powell 28* (K); Grants Well, track towards Ross Hill, *A.Pearson & D.A.Powell P92* (K); edge of National Park in Central Plateau, *R.Shivas 957* (PERTH).

Var. *pungens* can be differentiated from the other infraspecific taxa by its strongly bristly stems and pedicels, its epicalyx segments with stiffly hairy margins, and its orbicular, slightly lobed leaves. Although other subspecies reach 8 m in height, subsp. *tetraphyllus* is usually an undershrub to 3 m tall. The size of the specimens on Christmas Is. is therefore unusually large. Furthermore, var. *pungens* occurs throughout the rest of Malesia at altitudes of greater than 400 m, being replaced at lower altitudes by var. *tetraphyllus*.

3. THESPESIA

Thespesia Sol. ex Corrêa, *Ann. Mus. Natl. Hist. Nat.* 9: 290 (1807), *nom. cons.*; from the Greek *thespesio* (divine), in reference to the type species being held sacred on Polynesian islands and used in religious ceremonies, including Tahiti, where collected in 1769 by J.Banks and D.C.Solander on J.Cook's first voyage.

Type: *T. populnea* (L.) Sol. ex Corrêa

Trees or shrubs. Leaves entire or (not in our area) palmatilobed, usually with extra-floral nectaries. Flowers solitary, axillary. Epicalyx segments 3–6, free, small, caducous. Calyx cup-shaped, entire or minutely 5-toothed, persistent. Corolla deeply 5-lobed. Staminal column usually much shorter than corolla lobes, bearing anthers along its length. Ovary 5- or 10-locular; style short; stigma clavate, 5-grooved. Fruit indehiscent or (not in our area) capsular, 5- or 10-locular. Seeds few to many per locule, obovoid.

A pantropical genus of c. 15 species; 2 species in coastal tropical Australia, 1 of which is also on Cocos (Keeling) Is.

F.R.Fosberg & M.H.Sachet, *Smithsonian Contr. Bot.* 7: 8 (1972).

Thespesia populnea (L.) Sol. ex Corrêa, *Ann. Mus. Natl. Hist. Nat.* 9: 290, t. 8, fig. 1 (1807), *nom. cons.*

Hibiscus populneus L., *Sp. Pl.* 2: 694 (1753). T: Ceylon, Herb. P.Hermann, Vol. iv, fol. 34, *C.Linnaeus 258*; lecto: BM, *fide* J. van Borssum Waalkes, *Blumea* 14: 108 (1966). Epithet from the genus *Populus* and the Latin suffix *-eus* (resemblance in quality).

Illustration: F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 62, fig. 6(4–6) (1980).

Shrub or tree to 6 m (to 20 m elsewhere). Leaves broadly ovate, cordate to truncate at base, acuminate, 7-nerved at base with small saccate nectaries in vein axils on underside, sparsely scaly with brown peltate scales on upper surface, more densely so beneath; lamina 7–19 cm long; petiole 4–10 cm long. Pedicels 2–4 cm long, thickening towards apex. Epicalyx segments 3, ovate, acute, 4–10 mm long. Calyx 10–14 mm long, densely brown scaly outside, silky inside. Corolla campanulate, yellow, ageing orange, with a dark purple centre, scaly outside. Staminal column 2.5–3 cm long. Fruit indehiscent, ±globose, 2–4.5 cm diam. Seeds 4 per locule, 8–15 mm long, rusty hairy.

Cocos (Keeling) Is. Grows in strand shrub community with *Scaevola taccada* in coralline sand, apparently surviving only on Direction Is. H.B.Guppy, *J. Trans. Victoria Inst.* (*London*) 267–301 (1890) reported that it had almost been exterminated except for a few trees on Horsburgh Is. Widespread through the NE Indian and W Pacific Oceans, including N.T. and Qld.

C.K.Is.: NW coast, Direction Is. (Pulu Tikus), *D.G.Williams 121* (BISH, BRI, CBG, K, NSW, PERTH).

Superficially similar to *Hibiscus tiliaceus*. Seeds are distributed by ocean currents. H.B.Guppy, *Observ. Natur. Pacif.* 2: 529 (1906) and W.B.Hemsley, *Ann. Bot.* 5: 406 (1891) demonstrated their long viability in seawater.

4. GOSSYPIUM

Gossypium L., *Sp. Pl.* 2: 693 (1753); *Gen. Pl.* 5th edn, 764 (1754); from the Latin *Gossypion*, which was the name used by Pliny for *G. arboreum*, presumably from the Latin *gossum* (a swelling or excrescence), describing the cottony seeds which puff out from the capsule.

Type: *G. herbaceum* L.

Herbs or shrubs, with many black oil-glands. Leaves palmatifid, entire. Flowers solitary, terminal on sympodial, axillary, leafy shoots. Pedicels not jointed. Epicalyx segments 3, free or shortly connate, usually foliaceous, persistent, cordate at base, entire, dentate or deeply laciniate. Calyx cupular, of 5 connate segments, truncate or weakly 5-lobed. Corolla yellow or white; centre sometimes purple-marked, occasionally purple. Staminal column much shorter than petals. Ovary 3–5-locular; ovules several per locule. Style 1, short; stigma clavate, 5-grooved. Capsule globular to ovoid, acute or acuminate. Seeds usually with cottony hairs (floss or lint), sometimes a short brown indumentum (fuzz).

A pantropical genus of 20–70 species; 1 species on Christmas Is. Several species are cultivated cottons.

G.Watt, *The Wild and Cultivated Cotton Plants of the World* 406 pp. (1907).

***Gossypium barbadense** L., *Sp. Pl.* 2: 693 (1753)

var. **acuminatum** (Roxb.) Mast. in J.D.Hooker, *Fl. Brit. India* 1: 347 (1875)

G. acuminatum Roxb., *Fl. Ind.*, ed. W.Carey 3: 186 (1832). T: *W.Roxburgh*, Icon. 1498 (K).

Illustration: G.Watt, *op. cit.* t. 50.

Annual undershrub or perennial shrub; stems, petioles, pedicels and calyx black gland-dotted. Leaves orbicular to ovate, cordate at base, usually deeply 3–5-lobed with long central lobe; segments acute or acuminate; lamina to 12 cm long; petiole equal to or exceeding lamina; stipules leaf-like. Epicalyx segments free, appressed against corolla or capsule, deeply laciniate; teeth long, narrow, triangular. Calyx cupular, somewhat truncate; basal nectaries 3. Corolla funnel-shaped; petals obovate, c. 5 cm long, truncate, pale yellow. Staminal column c. 4 cm long; stamens equal; filaments short. Capsule ovoid, beaked, glabrous, pitted. Seeds ovoid, c. 8 mm long, long floss, and fuzz restricted to hilum.

Christmas Is. Introduced and now naturalised along roads and railway lines. From America, where it is widely cultivated in tropical South and Central America and the Antilles. It is cultivated in Malesia for cotton.

Ch.Is.: in cleared ground between road and railway, *A.Pearson P54* (K); Drumsite road and along railway, *D.A.Powell 105* (K).

This variety is commonly cultivated in Malesia as it will crop quite well in the damp, tropical climate.

5. URENA

Urena L., *Sp. Pl.* 2: 692 (1753); *Gen. Pl.* 5th edn, 754 (1754); from *Uren*, the Malabar vernacular name in India for *U. lobata*.

Type: *U. lobata* L.

Annual or perennial undershrubs; stems, petioles and pedicels with minute stellate hairs, reddish. Leaves strongly or weakly palmatifid to undivided, with extrafloral nectaries on veins beneath. Flowers solitary or in clusters, axillary. Pedicels not jointed. Epicalyx campanulate to tubular; segments 5, shortly connate, and adnate to calyx at base. Sepals connate at base. Corolla rotate, small, pink. Staminal column c. equal to petals; anthers in upper half. Ovary of 5 carpels; ovules 1 per carpel. Style 1, divided into 10 arms above the

middle; stigmas capitate. Fruit a schizocarp, splitting into 5 indehiscent mericarps with barbed bristles.

A monotypic genus of pantropical distribution, possibly of Asiatic origin; occurs on Christmas Is. It is closely related to and possibly congeneric with *Pavonia* Cav., differing in the presence of barbed bristles (glochidia) on the fruit. Some authors include 3 more species from *Pavonia*, of which 1 is endemic to Australia.

Urena lobata L., *Sp. Pl.* 2: 692 (1753)

subsp. **sinuata** (L.) Borss. Waalk., *Blumea* 14: 143 (1966)

var. **sinuata** (L.) Borss. Waalk., *loc. cit.*

U. sinuata L., *Sp. Pl.* 2: 692 (1753). T: Sri Lanka, Herb. P.Hermann, Vol. 4, fol. 34, LINN. n. 257; lecto: BM, *fide* J. van Borssum Waalkes, *Blumea* 14: 143 (1966). Epithets from the Latin *lobatus* (lobed), in reference to the leaves; and *sinuatus* (strongly waved), in reference to the leaf margin.

Illustration: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 417 (1940).

Annual, spindly, erect, somewhat woody undershrub, to c. 1.5 m tall. Leaves orbicular and palmatifid, often deeply lobed with rounded sinuses and irregularly serrate margin, to triangular with sinuate, crenate margin; lamina 1.5–7 cm long; petiole 0.3–12 cm long; stipules 2–4 mm long, lanceolate. Flowers axillary, raceme-like or panicle-like through reduction of the upper leaves. Pedicel 1–4 mm long. Epicalyx segments linear, 3–4 mm long, spreading to reflexed in fruit. Sepals 5, triangular, acute. Corolla 2–3 cm diam., rich pink; petals obovate, c. 12 mm long, slightly oblique, rounded. Staminal column 10–14 mm long; anthers purple. Style arms 1 mm long; stigmas dark purple. Mericarps trigonous; outer surface convex, with many stiff, barbed bristles.

Christmas Is. Occurs in open patches in the forest, in loose, disturbed soil and with limestone rocks. This variety occurs throughout Malesia, but not in New Guinea, especially at altitudes below 400 m. Above this altitude, varieties of subsp. *lobata* are more common.

Ch.Is.: track to Dolly Beach, *A.Pearson P66* (K); cleared area near Settlement, *B.A.Mitchell 160* (CBG, K); near railway, Central Plateau, *R.Shivas 887* (PERTH); roadside 1 km S of airport, *R.Shivas 954* (PERTH); SW of Murray Hill, *D.J. & B.P.Du Puy CI50* (CBG, K).

A polymorphic species of 2 subspecies each with 2 varieties. Var. *sinuata* differs from the other subspecific taxa in the presence of palmatifid, deeply lobed leaves with serrate segments, and in its spreading to reflexed fruiting epicalyx of linear segments 3–4 mm long. The stems yield tough, jute-like fibres (aramina).

6. MALVASTRUM

Malvastrum A.Gray, *Mem. Amer. Acad. Sci.* ser. 2, 4: 21–22 (1849), *nom. cons.*; from the genus *Malva* and *-astrum* which is a diminutive suffix.

Type: *M. spicatum* (L.) A.Gray

Annual or perennial undershrubs; simple and stellate hairs present. Leaves simple, rarely shallowly lobed, without nectaries. Flowers small, solitary, axillary or in clusters, or in terminal and axillary spikes, sessile or on a short, jointless pedicel. Epicalyx segments 3, small, slightly adnate to base of calyx. Calyx widely campanulate; sepals connate, at least at base. Corolla rotate, yellow. Staminal column shorter than corolla, with many apical filaments. Ovary of 10–15 uni-ovulate carpels. Styles 10–15, connate towards base; stigmas capitate. Fruit a schizocarp; mericarps to 15, flattened, reniform, indehiscent.

A genus of 3 tropical American species, 2 of which are pantropical weeds; 1 occurs on Christmas Is.

***Malvastrum coromandelianum** (L.) Garcke, *Bonplandia* 5: 295 (1857)

Malva coromandeliana L., *Sp. Pl.* 2: 687 (1753). T: Hort. Upsal., Herb. C.Linnaeus 870.3; lecto: LINN, *fide* J. van Borssum Waalkes, *Blumea* 14: 152–153 (1966). Epithet refers to the original collection of this species, made on the Coromandel Coast, peninsular India.

Malva tricuspidata R.Br. in W.T.Aiton, *Hort. Kew.* 2nd edn, 4: 210 (1812); *Malvastrum tricuspidatum* (R.Br.) A.Gray, *Pl. Wright.* 1: 16 (1852). T: as for *M. coromandeliana*.

Illustration: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 413 (1939).

Annual, erect herb or undershrub to 1 m tall; hairs simple and 2–4-armed. Leaves ovate to oblong, coarsely serrate, obtuse to acute; lamina 1–4.5 cm long; petiole 0.5–4 cm long; stipules narrowly lanceolate, 3–7 mm long, acuminate. Flowers solitary at first but with a subtending bud which may produce up to 3 more clustered flowers; pedicel 2–8 mm long. Epicalyx segments linear or narrowly lanceolate, 5–7 mm long, acute. Calyx widely campanulate, with 5 triangular, acuminate segments. Corolla 1.5 cm diam.; petals obliquely obovate, rounded or emarginate, yellow. Staminal column 2–3 mm long, conical. Mericarps usually 10–14, strongly curved; margins angled, with 3 stiff, curved awns and some dorsal hairs.

Christmas Is. Common since the start of this century, and often found on the terraces growing along the tracksides, often with *Sida* species. A pantropical species, probably originating in tropical America.

Ch.Is.: no precise locality, *C.W.Andrews 135* (K); Flying Fish Cove, *H.N.Ridley 89* (K); bush-tracks on the terraces, *D.A.Powell 384* (K).

An afternoon-flowering species, covered in sharp hairs.

7. ABUTILON

Abutilon Mill., *Gard. Dict. Abr.* 4th edn, (1754); from the Arabic *Abutilun*, one of the names for the Mulberry which has leaves resembling many Malvaceous plants.

Type: *A. theophrastii* Medik.

Annual or perennial herbs or shrubs, rarely small trees (not on Christmas Is.); hairs stellate, usually velvety. Leaves simple to lobed, cordate at base, without nectaries. Flowers axillary, solitary, sometimes in loose panicles by reduction of the leaves; pedicel jointed. Epicalyx absent. Calyx usually campanulate; sepals 5, partially connate. Corolla rotate or campanulate, red to yellow. Staminal column often shorter than corolla; base conical, with many apical filaments. Carpels 5–40, each with 2–9 ovules. Styles 5–40, connate towards base; stigmas filiform to capitate. Fruit a schizocarp; mericarps 5–40, bivalved, apically 1- or 2-beaked. Seeds reniform.

A genus of 100–150 species, probably of Old World origin but of pantropical and subtropical distribution; c. 30 species in Australia, 24 of which are endemic; 2 species on Christmas Is., 1 species on the Coral Sea Is. Several species are cultivated as ornamentals.

1 Stipules ovate, to 15 mm long; calyx lobes much shorter than fruit **1. A. auritum**

1: Stipules linear, less than 5 mm long; calyx lobes as long as fruit

2 Flowers in panicles; mericarps 6–8 mm long **2. A. listeri**

2: Flowers solitary; mericarps 10–12 mm long **3. A. asiaticum**

1. Abutilon auritum (Wall. ex Link) Sweet, *Hort. Brit.* 53 (1826)

Sida aurita Wall. ex Link, *Enum. Hort. Berol.* 2: 206 (1822). T: cultivated in the Botanical Garden, Calcutta, origin Java, *N.Wallich* Cat. n. 1860; neo: K-W, *fide* J. van Borssum Waalkes, *Blumea* 14: 165–166 (1966). Epithet from the Latin *auritus* (eared or auriculate).

Illustration: J.Sims, *Bot. Mag.* 51: t. 2495 (1824), a variant with red-striped flowers (as *Sida aurita*).

Strong undershrub, 1–3 m tall. Stems, petioles and pedicels thinly velvety with minute

hairs. Leaves orbicular to ovate, dentate to crenate, acuminate, densely stellate-hairy below, greyish; lamina usually 6–12 cm long; petiole slender, to 10 cm long; stipules to 15 mm long, foliaceous. Flowers often in loose, terminal panicles with leaves very reduced, often only represented by stipules; pedicel with many long, simple hairs above joint. Calyx campanulate; segments 5, ovate, acute, fused in basal half. Petals obovate, c 15 mm long, subacute, yellow. Staminal column 8–10 mm long; anthers clustered at apex. Schizocarp exceeding calyx; mericarps 8–12, 11–12 mm long, with a single, acute apex and some large, stellate hairs. Seeds usually 3.

Christmas Is. Grows on the terraces below Phosphate Hill, usually on open, wooded slopes, and in clearings in closed forest on Toms Ridge. This species has a broad but scattered distribution in Malesia, Australia (Qld), New Guinea and New Caledonia.

Ch.Is.: N of Flying Fish Cove, 1 Oct. 1889, *J.J.Lister* (K); Flying Fish Cove, *H.N.Ridley 100* (K); terraces below Phosphate Hill, *D.A.Powell 364* (K); Toms Ridge, *B.A.Mitchell 159* (CBG, K); Dales Track A, 7 Dec. 1983, *B.Riemann* (CBG).

H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 174 (1906) recorded it as common all around Flying Fish Cove, on the lower terrace, but it appears to be absent there now.

2. **Abutilon listeri** Baker f., *J. Bot.* 31: 269 (1893)

T: Christmas Is., 1 Oct. 1887, *J.J.Lister s.n.*; iso: K. Named in honour of J.J.Lister who collected the type specimen when naturalist on H.M.S. *Egeria* when it visited Christmas Is. in 1887.

Illustration: J. van Borssum Waalkes, *Blumea* 14: 168, fig. 18 (1966).

Elegant shrub, 1–3 m tall. Stems, petioles and pedicels faintly greyish with minute hairs, often glabrescent. Leaves circular to broadly ovate, entire or weakly crenate, long-acuminate, minutely stellate-hairy, often glabrescent; lamina usually 9–16 cm long; petiole 0.5–12 cm long; stipules setaceous, 2 mm long. Flowers often in loose, terminal panicles with many small leaves. Calyx campanulate; segments 5, ovate, apiculate, fused in basal third. Petals obovate, c. 15 mm long, rounded apically, yellow. Staminal column c. 8 mm long; anthers clustered at apex. Schizocarp not exceeding calyx; mericarps 10–14, 6–8 mm long, truncate with 2 divergent, acute points, and some large, coarse, stellate hairs. Seeds usually 2. Figs 19, 38A–C.

Christmas Is. Endemic. Grows in natural clearings and the forest margin behind the sea cliffs on the lower terraces, and is a frequent species in secondary growth and along paths and tracks. Has responded well to environmental disturbance, and is a common shrub.

Ch.Is.: without precise locality, *C.W.Andrews 8* (K); Flying Fish Cove, *H.N.Ridley 101* (K); Waterfall Rd, *A.Pearson P73* (K); shore terrace, South Point, *D.A.Powell 646* (K); Stubbings Point, W of South Point, *B.A.Mitchell 30* (CBG, K).

Closely related to the sympatric *A. auritum*, both having a paniculate inflorescence (although that of *A. listeri* has more small leaves) and fewer than 15 mericarps. However, there is a specimen (Waterfall pumping stn, *D.A.Powell 323*, K) which has an unusual combination of characters. It has many characteristics of *A. listeri*, including small, setaceous stipules, calyx segments as long as the schizocarp, and the mericarps are very similar in both size and shape. However, the pedicels have spreading, simple hairs and the calyx segments are acute, both indicative of *A. auritum*. This suggests that hybridisation may occur, and further investigation of this population is required.

3. **Abutilon asiaticum** (L.) Sweet, *Hort. Brit.* 53 (1826)

var. **australiense** (Hochr. ex Britten) Fosberg, *Micronesica* 2: 150 (1966)

A. indicum var. *australiense* Hochr. ex Britten, *Ill. Bot. Cook's Voy.* 1: 10, t. 20 (1900). T: Bustard Bay, Bay of Inlets, Endeavour R., [Qld], 1770, ?*J.Banks & D.Solander*; syn: all *n.v.* Epithets from the Latin *asiaticus* (Asian) and *australiensis* (Australian), in reference to the locality of the type collection.

[*A. indicum* var. *albescens auct. non* (Miq.) Borss. Waalk.: J. van Borssum Waalkes, *Blumea* 14: 172, fig. 19 (1966)]

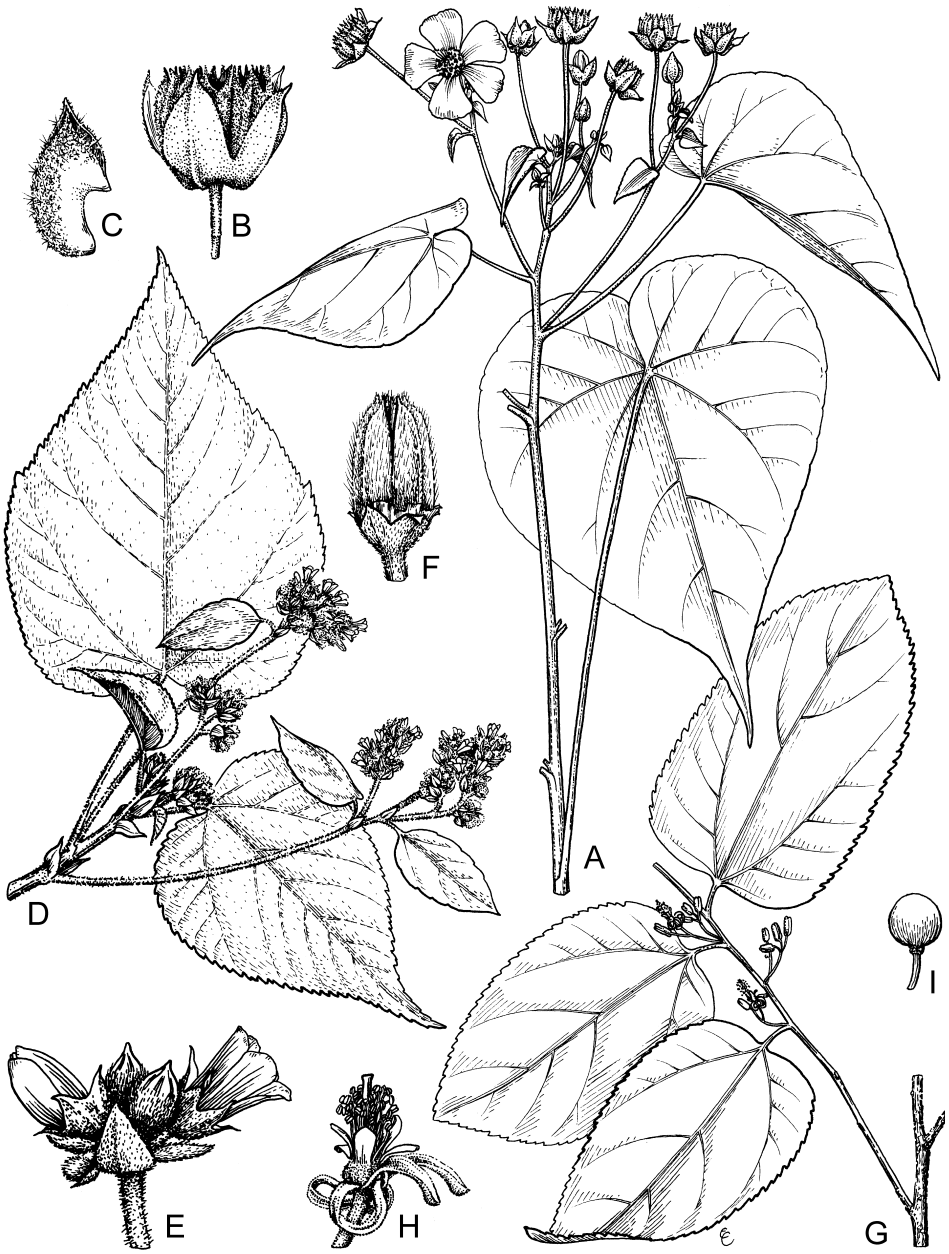

Figure 38. **A–C**, MALVACEAE: *Abutilon listeri*. **A**, flowering branchlet X0.5; **B**, fruit X2; **C**, single mericarp X2.5 (D.Powell 646, K). **D–F**, STERCULIACEAE: *Melochia umbellata*. **D**, flowering branchlet X0.5; **E**, umbel of flowers X2 (**D–E**, D.Powell 76, K); **F**, fruit X2 (A.Pearson P63, K). **G–I**, TILIACEAE: *Grewia insularis*. **G**, flowering branchlet X0.5; **H**, flower X2 (**G–H**, D.Powell 467, K); **I**, fruit X2 (D.Powell 370, K). Drawn by E.Catherine.

Illustration: J. van Borssum Waalkes, *loc. cit.*, as *A. indicum* var. *albescens*; A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 146 (1985), as *A. albescens* Miq.

Annual or perennial subshrub to 3 m, minutely stellate hairy. Leaves ovate, crenate to coarsely dentate, acuminate, paler beneath; lamina 2–16 cm long; petiole 1.5–5 cm long. Pedicel 2.5–12 cm long, articulate 3–12 mm below apex. Calyx broadly campanulate, 10–18 mm long, deeply 5-lobed; lobes ovate, acuminate. Corolla 2.5–5 cm diam., yellow to orange. Schizocarp truncate-subglobose, 1.5–2 cm diam., ±equal to fruiting calyx, dark brown to black; mericarps 15–25, reniform, compressed, 8–12 mm long, blunt, stellate-hairy dorsally. Seeds 2 or 3 per mericarp, reniform, 2–3 mm long, black. *Lantern Flower*.

Coral Sea Is. Grows in shrub and herb communities in coralline sand. Widespread through northern Australia the SW Pacific Ocean.

C.S.Is.: Magdelaine Cay, Oct. 1987, *T.Scotney & W.Jeffs* (CBG); NE Cay, Herald Cays, *I.R.Telford 11532* (AD, BISH, CBG); Coringa Is., Coringa (SW) Is., *I.R.Telford 11527* (AD, BISH, BRI, CBG, US).

Abutilon in the Pacific and NE Indian Oceans requires further study, as demonstrated by R.Fosberg, *Brittonia* 40: 60 (1988). The genus is currently under revision in Australia.

8. SIDA

Sida L., *Sp. Pl.* 2: 683 (1753); *Gen. Pl.* 5th edn, 306 (1754); from the Greek name *Side*, used by Theophrastus for the water lily *Nymphaea alba* L., although the 2 genera are very dissimilar.

Type: *S. rhombifolia* L.

Annual or perennial, prostrate to erect herbs or undershrubs, minutely stellate-hairy. Leaves usually simple, toothed or lobed, without nectaries. Flowers solitary, axillary, or in terminal spikes through reduction of the leaves. Pedicels jointed. Epicalyx usually absent. Calyx 5-toothed, widely campanulate. Corolla rotate, small, usually yellow. Staminal column usually shorter than corolla with many apical filaments. Ovary of 5–12 uni-ovulate carpels. Style 1, with as many branches as the carpel number. Fruit a schizocarp; mericarps 5–12, trigonous, usually aristate or biaristate.

In the broad sense the genus contains 150–200 species; about 100 are restricted to the New World with some endemism in Africa, SE Asia, Australia (2 species) and the Pacific islands. It has a pantropical and subtropical distribution; 3 species in our area, 1 on Christmas Is., 1 on Christmas and Cocos (Keeling) Islands, and 1 on Ashmore Reef.

It has been suggested that the genus may be polyphyletic. The genus is under revision with many Australian species previously placed in *Sida* to be transferred to other genera. *Sida s. str.* is followed in this treatment.

The 2 species on Christmas Is. are regarded as a nuisance because of their sharp-awned seeds.

W.Marais, Notes on Mascarene Malvaceae, *Kew Bull.* 38: 41–44 (1983); P.A.Fryxell, Sidus Sidarum vii–The genus *Sida* (Malvaceae) in Australia, *Sida* 12: 22–27 (1987).

1 Plant prostrate or decumbent; leaves less than 2 cm long **3. S. pusilla**

1: Plant erect; leaves usually more than 2 cm long

2 Stipules unequal, one linear-lanceolate, one narrower and shorter; pedicels less than 8 mm long; mericarps 5–9, each with 2 awns **1. S. acuta**

2: Stipules equal, filiform; pedicels elongating, up to 30 mm in fruit; mericarps usually 11 or 12, with a single awn **2. S. rhombifolia**

1. Sida acuta Burm.f., *Fl. Ind.* 147 (1768)

T: Java, *coll. unknown s.n.*; *n.v.* Epithet from the Latin *acutus* (acute, pointed).

[*S. spinosa auct. non* L.: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 174 (1906)]

Illustration: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 414 (1939).

Erect to ascending, annual undershrub, to 1.5 m tall, sparsely stellate hairy, soon glabrescent. Leaves distichous, narrowly ovate to elliptic, serrate, acute; lamina to 5 cm long, 3 cm wide; petiole 3–6 mm long; stipules c. 4 mm long, one linear-lanceolate, the other narrower and shorter. Flowers axillary, solitary, or often in clusters of c. 3, by the development of a subtending bud; pedicel 2–8 mm long, extending slightly in fruit. Calyx segments long, acuminate. Corolla 12–15 mm diam.; petals obovate, oblique, emarginate, yellow. Schizocarp c. 4 mm across; mericarps 5–9, with 2 sharp apical awns.

Christmas Is., Cocos (Keeling) Is. Grows commonly alongside roads and tracks. Apparently pantropical, occurring throughout Malesia and northern Australia.

Ch.Is.: Flying Fish Cove, *H.N.Ridley 88* (K); Murray Hill area, Toms Ridge, *B.A.Mitchell 147* (CBG, K); track to the Dales, 7 Dec. 1983, *B.Riemann* (CBG, K). C.K.Is.: E end of railway, North Keeling Is., *D.G.Williams 49* (CBG, K, PERTH); 250 m E of landing place, North Keeling Is., *D.G.Williams 174* (AD, BISH, CBG).

The ephemeral flowers appear to open only in the morning. Some specimens differ from the description given by J. van Borssum Waalkes, *Blumea* 14: 186 (1966), in the slightly fewer (5 or 6) mericarps in each fruit. This small number is typical for the species as described by W.Marais, *Kew Bull.* 38: 41–44 (1983).

2. Sida rhombifolia L., *Sp. Pl.* 2: 684 (1753)

subsp. **rhombifolia**

T: Herb. Hort. Cliff. 346, *Sida* 1; lecto: BM, *fide* J. van Borssum Waalkes, *Blumea* 14: 196 (1966). Epithet from the Latin *rhombeus* (rhombic) and *folium* (a leaf).

Illustrations: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 415 (1939); J. van Borssum Waalkes, *Blumea* 14: 194, fig. 21a–d (1966).

Erect to ascending annual undershrub, to 1.5 m tall; stems, petioles and leaves with many minute, stellate hairs. Leaves alternate, narrowly elliptic, serrate, obtuse to acute; lamina to 6 cm long, 2 cm wide; petiole 3–5 mm long; stipules c. 5 mm long, filiform, equal. Flowers axillary, usually solitary; pedicel c. 3 mm long before anthesis, extending to c. 30 mm in fruit. Calyx segments shortly acuminate. Corolla 15–17 mm diam.; petals obovate, oblique, emarginate, yellow. Schizocarp c. 6 mm diam.; mericarps usually 11 or 12, each with a single, sharp, apical awn.

Christmas Is. Very common where natural vegetation has been cleared. Apparently frequent throughout the tropical and subtropical regions of the Old and New World; common throughout Malesia.

Ch.Is.: without precise locality, *D.A.Powell 381* (K); SW perimeter cliff top, *N.M.Wace* C12 (CBG, K); Dales track, *B.Riemann 26* (CBG).

There are some problems in naming this taxon correctly. It differs from the description of *S. rhombifolia*, given by J. van Borssum Waalkes, *Blumea* 14: 193 (1966), in that the mericarps each have only 1 awn instead of 2. However, the Malesian specimens at Kew all have a single awn, and the description by J. van Borssum Waalkes therefore appears to be erroneous on this point. The treatment by W.Marais, *Kew Bull.* 38: 41–44 (1983), includes a key based on awn number and mericarp number. The specimen from Christmas Is. keys out as *S. retusa* L., but the leaf shape differs greatly from the type specimen of *S. retusa* (Herb. C.Linnaeus 866.7; holo: LINN).

This and the previous species occupy similar habitats and can often be found growing together. This species has many medicinal uses in Malaya, and the leaves may be used as a tea substitute.

3. Sida pusilla Cav., *Diss.* 1: 6, t. 1, fig. 4 (1785)

T: *n.v.* Epithet is the Latin for very small or insignificant.

Sida parvifolia DC., *Prodr.* 1: 461 (1824). T: Reunion (Bourbon), *J.B.G.G.M.Bory s.n.*; holo: G-DC, *fide* J. van Borssum Waalkes, *Blumea* 14: 192 (1966).

Prostrate to decumbent perennial herb or subshrub, to 60 cm high, minutely stellate hairy. Leaves narrowly elliptic to ovate, serrate, obtuse, paler beneath; lamina 5–15 mm long; petiole 2–3 mm long. Pedicel 2–10 mm long, articulate towards apex. Calyx broadly campanulate, 3–5 mm long, 5-lobed; lobes triangular, acute. Corolla c. 6 mm diam., yellow. Mericarps 5, trigonous, c. 2 mm long, with 2 short apical spines. Seeds ovoid, c. 1 mm long, glabrous, black.

Ashmore Reef. Grows on all islets in herbfield often as the dominant species, in coralline sand. Widespread on islands of the northern Indian and western Pacific Oceans from the Philippines S to the Mascarene Is., E through Malesia; also in coastal north-western Australia.

A.R.: West Is., 26 Oct. 1987, *M.D.Hinchley* (CBG); East Is., 12 Mar. 1986, *A.Grant* (CBG).

25. LECYTHIDACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees or erect shrubs. Leaves alternate, often crowded towards branchlet tips, simple; stipules absent or minute. Inflorescence a terminal or axillary spike, raceme or panicle, or flowers solitary. Flowers usually showy, actinomorphic or zygomorphic, bisexual; perianth and stamens epigynous. Calyx usually 4–6-lobed, or splitting into 2–5 segments. Petals 4–6, free or basally connate, often adnate to staminal tube, imbricate. Torus broad; intrastaminal disc sometimes present. Stamens many, often brightly coloured, in several whorls, connate basally into a short tube, sometimes in 2 unequal bundles arranged zygomorphically; anthers longitudinally dehiscent. Ovary inferior or half-inferior, usually 2–6-locular; ovules 1–many per locule; style solitary, entire, usually exserted. Fruit usually with a thick, fibrous mesocarp, a large berry or a woody capsule with an apical, operculate pore, often with persistent, apical calyx lobes. Seeds 1–many, sometimes nut-like or winged, usually without endosperm.

A family of c. 20 genera and c. 450 species, centred in tropical America, with some genera in Old World; 1 genus, with 1 species on each of Christmas and Cocos (Keeling) Islands. The Old World genera are sometimes separated as the family Barringtoniaceae. *Bertholletia excelsa* Humb. & Bonpl. (Brazil Nut) produces many nut-like seeds inside a large spherical, woody capsule.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Lecythidaceae, *Fl. Java* 1: 351–354 (1963); R.J.Henderson, Lecythidaceae, *Fl. Australia* 8: 1–6 (1982).

BARRINGTONIA

Barringtonia J.R.Forst. & G.Forst., *Char. Gen. Pl.* 75, t. 38 (1776), *nom. cons.*; after D.Barrington (1727–1800), English jurist, antiquary, botanist and naturalist.

Type: *B. speciosa* J.R.Forst. & G.Forst. = *B. asiatica* (L.) Kurz

Trees or shrubs. Stipules minute, caducous. Inflorescence usually a terminal raceme or spike; bracts small, caducous; buds spherical. Calyx splitting into 2–5 equal or unequal,

persistent segments, or 4-lobed, sometimes circumscissile leaving a cup-shaped ring. Petals usually 4, adnate basally to staminal tube. Disc annular, surrounding style base. Stamens very numerous, exserted, showy, connate basally, the inner whorls staminodal. Ovary inferior, 2–4-locular, each locule with c. 2–6 ovules; style solitary, filiform, exserted, persistent; stigma slightly dilated. Fruit obovoid to ellipsoidal, terete, 4-angled or 4-winged, often with a thick, fibrous mesocarp, indehiscent. Seed 1, large.

A genus of c. 40 species, distributed from E Africa and Madagascar, through SE Asia and Malesia to Australia and the Western Pacific islands; 1 species on Christmas Is., 1 species on Cocos (Keeling) Is. The large, fibrous fruits float well and are water-dispersed, both by sea and inland waterways.

J.P.D.W.Payens, A Monograph of the genus *Barringtonia* (Lecythidaceae), *Blumea* 15: 157–263 (1968)

Inflorescence erect; stamens 8–15 cm long; fruit 8–11 cm long; leaves entire **1. B. asiatica**

Inflorescence pendulous; stamens 2–4 cm long; fruit 5–9 cm long; leaves serrulate **2. B. racemosa**

1. Barringtonia asiatica (L.) Kurz, *Prelim. Rep. Forest Pegu* App. A: lxv, App. B: 52 in Key (1875)

Mammea asiatica L., *Sp. Pl.* 1: 512 (1753). T: Prinsen Is., W Java, *P.Osbeck s.n.*; holo: LINN; iso: S, *fide* J.Payens, *Blumea* 15: 198 (1968). Epithet from Asia and the Latin suffix *-atica* (indicating place of growth).

Tree to 20 m tall, eventually with large horizontal branches. Leaves subsessile, obovate, cuneate at base, entire, emarginate, coriaceous; lamina 20–40 cm long. Racemes terminal, erect, with 3–7 large flowers. Calyx splitting into 2 enlarging lobes, 3–4 cm long. Petals 4, oblong-elliptic, 5.5–8.5 cm long, white. Stamens many, showy, 8–15 cm long, white becoming red apically. Style 9–15 cm long, filiform, persistent. Fruit pyramidal, 8.5–11 cm long, 4-angled, glossy, thickly spongy and fibrous; calyx and style persistent at apex. *Putat Laut*, *Sea Putat*.

Cocos (Keeling) Is. Grows on the lagoon margin of the main atoll in strand forest with *Calophyllum inophyllum*. Widespread from Madagascar, through SE Asia and Malesia, to NE Australia and the Pacific islands.

C.K.Is.: near settlement, West Is., *I.R.Telford 10041 & C.Howard* (AD, CBG, K); West Is., *D.G.Williams 110* (CBG).

Flowers are nocturnal and pollinated by moths. Fruits are sea dispersed and sometimes washed up on the beaches. Cultivated on Christmas Is. The pounded, fresh seeds may be used as fish poison.

2. Barringtonia racemosa (L.) Spreng., *Syst. Veg.* 3: 127 (1826)

Eugenia racemosa L., *Sp. Pl.* 1: 471 (1753). T: Sri Lanka, Herb. P.Hermann vol. 5, fol. 212, 213, 339; syns: BM, *fide* J.P.D.W.Payens, *Blumea* 15: 195 (1968). Epithet from the Latin *racemus* (in reference to the inflorescence) and the suffix *-osus* (indicating abundance).

[*B. rubra auct. non* Miq.: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 192–193 (1906)]

Illustration: V.H.Heywood (ed.), *Fl. Pl. World* 99 (1978).

Tree to 30 m tall. Leaves clustered, elliptic to obovate, cuneate at base, acute or shortly acuminate, glabrous, dark green, glossy; lamina 10–40 cm long; petiole 5–15 cm long, narrowly winged. Racemes usually terminal, 20–80 cm long, pendulous; pedicels 3–15 mm long. Calyx entire in bud, splitting into 2–5 lobes c. 10–12 mm long, enlarging. Petals 4, oblong-elliptic, obtuse, c. 15–25 mm long, whitish. Disc c. 4 mm diam. Stamens prominent, c. 6-whorled; inner whorl staminodal; filaments 25–40 mm long, pale yellow or deep pink. Ovary usually 4-locular; style 3–5 cm long, persistent. Fruit ovoid, 5–7 cm long, weakly 4-angled, truncate; calyx and style persistent; mesocarp spongy, fibrous. *Putat*.

Christmas Is. One of the largest forest trees, forming about 17% of the primary forest canopy. It is most common above c. 150 m alt., but occurs down to the shore terrace on the

south-eastern side of the island. Also widespread from E Africa and Madagascar, through SE Asia and Malesia to NE Australia and the Pacific islands.

Ch.Is.: Flying Fish Cove, shore cliff, *C.W.Andrews 27* (K); Phosphate Hill, *H.N.Ridley 54* (K); northern plateau, *D.A.Powell 26* (K); South Point Rd, *A.Pearson P55* (K); plateau SW of Hanitch Hill, *B.A.Mitchell 41* (CBG).

The flowers have either pink or pale yellow stamens, but no other differences can be found to distinguish separate taxa. The corolla and stamens fall in a single unit and can often be found on the forest floor. The fruits are not eaten by animals and are dispersed by tumbling down the slopes onto which they fall. They are also found washed up on beaches.

26. FLACOURTIACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Shrubs, trees or (not in our area) climbers, sometimes dioecious. Leaves alternate or (not in our area) opposite or verticillate, simple; stipules present or (not in our area) absent. Inflorescence a supra-axillary cluster or (not in our area) a terminal or axillary raceme or panicle, or flowers solitary. Flowers actinomorphic, 2- to polymerous, bisexual or (not in our area) unisexual. Sepals united or (not in our area) free. Petals usually as many as and alternating with sepals or (not in our area) absent. Receptacle usually expanded into a disc. Stamens many or (not in our area) as many as petals; anthers 2-locular, dehiscing longitudinally. Ovary usually superior, 2–10-carpellate, 1-locular or appearing 2–10-locular by intrusion of the placentas; placentation usually parietal; ovules 2 to many; styles 1–10. Fruit a berry or (not in our area) a drupe, capsule or dry and indehiscent. Endosperm present.

A family of 90 genera and c. 1300 species, mainly tropical and subtropical; 1 species cultivated and naturalised on Christmas Is. and Cocos (Keeling) Is.

A.Cronquist, *An Integrated System of Classification of Flowering Plants* 349 (1981).

MUNTINGIA

Muntingia L., *Sp. Pl.* 1: 509 (1753); *Gen. Pl.* 5th edn, 225 (1754); named after the 17th century Dutch botanist, Abraham Munting.

Type: *M. calabura* L.

Small trees; with stellate hairs. Leaves alternate, serrate; base strongly oblique; stipules unequal, caducous. Flowers supra-axillary, in groups of 2 or 3. Sepals 5, connate at base. Petals 5, free, with a short claw. Disc cup-shaped, densely pilose along top margin. Stamens many, free. Ovary with 5–7 locules, each with many ovules. Stigma sessile, thick, bilobed or grooved. Fruit a berry, usually 6-locular, with many seeds.

A genus of 3 species from tropical America, 1 of which is naturalised on Christmas Is. and Cocos (Keeling) Is. *Muntingia* has usually been placed in family Elaeocarpaceae, but sometimes in Tiliaceae. It was transferred to Flacourtiaceae by A.Cronquist, *An Integrated System of Classification of Flowering Plants* 349 (1981).

*Muntingia calabura L., *Sp. Pl.* 1: 509 (1753)

T: Herb. Hort. Cliff. 202, *Muntingia* 1; holo: BM. Derivation of epithet not known.

Illustration: E.J.H.Corner, *Wayside Trees of Malaya* 2: t. 184 (1940).

Shrub or small tree, densely covered in a soft indumentum of stellate and glandular hairs, somewhat viscid. Leaves distichous, overlapping, narrowly ovate, serrate, acute to shortly acuminate, softly pubescent especially beneath; base strongly unequal with one side cordate, the other obtuse; lamina 5–12 cm long, 2–4.5 cm wide; petiole 3–6 mm long, articulated, with a dense tuft of hairs near base; stipules 4, linear, 1.5 mm long. Flowers 1.5–2 cm across. Sepals long-acuminate, c. 12 mm long, reflexed, exceeding corolla. Petals broadly obovate, 7–8 mm long, somewhat crumpled, white. Ovary shortly stalked, flask-shaped. Berry globose, 8–10 mm diam., red; seeds yellow, immersed in pulp. *Buak Cheri, Bird Cherry*.

Christmas Is., Cocos (Keeling) Is. Cultivated and now naturalised on Christmas Is. It grows as a pioneer species on mined areas, in marginal and open forest, and is most common above c. 150 m alt. Also cultivated on Cocos (Keeling) Is. and now naturalised. Often cultivated in SE Asia. Native of tropical America.

Ch.Is.: Drumsite, *D.A.Powell 46* (K); central area quarry, *R.Shivas 893 A* (PERTH); central plateau area, vicinity of Field 20, *B.A.Mitchell 122* (CBG, K). C.K.Is.: near settlement, West Is., *I.R.Telford 9971 & C.Howard* (AD, CBG, K, PERTH); near S end of airstrip, West Is., *A.S.George 16237* (CBG, K).

The red fruit, reminiscent of cherries, are edible and sweet. A rapidly growing shrub, often planted for shade as well as for the fruit.

27. BIXACEAE

D.J.Du Puy (Ch.Is.)

Small trees or shrubs. Leaves alternate, spirally arranged; stipules present, caducous. Flowers large, bisexual, somewhat zygomorphic, in terminal panicles. Sepals 4 or 5, free. Petals 5, sometimes 4–7, free, imbricate. Stamens many, free, on an annular, hypogynous disc; anthers bilocular. Ovary superior, unilocular, usually with 2 fused carpels and parietal placentation; style simple, with a 2-lobed stigma. Fruit a loculicidal capsule. Seeds many; endosperm present.

A pantropical family containing 3 genera and c. 25 species (sometimes treated as 2 families with 2 genera placed in the Cochlospermaceae); concentrated in America; 2 genera (1 naturalised) occur in Australia; the naturalised genus (1 species) also on Christmas Is.

A.S.George, Bixaceae, *Fl. Australia* 8: 84–88 (1982).

BIXA

Bixa L., *Sp. Pl.* 1: 512 (1753); *Gen. Pl.* 5th edn, 581 (1754); a Latin corruption of *Biche*, the Brazilian name for *B. orellana*.

Type: *B. orellana* L.

Trees or shrubs. Leaves simple, entire; sepals caducous, alternating with large, glistening, sessile glands at apex of pedicel. Petals slightly unequal. Ovary densely setose. Stamens many; anthers horseshoe-shaped, folded over top of filament, with an apparent apical pore. Capsule bristly. Seeds glabrous; testa very densely studded with small, sessile, red glands.

Usually considered to be monotypic. Native to tropical America and the West Indies; introduced on Christmas Is.

C.A.Backer, *Fl. Males.* ser. I, 4: 239–241 (1951).

***Bixa orellana** L., *Sp. Pl.* 1: 512 (1753)

T: Herb. Hort. Cliff. 211, Bixa 1; lecto: BM, *fide* D.O.Wijnands, *Bot. Commelins* 51 (1983). Epithet named in honour of Francisco de Orellana, 16th century Spanish soldier and first explorer of the Amazon River.

Illustrations: C.A.Backer, *op. cit.* 240, 241, figs 1, 2 (1951); S.R.Chant in V.H.Heywood (ed.), *Fl. Pl. World* 106 (1978).

Small trees, 2–8 m high; young twigs densely covered in rust-brown scales, glabrescent; sap reddish. Leaves ovate to cordate, acuminate, scaly beneath at first, densely red-dotted; lamina c. 10–15 cm long, 7–10 cm wide; petiole c. 5–10 cm long, slender; stipules 6–10 mm long. Inflorescence 8–50-flowered. Flowers 4–6 cm diam.; pedicel 8–10 mm long, scaly, with apical glands. Sepals obovate, obtuse, concave, densely rusty-scaly. Petals obovate, 2–3 cm long, white or pinkish, red-dotted outside. Anthers violet. Capsule ovoid, c. 4–5 cm long, bivalved, compressed contrary to the placentas, covered with many red bristles. Seeds 4–5 mm long, red.

Christmas Is. Introduced around 1970 from tropical America as an ornamental. At Drumsite the seeds have been carried down drainage channels and spontaneous seedlings are present.

Ch.Is.: no precise locality, *D.A.Powell 449* (K).

The testa of the seed is a source of a reddish yellow dye (anatto) which is no longer used as a fabric dye, but in Malesia is still used to colour food-stuffs such as cheese and butter.

28. TURNERACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Herbs, shrubs or small trees, usually variously pubescent. Leaves alternate, petiolate, simple, usually glandular-dentate; stipules small or absent. Inflorescence axillary, cymose, capitate or flowers solitary. Flowers actinomorphic, bisexual. Calyx tubular, 5-lobed. Petals 5, free, clawed, inserted in or at mouth of calyx tube and alternating with lobes. Stamens 5, inserted in calyx tube, alternating with petals; filaments usually adnate to calyx tube; anthers 2-locular, dehiscing longitudinally. Ovary superior, surrounded by calyx tube, 3-carpellate, 1-locular; placentation parietal; ovules 3–many per carpel, anatropous; styles 3, short or long in different flowers; stigmas 3, usually many-lobed. Fruit a 3-valved capsule, loculicidal, 3–many seeded. Seed with a funicular aril; endosperm copious.

A family of 8 genera and c. 120 species of tropical and subtropical America, Africa, Madagascar and the Mascarene Islands; 1 genus with 1 species naturalised on Christmas Is. and Cocos (Keeling) Is.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Turneraceae, *Fl. Java* 1: 179–180 (1963).

TURNERA

Turnera L., *Sp. Pl.* 1: 271 (1753); *Gen. Pl.* 5th edn, 131 (1754); honouring William Turner (1508?–1568), English clergyman and herbalist, sometimes called 'Father of English botany'.

Type: *T. ulmifolia* L.

Annual or perennial herbs, shrubs or (not in our area) small trees. Leaves dentate to serrate, 2 glands at base of lamina, gland-dotted beneath; stipules sometimes present. Flowers usually solitary, rarely in cymes or heads, bracteolate; pedicels usually adnate to petiole. Calyx lobes acute. Petals obovate, sometimes dentate. Stamens inserted towards base of

calyx tube; lower part of filaments adnate to tube, homostylous or heterostylous. Stigmas many-lobed. Capsule broadly ovoid, many-seeded. Seed cylindrical, curved, ribbed; aril along one side.

A genus of c. 60 species, mainly of tropical America and the West Indies, with 1 species in western Africa; 1 species naturalised on Christmas Is. and Cocos (Keeling) Is.

***Turnera ulmifolia** L., *Sp. Pl.* 1: 271 (1753)

T: described from Jamaica and tropical America; *n.v.* Epithet from the genus *Ulmus* and the Latin *folium* (a leaf) referring to the resemblance of the leaf to that of the elm.

Erect herb or shrub to 1 m; stems silky. Leaves lanceolate to ovate, serrate, acute, puberulous; lamina 4–12 cm long, 1–3 cm wide; petiole 7–20 mm long. Pedicel free for 3–5 mm, the free part obconical; bracteoles narrowly lanceolate, 8–35 mm long, serrate. Calyx 20–25 mm long. Petals 22–25 mm long, bright yellow. Styles similar in all flowers. Capsule 9–10 mm long, silky. Seed c. 3 mm long. Figs 39A–B, 57.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. a common weed of track and road verges. On Cocos (Keeling) Is. common in *Cocos* plantations and disturbed sites in calcareous sand.

Ch.Is.: Murray Hills area, Toms Ridge, *B.A.Mitchell 148* (CBG, K). C.K.Is.: near settlement, West Is., *I.R.Telford 9964 & C.Howard* (AD, CBG); E side of airstrip, West Is., *A.S.George 16241* (CBG, K).

29. PASSIFLORACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Herbs or shrubs, mostly climbing, with axillary tendrils, rarely succulent. Leaves alternate, simple, lobed or digitate, often with petiolar glands; stipules usually small, caducous. Inflorescence an axillary cyme, 1–many-flowered, sometimes resembling a raceme. Flowers actinomorphic, usually bisexual, with a cup-shaped to tubular hypanthium, sometimes with an involucre. Sepals and petals commonly 5, free or basally connate, imbricate, perigynous. Corona present inside the perianth, whorls on hypanthium rim, consisting of 1 or more whorls of filaments or scales, sometimes membranous. Stamens often 5, frequently adnate to gynophore; anthers longitudinally dehiscent. Ovary superior, usually on a gynophore or androgynophore, unilocular; ovules many, usually on 3 parietal placentas. Styles usually 3, sometimes partially connate; stigmas capitate. Fruit a 3-valved capsule, dehiscing longitudinally, or a berry, with many arillate seeds; endosperm present.

A pantropical and subtropical family of c. 10 genera and c. 500 species, with a centre of diversity in the New World, typically occurring in secondary vegetation. One genus (1 species) naturalised on Christmas Is. and Cocos (Keeling) Is. Many species produce cyanogenic glucosides and are poisonous, although several species of *Passiflora* have edible fruits. *Passiflora* species are widely cultivated for their unusual showy flowers as well as for fruit.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Passifloraceae, *Fl. Java* 1: 288–292 (1963); W.J.J.O. de Wilde, Passifloraceae, *Fl. Males.* ser. I, 7: 405–434 (1972); D.R.Satterthwait, Passifloraceae, *Fl. Australia* 8: 147–158 (1982).

Figure 39. **A–B**, TURNERACEAE: *Turnera ulmifolia*. **A**, flowering shoot X0.5; **B**, fruit and leaf base X0.5 (**A–B**, A.Pearson P60, K). **C–E**, CUCURBITACEAE: *Zehneria alba*. **C**, flowering stem X0.5; **D**, male flower X4 (**C–D**, D.Powell 223, K); **E**, fruit X0.5 (Christmas Is., J.Lister, K). **F–I**, RANUNCULACEAE: *Ranunculus crassipes*. **F**, habit X1; **G**, flower X2.5; **H**, petal X4 (**F–H**, R.Seppelt 12530, CANB); **I,** achene X4 (N.Laird, 2 Sept. 1948, CANB). **J–L**, SAPOTACEAE: *Planchonella nitida*. **J**, flowering branchlet X0.5; **K**, flower, X4 (**J–K**, B.Mitchell 201, K); **L**, seed X1 (D.Powell 20, K). **A–E** & **J–L** drawn by E.Catherine. **F–I** drawn by D.Boyer.

PASSIFLORA

Passiflora L., *Sp. Pl.* 2: 955 (1753); *Gen. Pl.* 5th edn, 410 (1754); from the Latin *passio* (passion) and *flos* (a flower), from the symbolistic resemblance of parts of the flower and plant to elements of the Crucifixion.

Type: *P. incarnata* L.

Climbing herbs or shrubs; tendrils simple, coiling. Leaves simple, lobed or digitate; stipules minute to foliaceous. Flowers often showy, usually solitary or paired, usually 5-merous, bisexual, often subtended by a trimerous involucre. Sepals and petals similar, mostly free, often brightly coloured. Corona with 1 or 2 outer whorls of many filaments, and 1–several inner whorls which often enclose a nectariferous chamber. Stamens usually 5, partially adnate to androgynophore; filaments becoming reflexed apically. Ovary subspherical, on androgynophore above point of insertion of stamens. Styles 3, spreading; stigmas capitate. Fruit a subspherical berry. Seeds many, pitted; aril fleshy to mucilaginous. *Passion Flower*, *Passion Fruit*, *Granadilla*.

A genus of c. 370 species, all except c. 20 native to the New World; there are no native species in Africa. Several species have become widely naturalised, including the 1 species on Christmas Is. and Cocos (Keeling) Is. Several species have edible fruits, such as *P. edulis* Sims (Passion Fruit, Purple Granadilla) and *P. quadrangularis* L. (Giant Granadilla), and are commercially grown for juice production. Many more are grown as ornamentals, including *P. caerulea* L. with blue flowers, and *P. racemosa* Brot., and *P. cinnabarina* Lindl., both with red flowers, the latter being native to Australia.

P.S.Green, *Passiflora* in Australasia and the Pacific, *Kew Bull.* 26: 539–558 (1972).

***Passiflora foetida** L., *Sp. Pl.* 2: 959 (1753)

T: West Indies, Herb. C.Linnaeus 1070.24; holo: LINN. Epithet from the Latin for stinking or foul-smelling, due to the many glandular hairs which occur on this species, making the foliage acrid.

Illustrations: F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra*, *Kew Bull. Add. Ser.* 7: 139, fig. 20 (1980); D.R.Satterthwait, *Fl. Australia* 8: 211, fig. 43 (1982).

Climbing shrub to c. 5 m tall; tendrils axillary; stems and leaves hirsute with scatttered glandular hairs. Leaves 3-lobed, ciliate, cordate at base, acute, sparsely hirsute; lamina c. 6–12 cm long; petiole c. 1–5 cm long, hirsute; stipules laciniate, segments filiform and glandular. Flowers usually solitary, ephemeral; involucre trimerous, finely bipinnatisect, glandular, c. 3–3.5 cm long; pedicel c. 3–4 cm long. Sepals 5, oblong, 1–2 cm long, mucronate, greenish-white. Petals 5, oblong, 1–2 cm long, white. Outer corona filaments c. 10–12 mm long, purple with white tips. Androgynophore c. 6 mm long. Ovary ellipsoidal, 3 mm long; styles 5 mm long, spreading. Fruit spherical, c. 1.5–2 cm diam., with 3 distinct segments, orange, enclosed in persistent involucre. *Stinking Passion Flower*, *Wild Passion Fruit*.

Christmas Is., Cocos (Keeling) Is. Common in disturbed ground and along roads, often forming a dense cover over rocks, shrubs and small trees. Native to the West Indies and S America, now widely naturalised in many tropical regions, including Australia.

Ch.Is.: Rocky Point, *D.A.Powell P25* (K); central plateau, alongside railway, *B.A.Mitchell 117* (CBG, K); on first terrace near the Grotto, *R.Shivas 870* (PERTH). C.K.Is.: near jetty, Ujong Tanjong, West Is., *I.R.Telford 10002 & C.Howard* (CBG); Ujong Tanjong, West Is., *D.G.Williams 63* (CBG, K, PERTH).

The foliage of this species has cyanogenic properties and is probably poisonous to grazing animals. However, the foetid smell usually deters them from eating it.

30. CARICACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Shrubs or small trees, usually dioecious; stems usually unbranched, soft, with lactifers bearing milky sap. Leaves alternate, simple, usually palmately lobed, large, exstipulate; petiole long. Inflorescence an axillary cyme or panicles or flowers solitary. Flowers actinomorphic, usually unisexual; sepals 5, ±free; corolla 5-lobed. Male flowers: corolla long-tubular; stamens usually 10, epipetalous; anthers dehiscing adaxially. Female flowers: corolla shortly tubular; ovary superior, 5-locular; placentation parietal; ovules many; styles 5, free; stigmas 5, broad. Fruit a large, fleshy berry. Seeds many; endosperm oily; embryo straight.

A family of 5 genera and c. 30 species of tropical America and Africa; 1 genus (1 species) naturalised on Christmas Is. and Cocos (Keeling) Is.; also sporadically so in tropical mainland Australia. Several species of *Carica* are cultivated for edible fruit.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Caricaceae, *Fl. Java* 1: 314 (1963).

CARICA

Carica L., *Sp. Pl.* 2: 1036 (1753); *Gen. Pl.* 5th edn, 458 (1754); from the Latin for a kind of fig, which the leaves and fruit of the type species somewhat resemble.

Type: *C. papaya* L.

Small trees or shrubs, usually dioecious; stems usually columnar. Leaves usually grouped towards stem apex, palmately 7–9-lobed. Male flowers in cymose panicles, sometimes with some polygamous flowers; flowers congested towards branch apices, sessile. Female flowers solitary or in 2- or 3-flowered cymes; ovary ovoid, ±5-lobed; stigmas large, fimbriate. Berry large, hollow.

A genus of c. 20 species of tropical and subtropical Central and South America; 1 species naturalised on Christmas Is. and Cocos (Keeling) Is. Several species, particularly *C. papaya* (pawpaw, papaya) and *C. pentagona* (babaco) are cultivated widely in tropics and subtropics for their edible fruit. The latex yields the enzyme papain.

***Carica papaya** L., *Sp. Pl.* 2: 1036 (1753)

T: Herb. C.Linnaeus 1190.1; syn: LINN. Epithet probably from a common name for the fruit of this species, originating in the West Indies.

Illustrations: A.B.Graf, *Tropica* 3rd edn, 291, 459, 475 (1981).

Tree to 6 m; stems marked by leaf scars. Leaves suborbicular in outline, glabrous, paler or glaucous beneath; lamina 25–75 cm diam.; lobes pinnatifid, obtuse, acute or acuminate; petiole 25–100 cm long, hollow. Male flowers: inflorescence a long-pedunculate pendulous panicles to 70 cm long; corolla tube 16–25 mm long; corolla lobes ovate, obtuse, 12–15 mm long, cream. Female flowers: cymes 1–3-flowered, shortly pedunculate; corolla lobes ovate, obtuse, 45–55 mm long, cream. Fruit ellipsoidal, 10–25 cm long, 7–15 cm diam., yellow or yellow-green. Seeds c. 4 mm long, black. *Pawpaw*, *Papaya*.

Christmas Is., Cocos (Keeling) Is. Established along roadsides and bush tracks throughout Christmas Is. On Cocos (Keeling) Is., naturalised only on North Keeling Is. in disturbed *Pisonia grandis* forest on calcareous sand and coral rubble. Also naturalised in tropical coastal N.T. and Qld. Native to Central America, but origin uncertain because of long history of cultivation.

Ch.Is.: without precise locality, *D.A.Powell 669* (K). C.K.Is.: North Keeling Is., *I.R.Telford 10021 & C.Howard* (CBG); 100 m E of landing place, North Keeling Is., *D.G.Williams 40* (CBG, K).

On Christmas Is., the fruits are prone to attack by fruit flies, unless picked just before they are fully ripe. They are also eaten by the fruit bat, which distributes the seeds.

This species can maintain very rapid growth, and can bear fruit in less than a year from seed. The flowers are moth-pollinated. The fruit is ripened on the bare stem below the apical crown of leaves in the female plant, often with a sequence of developing fruits apparent. The flesh of the fruit is usually orange, and is juicy and sweet, although selected cultivars maintained in cultivation bear better quality fruit with more flavour. The sticky latex present throughout the plant contains papain, a proteolytic enzyme which helps to tenderise meat. This is extracted in commercial quantities for meat canning in some regions. Meat wrapped in a papaya leaf, or cooked with a portion of an unripe fruit, becomes more tender. The latex can also be used to dress wounds.

31. CUCURBITACEAE

I.R.H.Telford (Ch.Is.)

Annual or perennial herbs, rarely woody, usually climbing by tendrils, usually variously hairy; monoecious or dioecious. Tendrils stipular in position. Leaves alternate, simple, variously lobed or compound. Inflorescence usually an axillary raceme, cluster, head or panicle, or flowers solitary. Flowers actinomorphic, usually unisexual. Hypanthium cup-shaped, campanulate or tubular. Calyx usually 5-lobed. Corolla usually tubular, 5-lobed or petals free. Male flowers: stamens usually basically 5, variously united; frequently stamens 3, of which 2 double, 1 single, inserted on hypanthium; anther locules straight to flexuose, dehiscing longitudinally. Female flowers: ovary inferior, 1–3-locular; placentation usually parietal; ovules 1–many. Fruit a fleshy or dry berry or capsule, 1–many-seeded. Seeds large; endosperm absent.

A family of c. 120 genera and c. 850 species mostly tropical or subtropical; 18 genera and 44 species in Australia, of which 4 genera (4 species) occur on Christmas Is. The family contains important food plants such as pumpkin (*Cucurbita* spp.), marrow and squash (*Cucurbita pepo* L.), rock and honeydew melon (*Cucumis melo* L.), cucumber (*Cucumis sativus* L.) and watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai). A drift seed of *Hodgsonia macrocarpa* Cogn., a Malesian species, has been found on Christmas Is., (*D.A.Powell 591*, K), but is not naturalised there.

G.Bentham, Cucurbiteae, *Fl. Austral.* 3: 313–322 (1866); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Cucurbitaceae, *Fl. Java* 1: 292–307 (1963); I.R.H.Telford, Cucurbitaceae, *Fl. Australia* 8: 158–198 (1982); C.Jeffrey, *The Cucurbitaceae of E. Asia* (1980).

KEY TO GENERA

1 Tendrils simple; flowers less than 4 cm diam.; fruit less than 5 cm diam.

- **2** Flowers yellow; flower stalk bracteate; fruit a fleshy capsule — **1. MOMORDICA**
- **2:** Flowers white; flower stalk not bracteate; fruit not capsular
  - **3** Male flowers in many-flowered umbels; female flowers solitary; fruit softly bristly — **2. MUELLERARGIA**
  - **3:** Male flowers in clusters or few-flowered umbels or racemes; female flowers clustered; fruit smooth — **3. ZEHNERIA**

1: Tendrils branched; flowers more than 5 cm diam.; fruit more than 5 cm diam. **4. LAGENARIA**

1. MOMORDICA

Momordica L., *Sp. Pl.* 2: 1009 (1753); *Gen. Pl.* 5th edn, 440 (1754); from the Greek *mordeo* (to bite), in reference to the bitten appearance of the seeds.

Type: *M. balsamina* L.

Climbing monoecious or (not in our area) dioecious herbs, annual or perennial, glabrous or pubescent. Tendrils simple or (not in our area) 2-branched. Leaves simple, usually palmately 3–7-lobed. Flowers axillary, solitary, on bracteate scapes (peduncle below bract, pedicel above). Male flowers: hypanthium shallowly cup-shaped; calyx 5-lobed; petals 5, free, 1–3 with incurved scales at base; stamens usually 3, inserted towards base of hypanthium; filaments broad; anthers with 2 bilocular and 1 unilocular locules; locules curved or flexuose. Female flowers: calyx and corolla as in male; ovary ovoid to fusiform; ovules many, horizontal. Fruit indehiscent or dehiscing by 3 valves, usually ridged or warted.

A genus of c. 45 species mostly of tropical Africa, also Asia to Australia; 3 species in Australia, 1 of which also on Christmas Is., possibly a naturalised introduction. Included in trib. *Jollifeae*.

Momordica charantia L., *Sp. Pl.* 2: 1009 (1753)

T: from a plant cultivated at Hartekamp, Holland; lecto: BM *n.v.*, *fide* C.Jeffrey, *Fl. Trop. E. Africa*, Cucurbitaceae: 31 (1967). Epithet from the Italian name, *caranza*, for this plant.

Illustration: I.R.H.Telford, *Fl. Australia* 8: fig. 37A–C (1982).

Annual climber; stems to 4 m long, pubescent, glabrescent. Leaves broadly ovate to suborbicular, cordate at base, deeply 5-lobed, dentate; lamina 4–10 cm long, 4–8 cm wide; lobes ovate, acute; petiole 3–5 cm long. Bracts below middle of scape, suborbicular, 3–20 mm long, green. Male flowers: scape 5–95 mm long; hypanthium 2–4 mm long; calyx lobes lanceolate, 4–6 mm long; petals broadly obovate to spathulate, 10–12 mm long, yellow. Female flowers: scape 2–50 mm long; ovary ovoid to ellipsoidal, attenuate, 8–30 mm long; stigmas papillate. Fruit ovoid to ellipsoidal, attenuate, 3–12 cm long, orange-red, 3-valved, warty; longitudinal ridges short. Seeds few to many, ovate, 8–16 mm long, granular, pale brown, slightly undulate.

Christmas Is. Grows in disturbed areas and in forest margins. Also from tropical Africa, Asia, and Malesia to N Australia.

Ch.Is.: no precise locality, *D.A.Powell 452* (K); roadside, central plateau, *R.Shivas 961* (PERTH); Flying Fish Cove, *C.W.Andrews 80* (K); cleared land beside railway, *A.Pearson & D.A.Powell P37* (K).

Cultivated as a minor crop (bitter melon). A common tropical weed, perhaps an introduction.

2. MUELLERARGIA

Muellerargia Cogn. in A. & C.de Candolle, *Monogr. Phan.* 3: 630 (1881); honouring Jean Mueller (1828–1896), Swiss botanist who adopted the epithet Argoviensis, from Aargau, his birth place.

Type: *M. timorensis* Cogn.

Monoecious climbing herbs. Tendrils simple. Leaves simple, mostly shallowly 3-lobed. Male inflorescence an axillary, umbellate raceme. Male flowers: hypanthium shallow, broadly campanulate; calyx 5-lobed; corolla 5-lobed; stamens 3, inserted towards base of

hypanthium; connective broad; anthers with 2 bilocular and 1 unilocular locules; locules apically hooked. Female flowers solitary; perianth similar to male; staminodes absent; ovary subglobose to ellipsoidal, attenuate, softly setose; ovules many, horizontal; stigmas 2, linear. Fruit subglobose to ellipsoidal, fleshy with many seeds. Seeds ovate, compressed.

A genus of 2 species, 1 endemic in Madagascar, the other in Malesia, northern Qld, Australia, and Christmas Is. Included in trib. *Melothrieae*.

Muellerargia timorensis Cogn. in A. & C.de Candolle, *Monogr. Phan.* 3: 630 (1881)

T: Timor, *C.G.C.Reinwardt*; syn: BO *n.v.*, BR; Timor, *F.Bauer 56*; syn: W. Epithet from Timor and the Latin suffix *-ensis*, indicating the place where originally collected.

Stems to 2 m long, pubescent. Leaves ovate, cordate at base, sinuate-dentate to shallowly 3- or 5-lobed, acuminate, hispid; lamina 25–70 mm long, 30–75 mm wide; petiole 14–40 mm long. Male racemes 12–40-flowered; peduncle 3–12 cm long; pedicels 10–16 mm long. Male flowers: hypanthium 0.5–0.7 mm long; calyx lobes subulate, c. 0.2 mm long; corolla lobes ovate, 0.5–0.7 mm long, white. Female flowers: pedicels 20–45 mm long; ovary 3–3.5 mm diam., setose. Fruit 17–25 mm long, with many soft, bristle-like emergences, many-seeded, dehiscing through ruptured attachment of pedicel; pedicel 18–50 mm long. Seeds 8–10 mm long, finely pitted, pale buff; margin slightly thickened.

Christmas Is. Grows on forest or shrubbery margins. Occurs through E Malesia to NE Australia.

Ch.Is.: no precise locality, *C.W.Andrews 67* (K); Toms Ridge, *D.A.Powell 316* (K); below Toms Ridge, *D.A.Powell 535* (K).

3. ZEHNERIA

Zehneria Endl., *Prodr. Fl. Norfolk.* 69 (1833); honouring Joseph Zehner, botanical artist.

Type: *Z. baueriana* Endl.

Monoecious or dioecious climbing annual or perennial herbs. Tendrils simple. Leaves simple, dentate, usually palmately lobed. Male inflorescence an axillary raceme, sometimes paniculate by leaf reduction, or cluster or rarely flowers solitary. Male flowers: hypanthium campanulate; calyx 5-lobed; corolla 5-lobed; stamens 3, inserted about middle of hypanthium; connective broad, papillose; anthers 2-locular. Female inflorescence an axillary raceme or cluster or flowers solitary. Female flowers: perianth similar to male; staminodes 3; ovary usually globose or ovoid; ovules few to many, horizontal; stigma usually 3-lobed. Fruit fleshy, usually globose or ellipsoidal, indehiscent, few to many-seeded. Seeds obovate, compressed, smooth.

A genus of c. 35 species of Africa, SE Asia to the SW Pacific including N and E Australia; 2 species in Australia; 1 species on Christmas Is. Included in trib. *Melothrieae*.

Zehneria alba Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 195 (1906)

T: Flying Fish Cove, Christmas Is., 1897, *C.W.Andrews 2*; holo: BM; iso: K. Epithet from the Latin *albus* (white) in reference to the flower colour.

Dioecious climber; stems to 3 m. Leaves broadly ovate, cordate at base, unlobed to shallowly 3-lobed, dentate, acute to acuminate; lamina 5–8 cm long. Male inflorescence racemose or paniculate, 3–15 cm long; peduncle 1–13 cm long. Male flowers: hypanthium c. 2 mm long; calyx lobes narrowly triangular, c. 0.5 mm long; corolla lobes ovate, c. 2.5 mm long, white. Female flowers solitary or clustered; ovary c. 5 mm long, glabrous. Fruit ellipsoidal, 2–3 cm long. Seeds c. 4 mm long. Fig. 39C–E.

Christmas Is. Grows in forest or shrubbery margins. Regarded as endemic unless included in the broader circumscription of *Z. mucronata* Blume.

Ch.Is.: Phosphate Hill, *H.N.Ridley 83* (K); no precise locality, Oct. 1887, *J.J.Lister* (K); Flying Fish Cove,

C.W.Andrews 2 (BM, K); no precise locality, *D.A.Powell 223* (K); no precise locality, *D.A.Powell 230* (K).

C.Jeffrey, *The Cucurbitaceae of E. Asia* 15–17 (1980), indicated a cline of intergrading variants from Malesia to Australia and islands of the NE Indian and W Pacific Oceans, including this species and *Z. baueriana* Endl. of Norfolk Is. They are probably conspecific with *Z. mucronata* and require further study. C.W.Andrews, *Monogr. Christmas Is.* 179 (1900] treated it as *Melothria mucronata* Cogn. (= *Zehneria mucronata* Blume).

4. LAGENARIA

Lagenaria Ser., *Mém. Soc. Phys. Genève* 3: 25, t. 2 (1825); from the Greek *lagion* (a vase or jar), in reference to the shape and use of the fruit of the type species.

Type: *L. vulgaris* Ser. = *L. siceraria* (Molina) Standl.

Monoecious climbing herbs. Tendrils 2-branched. Leaves simple, dentate; petiole bearing 2 glands towards apex. Male flowers solitary; hypanthium campanulate; calyx 5-lobed; corolla 5-lobed; stamens 3, inserted towards base of hypanthium; anthers with 2 bilocular and 1 unilocular; locules flexuose. Female flowers solitary; perianth similar to male; staminodes 3; ovary cylindrical or ellipsoidal; ovules many, horizontal; stigmas 3, bilobed. Fruit large, indehiscent. Seeds many, obovate or oblong, compressed.

A genus of 6 species of tropical and subtropical Africa; 1 species which occurs on Christmas Is. extends through southern Asia to Australia and the W Pacific, also tropical America; widely cultivated.

***Lagenaria siceraria** (Molina) Standl., *Publ. Field Mus. Nat. Hist., Bot. Ser.*, 3: 435 (1930)

Cucurbita siceraria Molina, *Sag. Stor. Nat. Chili* 133 (1782). T: Chile, *G.I.Molina*; *n.v.* Epithet from the Greek *sicyos* (a gourd) and the Latin *-aria* (pertaining to), in reference to the fruit.

L. vulgaris Ser., *Mém. Soc. Phys. Genève* 3: 16, t. 2 (1825). T: from a plant cultivated at Uppsala, Sweden; lecto: LINN 1151/1 *n.v., fide* C.Jeffrey, *Fl. Trop. E. Africa,* Cucurbitaceae: 51 (1967).

Stems to 4 m long, pilose. Leaves broadly ovate or sub-triangular, cordate at base, sinuate-dentate to shallowly 3–7-lobed, acuminate, pubescent on both surfaces; lamina to 30 cm long, 30 cm wide; petiole 3–20 cm long. Male flowers: peduncle 7–40 cm long; hypanthium 10–35 mm long, pubescent; calyx lobes 5–15 mm long; corolla lobes obovate, 20–45 mm long, white. Female flowers: peduncle 6–10 cm long; ovary 10–17 mm long, villous. Fruit ellipsoidal, ovoid, pyriform or clavate, 10–20 cm diam., green. Seeds truncate, 16–20 mm long, ornamented by 2 ridges on both faces. *Bottle Gourd*.

Christmas Is. If naturalised, probably a recent garden escape.

Ch.Is.: Phosphate Hill, alongside airstrip, *D.A.Powell 44* (K).

Cultivated for gourd utensils and the young fruit also used as a vegetable. The long history of cultivation has obscured its natural range.

32. CAPPARACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R.)

Herbs or shrubs, often climbing, rarely trees, glabrous or hairy to prickly, the hairs sometimes glandular. Leaves alternate, spirally arranged, petiolate, simple to palmate, entire; stipules absent, rarely thorny. Inflorescence usually racemose, leafy, terminal or

lateral. Flowers bisexual, mostly slightly zygomorphic in orientation of the petals. Sepals 4, free. Petals 4, free, often clawed at base. Stamens usually 6–many, sometimes adnate to the gynophore, forming an androgynophore; anthers bilocular, dehiscing by longitudinal slits. Ovary usually unilocular, sometimes sessile but usually on a gynophore; placentation parietal; stigma simple, subsessile. Fruit a capsule or berry. Seeds 1–many, mostly horseshoe-shaped or reniform; testa often sculptured; with or without an elaiosome; endosperm sparse or absent.

There are c. 45 genera, with 700 species, although many genera are monotypic. The family is pantropical and subtropical, with the greatest diversity in the neotropics and Africa; 1 genus (3 speon Christmas Is., Cocos (Keeling) Is. and Ashmore Reef. Many species are xerophilous. Capers are the preserved flower buds of some *Capparis* species, and *Cleome spinosa* Jacq. is a commonly cultivated, temperate garden plant.

F.Pax and K.Hoffmann, Capparidaceae, *Nat. Pflanzenfam.* 2nd edn, 17b: 146–223 (1936); M.Jacobs, Capparaceae, *Fl. Males.* ser. I, 6: 61–105 (1960); C.A.Backer and R.C.Bakhuizen van den Brink Jr, Capparaceae, *Fl. Java* 1: 181–185 (1963); M.Jacobs, The genus *Capparis* (Capparaceae) from the Indus to the Pacific, *Blumea* 12: 385–541 (1965); H.J.Hewson, Capparaceae, *Fl. Australia* 8: 207–231 (1982).

CLEOME

Cleome L., *Sp. Pl.* 2: 671 (1753); *Gen. Pl.* 5th edn, 302 (1754); from the Greek *kleio* (to shut); derivation obscure. The ancient name *Cleome* was applied to a bitter-tasting herb of damp places which had some similarity to the Brassicaceae.

Type: *C. ornithopodioides* L.

Annual or perennial herbs, often pubescent, glandular-pubescent or with bristles or prickles. Leaves usually palmately compound, 3–5-foliolate, petiolate; leaflets often elliptic or rhomboidal; stipules absent. Inflorescence a bracteate raceme; leaves gradually reduced towards apex. Flowers pedicellate, often zygomorphic due to orientation of petals. Sepals and petals 4, equal, free, the petals often clawed. Stamens usually 6–30, sometimes adnate to base of gynophore, forming an androgynophore. Stigma capitate. Ovary usually on a gynophore, rarely sessile, unilocular with 2 placentas. Fruit a linear, cylindrical, beaked, 2-valved capsule. Seeds many, orbicular (not in our area) to horseshoe-shaped, sculptured; elaiosome present or absent.

A pantropical and subtropical genus containing c. 150 species with greatest diversity in America and Africa; 10 species in Australia, of which 6 are endemic; 3 ruderal species on Christmas Is., 1 of which is also on Cocos (Keeling) Is. and Ashmore Reef. They are often found near human habitation and in sandy soil.

H.H.Iltis, Studies in the Capparidaceae –7. Old Word Cleomes adventive in the New World, *Brittonia* 12: 279–294 (1960).

1 Plant spreading, with horizontal lateral branches, with coarse, sparse, stiff bristles especially on petiole of leaf and leaf margin, not strongly foetid; flowers lilac-blue, becoming pink; seeds with a whitish elaiosome **3. C. rutidosperma**

1: Plant erect, strongly to slightly glandular-pubescent, foetid; flowers white or yellow; seeds without an elaiosome

2 Flowers bright yellow; stamens 12–20, free; ovary sessile; capsule stalkless above the corolla scar; seeds ribbed **1. C. viscosa**

2: Flowers usually white or ivory; stamens 6, fused to the gynophore; ovary on an androgynophore; capsule on a 15–25 mm stalk above the corolla scar; seeds tuberculate **2. C. gynandra**

1. **Cleome viscosa** L., *Sp. Pl.* 2: 672 (1753)

T: Sri Lanka, Herb. P.Hermann 241, Vol. 3, fol. 2; lecto: BM, *fide* W.Fawcett & A.B.Rendle, *Fl. Jamaica* 3: 228 (1914). Epithet from the Latin *viscosus* (sticky), in reference to the glandular hairs.

Illustration: H.H.Iltis, *Brittonia* 12: 287, fig. 1 (1960).

Erect, annual herb, to 1.5 m tall, glandular-pubescent, foetid. Leaves 3–5-foliolate; leaflets to 6 cm long and 3 cm wide, glandular-ciliate. Sepals glandular-pubescent, usually deciduous. Petals 7–14 mm long, attenuate to scarcely clawed, bright yellow. Stamens 8–30, free; anthers bluish. Ovary sessile. Capsule not stalked above corolla scar, glandular-pubescent; valves persistent, dehiscing from apex. Seeds ribbed; elaiosome absent.

Christmas Is. A weedy species, often in sandy soil such as coral beaches; tropical, widespread from Africa to northern Australia, and common throughout Malesia. Also commonly adventive in the New World. Used in Malesia as a vegetable.

Ch.Is.: without precise locality, *D.A.Powell 299* (K); entrance to golf course, *R.Shivas 833* (PERTH).

2. **Cleome gynandra** L., *Sp. Pl.* 2: 671 (1753)

T: Herb. Hort. Cliff. 341, *Cleome* 1; lecto: BM, *fide* J.Elfers, R.A.Graham & G.P.DeWolf, *Fl. Trop. E. Africa,* Capparidaceae: 18 (1964). Epithet from the Greek prefix *gyn-* (female) and the Greek suffix *-andrus* (male).

C. pentaphylla L., *Sp. Pl.* 2nd edn, 938 (1763) *nom. illeg.*; *Pedicellaria pentaphylla* (L.) Schrank, Roemer & Usteri, *Mag. Bot.* 3(8): 11 (1790); *Gynandropsis pentaphylla* (L.) DC., *Prodr.* 1: 238 (1824). T: as for *C. gynandra* L., *fide* J.Elfers, R.A.Graham & G.P.DeWolf, *Fl. Trop. E. Africa,* Capparidaceae: 18 (1964).

Illustration: H.H.Iltis, *Brittonia* 12: 287, fig. 1 (1960).

Erect, annual herb to 1.3 m tall, sparsely glandular-pubescent, foetid. Leaves 3–7-foliolate; leaflets to 7 cm long and 4 cm wide, glandular-ciliate, especially along the abaxial venation. Sepals glandular-pubescent. Petals 6–20 mm long, white or yellowish, occasionally pink or purple; claw c. half total length. Stamens 6. Androgynophore present, lengthening greatly after anthesis, forming a 15–25 mm long stalk separating capsule from corolla scar. Capsule sparsely and minutely pubescent; valves deciduous. Seeds tuberculate; elaiosome absent.

Christmas Is., Cocos (Keeling) Is., Ashmore Reef. On Christmas Is. grows in disturbed sites. On Cocos (Keeling) Is. recorded only from North Keeling Is. as rare in herbfield with *Sesuvium portulacastrum*. On Ashmore Reef recorded from Middle Is. in herbfield in calcareous sand. Native to Africa where it is common and widespread, and probably also native to Asia from India to Malesia, widely naturalised; also in Australia and in the New World.

Ch.Is.: without precise locality, 1897, *C.W.Andrews* (K). C.K.Is.: N edge of saltmarsh, North Keeling Is., *D.G.Williams 36* (CBG, K, PERTH). A.R.: Middle Is., 12 Mar. 1986, *A.Grant* (CBG); around well, Middle Is., .7 Oct. 1984, *M.Hinchey*, (CBG); Middle Is., *K.F.Kenneally 6364* (PERTH).

A night-flowering species, the ephemeral flowers opening in the evening and withering in the morning. The seeds and plant are rich in a volatile oil resembling garlic or mustard oil. The leaves are eaten raw or used in cooking as a flavouring herb. The seeds may be ground up and used as mustard.

3. ***Cleome rutidosperma** DC., *Prodr.* 1: 241 (1824)

T: Sierra Leone, West Africa, ?*H.Smeathmann s.n.*; *n.v.* Epithet from the Greek *rutidos* (a wrinkle) and *sperm* (seed).

Illustrations: M.Jacobs, *Fl. Males.* ser. I, 6: 98, fig. 30 (1960); H.H.Iltis, *Brittonia* 12: 287, fig. 1 (1960).

Spreading, widely branching, annual herb to 1 m tall, sparsely covered in small, coarse bristles, not strongly foetid. Leaves 3-foliate; leaflets to 3 cm long and 2 cm wide, with coarse bristles especially on margins. Sepals with short bristles. Petals 9–12 mm long, violet-blue turning pink, the 2 central petals with a yellow band; claw short, 2–3 mm long; all 4 petals strongly swept upwards. Stamens 6, free. Ovary on a short gynophore, which lengthens greatly after anthesis, forming a 4–8 mm long stalk separating capsule from corolla scar. Capsule glabrous; valves deciduous. Seeds ribbed, with a white elaiosome. Figs 17, 40F–H.

Christmas Is. Locally common along railway at 200 m alt. in limestone rubble and clay loam. A weed of disturbed ground. Native to tropical W Africa, but introduced to the Caribbean region and Malesia.

Ch.Is.: without precise locality, *D.A.Powell 170* (K); near Camp 4, central plateau, *B.A.Mitchell 123* (CBG, K); 2 km W of Settlement, *R.Shivas 817* (PERTH).

This species is extending its range in SE Asia. It was first collected in northern Sumatra in 1920, in Java in 1946, in Sarawak and Borneo in 1958, and on Christmas Is. in 1980.

33. BRASSICACEAE

I.R.H.Telford (C.K.Is., C.S.Is.)
A.E.Orchard (M.Is., H.Is.)
D.J.Du Puy (Ch.Is.)

Annual, biennial or perennial herbs or subshrubs, rarely shrubs. Leaves alternate, simple, entire to deeply dissected or pinnate, exstipulate. Inflorescence a raceme, corymb or panicle, usually ebracteate. Flowers bisexual, actinomorphic, nectariferous. Sepals 4, in 2 whorls, the inner pair often cupped at base. Petals 4, usually clawed, the lamina usually abruptly spreading, rarely absent. Stamens usually 6, occasionally 4 or 2, in 2 whorls, typically with the outer whorl of 2 shorter and the inner whorl of 4 longer; anthers 2-locular, dehiscing longitudinally. Ovary superior, of 2 fused carpels; locules 2, divided by a false septum; placentation parietal; ovules 1–many on each placenta; style 1; stigma 2-lobed. Fruit a siliqua or silicula, usually dehiscent, 2–many-seeded. Seeds with a large oily embryo; little or no endosperm.

An almost cosmopolitan family of 375 genera and c. 3200 species, mainly of northern temperate regions, some cosmopolitan; in Australia 52 genera, 160 species including many introduced weeds; 4 genera, 5 species on the oceanic islands dealt with in this volume, of which 2 are native to the subantarctic islands.

Many cosmopolitan species are efficient weeds; other species are important crop and horticultural plants.

G.Bentham, Cruciferae, *Fl. Austral.* 1: 63–88 (1863); T.F.Cheeseman, Cruciferae, *Vasc. Fl. Macq. Is.* 17–18 (1919); O.E.Schulz, Cruciferae, *Nat. Pflanzenfam.* 2nd edn, 176: 227–658 (1936); B.W.Taylor, Cruciferae, *Fl. Veg. Soils Macquarie Is.* 107–110 (1955); H.H.Allan, *Fl. New Zealand* 1: 174–189 (1961); J.G.Vaughan, A.J.Macleod & B.M.G.Jones, *The Biology and Chemistry of the Cruciferae* (1976); H.J.Hewson, Brassicaceae (Cruciferae), *Fl. Australia* 8: 231–357 (1982); C.J.Webb *et al.*, Cruciferae, *Fl. New Zealand* 4: 394–447 (1988).

KEY TO GENERA

1 Seeds in a row of more than 4 per fruit locule

- **2** Fruit more than 5 times as long as wide; leaves in a basal rosette and usually reducing up the stem; petals present (Ch.Is., M.Is.) **4. CARDAMINE**
- **2:** Fruit less than 5 times as long as wide; leaves congested at apex of stout rhizome; petals absent (H.Is.) **3. PRINGLEA**

1: Seeds 1 or 2 per fruit locule

- **3** Fruit dehiscent, smooth; inflorescence terminal (C.K.Is.) **1. LEPIDIUM**
- **3:** Fruit indehiscent, warty or ridged; inflorescence leaf-opposed (C.S.Is.) **2. CORONOPUS**

1. LEPIDIUM

Lepidium L., *Sp. Pl.* 2: 643 (1753); *Gen Pl.* 5th edn, 291 (1754); from the Greek *lepis* (a scale) in reference to the appearance of the fruit.

Type: *L. latifolium* L.

Annual or perennial herbs or shrubs; stems erect to decumbent, sometimes stoloniferous. Leaves usually ±rosulate and cauline, reducing up the stem. Inflorescence a terminal raceme, ebracteate. Sepals equal. Petals variously shaped, sometimes (not in our area) absent, usually white or (not in our area) pink or purple. Sepals 2, 4 or (not in our area) 6. Nectary glands 4 or 6. Ovary sessile or on a gynophore. Stigma capitate to slightly 2-lobed. Fruit a silicula, flattened at right angles to septum, usually notched; valves keeled, often winged. Seeds 1 per locule.

An almost cosmopolitan genus of 150 species; 35 species endemic in Australia, 8 naturalised, 1 of which also naturalised on Cocos (Keeling) Is. The type genus of trib. *Lepideae*.

H.J.Hewson, The Genus *Lepidium* L. (Brassicaceae) in Australia, *Brunonia* 4: 217–308 (1981).

*Lepidium virginicum L., *Sp. Pl.* 2: 645 (1753)

T: from America and the West Indies; *n.v.* Epithet from Virginia, America, where the taxon is native.

Illustrations: H.J.Hewson, *Brunonia* 4: 278, fig. 19 (1981); H.J.Hewson, *Fl. Australia* 8: 281, fig. 52K, L (1982).

Annual or biennial herb 30–50 cm tall, erect to decumbent. Basal leaves lyrate to pinnate, to 9 cm long, hirsute; cauline leaves reducing to simple, serrate or entire. Inflorescence dense, elongate. Sepals 0.7–1 mm long. Petals 1–2 mm long, white. Stamens 2, rarely 4. Siliqua broadly ovate to circular, 3–4 mm long, glabrous; wings in upper half, small, forming shallow notch. Seeds 1.2–2 mm long. *Virginian Peppercress*.

Cocos (Keeling) Is. Grows in open disturbed sites around settlement, in calcareous sand. Native to south-eastern North America, now widely naturalised.

C.K.Is.: airstrip verge, S end, West Is., *D.G.Williams 4* (CBG, PERTH); near settlement, West Is., *I.R.Telford 10086 & C.Howard* (CBG, K).

2. CORONOPUS

Coronopus Zinn, *Cat. Pl. Gotting.* 325 (1757), *nom. cons.*; from the Greek *korone* (crow) and *pous* (foot), in reference to the shape of the basal leaves.

Type: *C. ruellii* All.

Annual or perennial herbs; stems prostrate to ascending. Leaves basal and cauline, reducing up stems. Sepals equal. Petals small, white, or (not in our area) absent. Stamens 2 or (not in our area) 4 or 6. Nectary glands 2 or (not in our area) 4. Stigma subsessile. Silicula indehiscent, compressed at right angles to septum, usually splitting into 2 articles; valves hemispherical. Seeds 1, rarely 2 per locule.

A genus of 10 species of the Mediterranean region, E Africa and S America; 3 species naturalised in Australia, 1 of which also naturalised on cays of the Coral Sea. Included in trib. *Lepideae*.

*Coronopus integrifolius (DC.) Spreng., *Syst. Veg.* 2: 853 (1825)

Senebiera integrifolia DC., *Mém. Soc. Hist. Nat. Paris* 144 (1799). T: from Madagascar; *n.v.* Epithet from the Latin *integer* (entire) and *folium* (a leaf).

Perennial herb, decumbent to erect, to 30 cm. Basal leaves 50–75 mm long, pinnatisect with

3–7 pairs of lobes; cauline leaves lanceolate, entire. Inflorescence a leaf-opposed, dense raceme. Sepals 0.5–0.8 mm long. Petals 1–1.5 mm long. Stamens 2. Silicula 0.8–1 mm long, notched at base and apex; valves keeled, usually warted or reticulate-pitted, ±corky, splitting into 2 articles. Seeds 1 or 2 per locule, 0.5–0.8 mm long.

Coral Sea Is. Grows in herb communities with *Lepturus repens* in calcareous sand. Widespread through the northern Indian and western Pacific Oceans, probably naturalised.

C.S.Is.: SW Cay, Herald Cays, *J.Hicks 7* (BISH, CBG); Northeast (Chilcott) Is., Coringa Is., *S.Hogg 28* (BRI, CBG).

3. PRINGLEA

Pringlea W.Anderson ex Hook.f., *Fl. Antarct.* 238, t. 90, 91 (1845); honouring Sir John Pringle (1707–1782), British physician, founder of modern military medicine, who studied scurvy.

Type: *P. antiscorbutica* R.Br. ex Hook.f.

Perennial rhizomatous, fleshy herb. Leaves imbricate, large, crowded at rhizome apex, entire. Inflorescence spike-like, axillary. Sepals 4. Petals absent. Stamens 6; filaments short, broad; anthers oblong-lanceolate. Ovary obovate; septum absent; ovules in 2 rows; stigma capitate, entire. Siliqua oblong; septum absent; valves convex, obscurely 1-veined, transversely crenulate. Seeds many in 2 rows, oblong-cordate, subcompressed, shortly beaked.

A monotypic genus confined to the subantarctic islands south of the Indian Ocean; Kerguelen, Crozet, Prince Edward, Marion, MacDonald and Heard Islands. The only genus of trib. *Pringleae*.

Pringlea antiscorbutica R.Br. ex Hook.f., *Fl. Antarct.* 2: 239, t. 90, 91 (1845)

T: Kerguelens Land [Kerguelen Is.], *W.Anderson*; holo: probably BM *n.v.* Epithet from the Greek *anti-* (against) and the Latin *scorbutus* (scurvy), in reference to its reputed rich vitamin C content.

Illustrations: J.D.Hooker, *Fl. Antarct.* t. 90, 91 (1845); E.M. van Zinderen Bakker, J.M.Winterbottom & R.A.Dyer, *Marion & Prince Edward Islands* photos 41 & 56, following p. 120 (1971); P.L.Keage, The Conservation Status of Heard Island and the MacDonald Islands, *Univ. Tas. Envir. Stud. Occ. Paper* 13: 38 (1981).

Stem prostrate, to 1 m long, 1–2 cm diam.; cortex corky. Leaves obovate to spathulate, glabrous apart from a sparse, marginal fringe of fine, unicellular, simple hairs 0.7–1 mm long; lamina 5–8 cm long, 4–6 cm wide (sometimes to 20 x 11 cm). Inflorescence to 25 cm tall, lower third of scape naked, with alternate reduced leaf-like bracts in middle portion; flowers densely clustered near apex, ebracteate. Sepals broadly lanceolate, 4–5 mm long. pilose. Staminal filaments 7 mm long, slightly dilated at base; anthers 1.3 mm long, shortly apiculate. Style 0.8 mm long; stigma capitate. Siliqua shortly cylindrical, inflated, 12–25 mm long, 5–8 mm diam., pilose, with 15–25 ovoid to subreniform seeds. *Kerguelen Cabbage*. Figs 40A–E, 59, 79.

Heard Is. Common and widespread on deeper soils away from massive seal and penguin disturbance. Also Kerguelen, Crozet, Prince Edward, Marion and MacDonald Islands.

H.Is.: Atlas Cove, *A.McGregor 11* (HO); Fairchild Beach, 23 Dec. 1986, *J.J.Scott* (HO); base of Mount Drygalski, SW side, 1 Feb. 1988, *J.J.Scott* (HO); Spit Bay, 20 Feb. 1988, *J.J.Scott* (HO); near former ANARE base camp, Atlas Cove, *J.M.B.Smith 771* (HO).

All the Heard Is. plants seen have leaves glabrous on the upper and lower surfaces, with just a sparse fringe of hairs on the margin. Those from Kerguelen Is. are pilose over the entire upper and lower surfaces. Hooker described the leaves of Kerguelen Is. plants as 'Folia margine...ciliata, interdum pubescentia.' This regional difference requires further investigation.

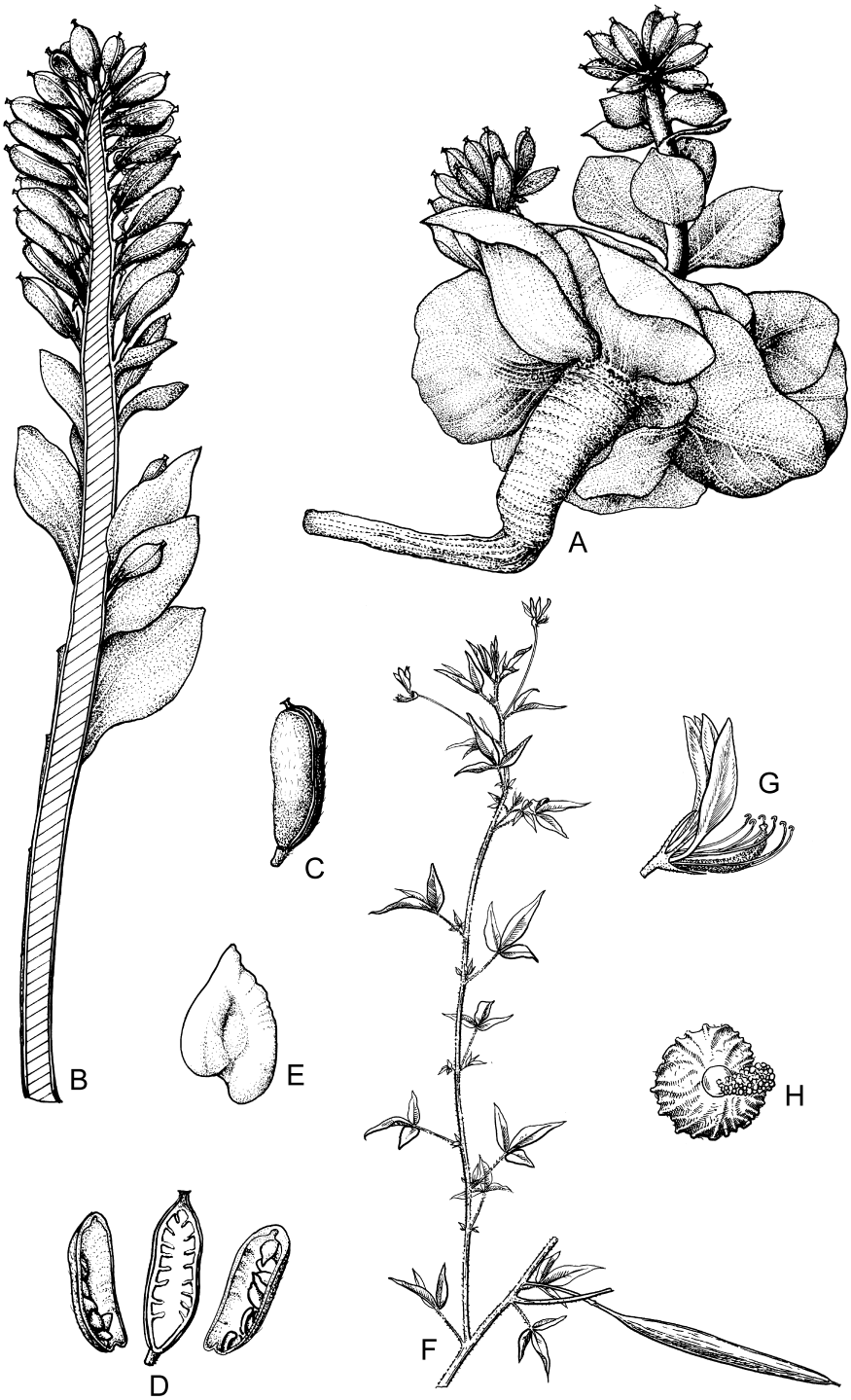

Figure 40. **A–E**, BRASSICACEAE: *Pringlea antiscorbutica*. **A**, habit X0.5; **B**, infructescence X0.5; **C**, fruit X1; **D**, fruit after dehiscence X1; **E**, seed X4 (**A–E**, J.Smith 771, CANB). **F–H**, CAPPARACEAE: *Cleome rutidosperma*. **F**, flowering and fruiting shoot X0.5; **G**, flower X2; **H**, seed X8 (**F–H**, D.Powell 170, K). **A–E** drawn by D.Boyer. **F–H** drawn by E.Catherine.

4. CARDAMINE

Cardamine L., *Sp. Pl.* 2: 654 (1753); *Gen. Pl.* 5th edn, 295 (1754); from the classical Greek *kardamon*, a name used by Dioscorides for a bitter-tasting species in this family, derived from *kardia* (heart) and *damaein* (to bind) due to its reputed heart-strengthening effect.

Type: *C. pratensis* L.

Annual or perennial herbs; stems erect to decumbent, sometimes stoloniferous. Leaves rosulate and cauline, pinnate, dissected or lobed. Inflorescence a few- to many-flowered raceme or rarely flowers solitary. Sepals ±equal or nearly so. Petals clawed, white, pink or purple. Stamens 4 or 6 in half-ring around shorter stamens, and variously shaped outside longer median stamens. Nectary glands 4 or 6. Stigma entire or slightly 2-lobed. Fruit a siliqua, dehiscing suddenly from the base upwards, ejecting the seeds; valves flat, lacking conspicuous veins; replum margin flanged. Seeds in 1 row per locule.

An almost cosmopolitan genus of c. 160 species but predominantly temperate; several species endemic in Australia, 2 introduced, 1 of which also naturalised on Christmas Is.; 1 native species on Macquarie Is. not in mainland Australia. Included in trib. *Arabideae*.

G.R.Copson, An annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 43 (1984).

Leaves pinnate; flowers in racemes (Ch.Is.) **1. C. hirsuta**

Leaves entire, rarely lobed; flowers solitary (M.Is.) **2. C. corymbosa**

1. *Cardamine hirsuta L., *Sp. Pl.* 2: 655 (1753)

T: Herb. C.Linnaeus 835.13; lecto: LINN, *fide* B.Jonsell, *Fl. Trop. E. Africa*, Cruciferae 3: 42 (1982). Epithet from the Latin *hirsutus* (hirsute).

Annual herb to 30 cm; stem erect, branched, sparsely hirsute. Leaves pinnate, petiolate; lower leaves rosulate, long; cauline leaves few, reducing towards stem apex; pinnae 3–7 pairs, lobed. Flowers 1–12, in racemes; pedicels 1–3 mm long. Sepals c. 1.5 mm long, purplish green with white margins. Petals 2.5–3 mm long, white. Stamens 4, rarely 6. Style conical, 0.5–1 mm long. Siliqua linear, 15–25 mm long, 0.7–1.5 mm wide, erect, overtopping the unopened flowers. Seeds c. 1 mm long, compressed, narrowly winged. *Common Bitter Cress*, *Hairy Wood Cress*.

Christmas Is. A weed of disturbed sites, especially gardens and cultivated land; in Australia in all States. Native to Europe, now a cosmopolitan weed of cultivation.

Ch.Is.: Drumsite, *D.A.Powell 327* (K).

2. Cardamine corymbosa Hook.f., *Fl. Antarct.* 1: 6 (1844)

C. hirsuta var. *corymbosa* (Hook.f.) Hook.f., *Handb. New Zealand Fl.* 12 (1864). T: Campbell Is., *J.D.Hooker*; *n.v.* Epithet refers to the inflorescence structure.

Illustration: J.D.Hooker, *Icon. Pl.* 7: t. 686 (1844).

Extremely variable glabrous to sparsely hairy perennial herb; rootstock slender, rhizomatous. Stem erect, simple or branched, to 2 cm tall (to 16 cm in etiolated plants). Leaves rosulate or cauline, 0.5–10 cm or more long (including petiole), mostly simple but usually at least some (sometimes all) with 1 or 2 pairs of lateral leaflets; terminal leaflet ovate, orbicular or subreniform, 2–15 mm long; lateral leaflets shortly petiolulate, ovate, much smaller. Flowers solitary or in irregular clusters of 2–5, subtended by a leaf. Sepals 1.4–2.4 mm long, green to purplish with white margins. Petals 3.6–5 mm long, white. Stamens 6. Siliqua linear, 1–2 cm long, 1–1.3 mm wide, erect, with 18–28 seeds, each 0.8–1 mm long.

Macquarie Is. Very widespread and common. Also found on Auckland and Campbell Islands. Reported from New Zealand by O.E.Schulz, *Nat. Pflanzenfam.* 2nd edn, 17b: 561 (1936).

M.Is.: southern slopes of Wireless Hill, 19 Nov. 1948, *N.R.Laird* (HO); 800 m SE of Pyramid Lake on ridge top above saddle point, *R.D.Seppelt 12042* (HO); 500 m SW of Mt Ifould, *R.D.Seppelt 12441* (HO); coastal slopes east of Boiler Rocks, *R.D.Seppelt 12520* (HO, MEL); Gadgets Gully, *R.D.Seppelt 12772* (HO, MEL).

H.H.Allan, *Fl. New Zealand* 1: 184 (1961), recorded *C. subcarnosa* from Macquarie Is. but no specimen has been seen by me that matches this description. H.J.Hewson, *Fl. Australia* 8: 312–313 (1982), treated this taxon under the name *C. depressa* var. *stellata* (Hook.f.) Hook.f. Allan (*loc. cit.*) and other authors have used the name *C. corymbosa* Hook.f. Most recently, C.J.Webb *et al.*, *Fl. New Zealand* 4: 416 (1988), have followed Hewson in treating the species as a variant of *C. depressa*, but suggesting that an undescribed species might be involved. Both *C. stellata* and *C. corymbosa* were described by Hooker from Campbell Is., simultaneously with *C. depressa* from Auckland Is. The three taxa seem to be extreme forms of a widespread polymorphic complex, extending from New Zealand and Tasmania to the subantarctic islands, which requires much more investigation. If the taxa are maintained, then the Macquarie Is. plants come closest to *C. corymbosa*, but differ in having some leaves simple, and the pinnate leaves have reduced and usually fewer lateral leaflets. Allan described subterranean cleistogamous flowers for this species, but cleistogamous flowers apparently occur only rarely on the Macquarie Is. plants. Two collections (*Laird s.n.*, HO 86892 & 86910) have flowers in which the petals are very reduced or absent, and the sepals remain almost closed. The anthers are functional and fruits set readily.

34. MORINGACEAE

D.J.Du Puy (Ch.Is.)

Trees or shrubs, often with swollen trunks or large rootstocks; bark gummy. Leaves alternate, compound, pinnate to tripinnate, with stalked glands at base of petiolules and pinnae; pinnae and leaflets opposite, articulated; stipules minute, knob-like. Inflorescence axillary, paniculate. Flowers scarcely to strongly zygomorphic, bisexual. Perianth perigynous or rarely hypogynous. Hypanthium cup-shaped or tubular, sometimes very short. Calyx lobes 5, imbricate, usually unequal. Petals 5, imbricate, usually unequal, the lowermost largest. Stamens 5, inserted on margin of hypanthium, alternating with 5 subulate staminodes; anthers unilocular, longitudinally dehiscent. Ovary short-stalked, superior, unilocular, with 3 parietal placentas; ovules many. Fruit a 3-valved, linear, beaked capsule; valves thick and spongy. Seeds large, winged or not; endosperm sparse or absent.

Monotypic family containing the genus *Moringa* with 13 or 14 species distributed from SW Africa and Madagascar to India; 1 species widely cultivated throughout the tropics, incompletely naturalised in many areas including Christmas Is. and northern Australia.

C.G.G.J. van Steenis, Moringaceae, *Fl. Males.* ser. I, 4: 45–46 (1954); C.G.G.J. van Steenis, Moringaceae, *op. cit.* 5: 554 (1958); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Moringaceae, *Fl. Java* 1: 185–186 (1963); M.Keraudren & J.B.Gillett, Sur le type du *Moringa oleifera* Lam., et la valeur de ce binôme, *Bull. Soc. Bot. France* 110: 316–318 (1963); A.C.Smith, Moringaceae, *Fl. Vit. Nova* 2: 711–713 (1981); T.D.Stanley, Moringaceae, *Fl. Australia* 8: 358–359 (1982); B.Verdcourt, A synopsis of the Moringaceae, *Kew Bull.* 40: 1–23 (1985).

MORINGA

Moringa Adans., *Fam. Pl.* 2: 318, 579 (1763); a Latin corruption of the Malabar name *murunga*.

Type: *M. oleifera* Lam.

***Moringa oleifera** Lam., *Encycl.* 1: 398 (1785).

Based on *Guilandina moringa* L., *Sp. Pl.* 1: 381 (1753). T: Sri Lanka, Herb. P.Hermann 126, vol. 2, fol. 24; lecto: BM, *fide* M.Keraudren & J.B.Gillett, *Bull. Soc. Bot. France* 110: 316 (1963). Epithet from the Latin *oleum* (oil) and *ferre* (to bear), in reference to the seeds which yield a fine oil.

M. pterygosperma Gaertn., *Fruct. Sem. Pl.* 23: 314 (1791), *nom. illeg.* T: cultivated in Leiden Botanical Garden, Holland; holo: probably L *n.v.*

Illustrations: C.G.G.J. van Steenis, *Fl. Males.* ser. I, 4: 46, fig. 1 (1949); A.B.Graf, *Tropica* 662 (1978).

Small tree, 3–10 m tall. Leaves mostly tripinnate, crowded towards branchlet tips, 25–60 cm long; leaflets elliptic to obovate, rounded to cuneate at base, entire, rounded or emarginate at apex, glabrous; lamina 8–22 mm long. Panicles erect, 10–30 cm long. Flowers strongly zygomorphic, whitish, scented. Hypanthium c. 3 mm long. Calyx lobes petaloid, unequal, 7–14 mm long, reflexed. Petals hairy basally; upper petals 10–13 mm long, reflexed; lower petals 14–17 mm long, erect. Stamens and staminodes hairy basally. Ovary densely hairy. Capsule slender, 3-angled, slightly constricted between the seeds, 18–45 cm long, pendulous; valves with 3 broad ribs. Seeds c. 10 mm diam., with 3 broad, membranous wings. *Horseradish Tree*.

Christmas Is. Frequent in undergrowth surrounding settlements, the discarded branches remaining viable for a relatively long period, and often forming roots. Probably indigenous in NW India, but now widely cultivated throughout the tropics, especially in Africa, SE Asia and Malesia. Often persisting as a relic of cultivation, but apparently not fully naturalised.

Ch.Is.: shore terrace, Rocky Point, *A.Pearson P82* (K); Rocky Point, *D.A.Powell 673* (K).

An ornamental species, often used as a hedging plant. The flowers, leaves and young fruit are used as vegetables. The thick, soft roots provide a seasoning somewhat similar to horseradish. The bark, roots and leaves are used medicinally in India, and antibiotic substances have been isolated. The seeds yield ben oil, used in the lubrication of fine machinery such as clocks, and in cosmetics. The seeds act as a flocculant in dirty water, causing the impurities to coagulate and sink, leaving clean water.

This species was treated as *M. pterygosperma* Gaertn. by T.D.Stanley, *Fl. Australia* 8: 358–359 (1982). However, A.C.Smith, *loc. cit.* and B.Verdcourt, *loc. cit.* both used *M. oleifera*, which is an earlier name than *M. pterygosperma*. The protologues of both these names include the type of *Guilandina moringa* L., making *M. pterygosperma* a superfluous name, and therefore illegitimate. Arguments suggesting that *M. oleifera* is itself illegitimate (referred to by C.G.G.J. van Steenis, *Fl. Males.* ser. I, 5: 554 (1958), due to the inclusion of *Balanus myrepsica* Garsault as a synonym, are not accepted as Garsault did not uniformly use the binomial system of nomenclature, and his names must therefore be considered invalid (M.Keraudren & J.B.Gillett, *Bull. Soc. Bot. France* 110: 316–318, 1963).

35. SAPOTACEAE

D.J.Du Puy (Ch.Is.)

Trees or shrubs with latex; hairs often 2-branched. Leaves alternate, simple, entire, often coriaceous; stipules small or absent. Flowers usually in axillary, cymose fascicles, sometimes combined into pseudo-racemes, actinomorphic, usually bisexual. Calyx usually either 5–7-lobed, imbricate, or the lobes in 2 whorls of 2–4. Corolla lobes often as many as the calyx, or twice as many, imbricate, sometimes with petaloid appendages. Disc usually inconspicuous. Stamens epipetalous, in 2 or 3 whorls, sometimes 1 or 2 whorls staminodal or absent; fertile stamens opposite and as many as corolla lobes; anthers longitudinally dehiscent. Ovary superior, 1–12-locular (often 4- or 5-locular); ovules 1 per locule, with axile placentation; style solitary; stigma minute. Fruit usually an indehiscent berry. Seeds 1–12, usually with a large, often linear, scar; endosperm present.

A pantropical and subtropical family, occasionally extending into warm temperate regions, with some 35–75 genera and 600–800 species; 1 genus with 1 species occurs on Christmas Is. Members of this family are important constituents of lowland rainforest in Malesia, and some species become massive emergents above the main canopy. The flowers are often white and nocturnal, suggesting pollination by bats or moths.

The generic limits are difficult to define, and various classifications have been proposed. This family has been important for its latex products, including chicle from *Manilkara zapota* (L.) P.Royen, and gutta percha from *Palaquium gutta* (Hook.f.) Baill. The main importance of the family now is as a source of timber. Several species are cultivated for their edible fruits, including two fruit trees grown on Christmas Is. — *Manilkara zapota* (L.) P.Royen, the Sapodilla or Chiku and *Mimusops elengi* L., the Tanjong tree.

N.H.J.Lam, The Sapotaceae of the Dutch East Indies and surrounding countries, *Bull. Jard. Bot. Buitenzorg* ser. 3, 7: 2–289 (1925); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Sapotaceae, *Fl. Java* 2: 189–194 (1965); A.C.Smith, Sapotaceae, *Fl. Vit. Nova* 2: 744–782 (1981).

PLANCHONELLA

Planchonella Pierre, *Not. Bot. Sapot.* 34 (1890), *nom. cons.*; after J.E.Planchon (1823–1888), a French botanist and pharmacist, and Director of the botanic garden at Montpellier.

T: *P. obovata* (R.Br.) Pierre (*Sersalisia obovata* R.Br.), *typ. cons.*

Trees or tall shrubs; branchlet tips and inflorescences tomentose; sap milky. Leaves alternate, often crowded towards the branchlet tips; lateral veins arcuate and confluent near margin. Flowers small, in clusters, axillary or along leafless lateral shoots, bisexual or female. Calyx deeply 5-lobed. Corolla 5-lobed; lobes about as long as corolla tube, imbricate. Disc cupular to annular. Stamens 5, opposite corolla lobes, adnate to corolla tube, alternating with 5 staminodes. Ovary 5-locular, usually pubescent; ovules 5, attached near locule apex; style cylindrical. Fruit a berry, sometimes dry or woody. Seeds 1–5, with a long, linear scar.

A mainly Old World genus of c. 100 species, distributed from SE Asia, through Malesia to Australia and the Pacific islands, with a centre of diversity in the region of New Guinea, northern Australia and New Caledonia; 1 species occurs on Christmas Is. Many species are large, rainforest trees.

Following P. van Royen, *Blumea* 8: 235–239 (1957), this genus here is kept distinct from *Pouteria* Aubl., which has an American centre of diversity. T.D.Pennington, (The genera of

the Sapotaceae 67, 1991) implied that *Planchonella nitida* should be transferred to the genus *Pouteria* along with the other species of the genus. The exisiting name *Pouteria nitida* Radlk. (1882), however, prevents this combination being made, and if the transfer is made then a new name will be needed.

P. van Royen, Sapotaceae of the Malaysian area, VII. *Planchonella*, *Blumea* 8: 235–445 (1957); T.D.Pennington, The genera of the Sapotaceae (1991).

Planchonella nitida (Blume) Dubard, *Ann. Inst. Bot.-Géol. Colon. Marseille* 20: 62 (1912)

Sideroxylon nitidum Blume, *Bijdr.* 675 (1826). T: Sulin Prov., Java, *C.L.Blume s.n.*; holo: L *n.v.*, *fide* P. van Royen, *op. cit.* 363. Epithet from the Latin *nitidus* (shining), alluding to the glossy leaves.

Chrysophyllum sundaicum Miq., *Fl. Ned. Ind.* Suppl. 1, Sumatra 578–579 (1861); *Sideroxylon sundaicum* (Miq.) Burck, *Ann. Jard. Bot. Buitenzorg* 5: 9 (1886). T: Pulu-Sangian Is., Selat Sunda (Strait), *J.E.Teijsmann* in Herb. Bogor. n. 2976; *n.v.*

Tree to 40 m tall, buttressed; sap white. Leaves elliptic, slightly decurrent at base, shortly acuminate to obtuse, rusty-tomentose when young, glabrescent; lamina c. 5–20 cm long; petiole 2–4 cm long, channelled. Pseudo-racemes c. 3–10 cm long, indeterminate, sometimes branched, with lateral clusters of 2–7 flowers; pedicels c. 4–8 mm long, enlarging. Flowers scented, usually bisexual. Calyx deeply 5-lobed; lobes broadly ovate, 1–1.5 mm long, obtuse, tomentose. Corolla 3.5–4 mm long, deeply 5-lobed, pale green; lobes oblong-elliptic, c. 2 mm long, obtuse. Stamens 5; staminodes subulate, minute. Ovary pubescent; style short. Berry obovoid to ellipsoidal, 1.5–2.5 cm long, often beaked, orange, subtended by persistent calyx. Seeds usually 1–4, ovoid, compressed, brown, glossy. Figs 20, 39J–L.

Christmas Is. Very common in primary forest, forming about 20% of the main canopy (c. 30 m tall) and about 40% of the emergent species (c. 40 m tall). Also occurring in Sumatra, Java, the Sunda Islands, western New Guinea, Sulawesi, Borneo and the Philippines, in mixed and secondary forest, on limestone and in periodically inundated localities.

Ch.Is.: Phosphate Hill, *H.N.Ridley 95* (K); northern plateau, *D.A.Powell 20* (K); Murray Hill, *D.A.Powell 66* (K); plateau, SW of Hanitch Hill, *B.A.Mitchell 51* (CBG, K); central NW of Island, *B.A.Mitchell 201 & 201A* (CBG, K).

Recorded for Cocos (Keeling) Is. by H.Forbes, *A Naturalist's Wanderings in the Eastern Archipelago* (1885) and F.Wood-Jones, *Corals & Atolls* (1912), but no specimens have been located and the species apparently does not survive there.

This is an important nesting tree for many seabirds on Christmas Is., notably the endemic Abbott's Booby. It is easily identified as it is the only forest tree on Christmas Is. with milky sap. The fruit is edible and is reported to be eaten by pigeons and red land crabs. The timber is pale cream, hard but rather brittle, and not very durable. The leaves on juvenile specimens and on sterile shoots are much larger than the adult foliage (up to 50 cm long) and vary in shape from narrowly elliptic to oblong-obovate.

36. MYRSINACEAE

D.J.Du Puy (Ch.Is.)

Trees or shrubs, sometimes climbing; usually bisexual, sometimes dioecious. Leaves alternate, rarely opposite, sometimes subverticillate, simple, entire to serrate, often coriaceous, usually glandular-punctate or with resin ducts; stipules absent. Inflorescence terminal or axillary, paniculate, racemose, umbelliform or clustered. Flowers actinomorphic, usually 4- or 5-merous, mostly small, usually bisexual; bracteoles sometimes present. Calyx deeply lobed, often glandular-punctate, persistent. Corolla often deeply lobed, convolute or valvate, caducous. Stamens usually 4 or 5, opposite and adnate to corolla lobes; free part of filaments short; anthers dehiscing longitudinally, or through apical pores. Ovary superior or semi-superior, unilocular; ovules few to many, in 1–several series, usually on a thick, free-central placenta. Style simple; stigma various. Fruit a berry or drupe. Seeds 1–many; endosperm usually present.

A mainly pantropical and subtropical family, extending into warm-temperate regions, with 32–35 genera and c. 1000 species; 1 genus with 1 species occurs on Christmas Is.

This family is of little economic importance, although a few species in *Ardisia* Sw., *Myrsine* L. and *Maesa* Forssk. are cultivated as ornamentals. *Maesa camfieldiana* Fosberg has edible berries.

C.Mez, Myrsinaceae, *Pflanzenr.* 9 (IV, 236): 1–437 (1902); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Myrsinaceae, *Fl. Java* 2: 194–203 (1965).

ARDISIA

Ardisia Sw., *Nov. Gen. Sp. Prodr.* 3: 48 (1788), *nom. cons.*; from the Greek *ardis* (a point), referring to the protruding, slender style, or the sagittate anthers.

Type: *A. tinifolia* Sw.

Small trees or shrubs, rarely climbing. Leaves alternate or subverticillate, glandular-punctate (sometimes obscurely so) or with resin ducts. Inflorescence usually paniculate, rarely racemose, umbelliform or clustered. Flowers small, bisexual, 5-merous, white or pink, pedicellate. Calyx deeply 5-lobed, persistent. Corolla usually deeply 5-lobed, spreading, convolute, caducous. Stamens 5, adnate to corolla base; filaments short; anthers sagittate, connivent around style, longitudinally dehiscent. Ovary superior; style filiform, sometimes exserted from unexpanded bud; stigma minute; ovules usually in several series. Fruit a drupe, subspherical with a circular scar or persistent style base at apex. Seed 1.

The majority of the c. 300 species in the genus are native to tropical and warm-temperate SE Asia, Malesia, Australia and the Pacific islands as far east as Fiji, with some representatives in tropical America, and very few species in Africa; 1 species occurs on Christmas Is.

Ardisia crispa (Thunb.) A.DC. is sometimes cultivated as an ornamental shrub, with white or pink flowers and red, persistent fruit.

Ardisia colorata Roxb., *Hort. Bengal.* 16 (1814)

T: illustration of *Ardisia colorata*, *W.Roxburgh* Icon. no. 2126; K. Epithet from the Latin *colorare* (to colour), in reference to the pink-coloured flowers.

A. complanata Wall. in W.Roxburgh, *Fl. Indica* 2: 280 (1820). T: Pinang (Penang) Is., Malaya, *G.Porter*, N.Wallich Cat. no. 2277; holo: K.

Figure 41. **A–C**, FABACEAE: *Inocarpus fagifer*. **A**, flowering branchlet X0.5; **B**, flower X3 (**A–B**, C.Andrews 28, K); **C**, fruit X0.5 (Christmas Is., J.Lister, K). **D–E**, CAESALPINIACEAE: *Cynometra ramiflora*. **D**, flowering branchlet X0.5 (SAN 30024, K); **E**, fruiting branchlet X0.5 (D.Powell, 2 Mar 1980, K). **F–H**, MYRSINACEAE: *Ardisia colorata*. **F**, flowering branchlet X0.5; **G**, umbel of flowers X2 (**F–G**, D.Powell 97, K); **H**, fruits X1 (Christmas Is., J.Lister, K). Drawn by E.Catherine.

A. pulchra Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 199–200 (1906), as *A. polchra*. T: Christmas Is., plateau, *H.N.Ridley 3*; iso: K.

Erect shrub to c. 4 m tall; branchlets flattened, narrowly winged, often zigzag, red-brown lepidote when young. Leaves narrowly elliptic, cuneate at base, sometimes superficially dentate, acute, sparsely lepidote; lamina c. 6–22 cm long. Inflorescence a many-flowered panicle, mostly of stalked umbels of c. 5–15 flowers, usually terminal, red-brown lepidote; pedicels 5–8 mm long, enlarging. Flowers c. 6 mm diam., pink. Perianth deeply lobed, glandular-punctate; calyx lobes oblong-ovate, c. 1 mm long, obtuse; margin papillose-ciliate; corolla-lobes broadly ovate, c. 3 mm long, subacute, mucronulate, spreading. Stamens 5; filaments 1 mm long; anthers sagittate, 2 mm long. Style 3 mm long. Drupe subspherical, 4–5 mm diam.; apical scar small, white becoming black. Fig. 41F–H.

Christmas Is. Found in the primary forest on the plateau, where it often forms part of the understorey with *Aidia*. A very variable species distributed from N India and S China, through Indo-China to the Malay islands, including Sumatra, Java, Borneo, Sulawesi and Christmas Is.

Ch.Is.: summit, 6 Oct. 1887, *J.J.Lister* (K); new south-east road, plateau, *C.W.Andrews 1* (K); plateau, *H.N.Ridley 3* (K); W side of Drumsite to South Point railway, 5 mile [8 km] peg, *D.A.Powell 97* (K); plateau, SW of Hanitch Hill, *B.A.Mitchell 45* (CBG, K).

This is an attractive species, as represented on Christmas Is., with strikingly flattened and narrowly winged young stems, and panicles of rose-pink flowers. Christmas Is. specimens are unusual in the presence of the narrow but distinct wing on the stems, decurrent from each side of the petiole base. This character was used by H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 199–200 (1906) to distinguished a separate species, *A. pulchra*, endemic on Christmas Is., but *A. colorata* frequently has similarly flattened stems, and occasionally they are narrowly winged. This same feature was used to distinguish both *A. blumei* A.DC. (1834) and *A. pterocaulis* Miq. (1853), from Java and Sumatra. These taxa and the other species in subg. *Stylardisia* Mez are in need of taxonomic revision; the variants with winged stems could perhaps be distinguished at varietal level.

The leaves of this species are used in Malaya to treat stomach complaints.

37. PITTOSPORACEAE

D.J.Du Puy (Ch.Is.)

Trees and shrubs, usually evergreen. Leaves alternate, simple, entire, leathery; stipules absent. Flowers usually actinomorphic, bisexual, hypogynous, solitary or in short corymbs, racemes or cymose panicles. Sepals 5, free or connate below, imbricate. Petals 5, usually connate and often clawed; imbricate. Disc absent. Stamens 5, usually free, alternating with the petals; anthers 2-locular, dehiscing by longitudinal slits. Ovary superior, usually of 2 fused carpels with 2 deeply penetrating parietal placentas. Style 1, simple. Ovules usually many. Fruit a usually 2-valved capsule or (not on Christmas Is.) a berry. Seeds immersed in a sticky pulp; endosperm present.

An Old World family of c. 9 genera and 200 species distributed in Africa and throughout SE Asia to Polynesia, with 8 genera occurring in Australia; 6 of the Australian genera are endemic; 1 genus (1 species) is represented on Christmas Is.

The family is divided into 2 tribes on the basis of fruit structure. The *Pittosporeae* have capsules, while the *Billardiereae* (not represented on Christmas Is.) have berries.

K.Bakker & C.G.G.J. van Steenis, Pittosporaceae, *Fl. Males.* ser. I, 5: 345–362 (1957); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Pittosporaceae, *Fl. Java* 1: 279–280 (1963).

PITTOSPORUM

Pittosporum Banks ex Sol. in C.F.Gaertner, *Fruct. Sem. Pl.* 1: 286, t. 59 (1788), *nom. cons.*; from the Greek *pitta* (resin) and *spora* (seed), descriptive of the sticky, resinous fluid covering the seed.

Type: *P. tenuifolium* Banks ex Sol. (*typ. cons.*)

Evergreen trees or shrubs with buds enclosed in cataphylls. Leaves often crowded in pseudo-whorls towards end of twigs, usually petiolate, aromatic, young leaves pubescent. Inflorescence a few- to many-flowered, bracteate, axillary or terminal, raceme or panicle, condensed into rounded or umbel-like clusters. Flowers bisexual with some tendency towards functional sexual dimorphism. Sepals and petals free or variously connate, spreading. Ovary sessile or on a short gynophore, 1-locular with 2, rarely up to 5, placentas; stigma capitate. Capsule with 2, rarely up to 5, valves, usually orange when mature. Seeds 1–many, viscid, not winged.

A genus of about 100 species from Africa to E Asia and Australasia, with a centre of diversity in E Malesia. In E Asia it occurs from Japan and Korea to Melanesia, Micronesia, Polynesia and New Zealand; 1 species on Christmas Is.; 9 species in Australia.

R.C.Cooper, The Australian and New Zealand species of Pittosporum, *Ann. Missouri Bot. Gard.* 43: 87–188 (1956).

Several *Pittosporum* species are used as garden ornamentals. The leaves and fruits of some species are used in Malaya as fish poisons. They have a high saponin content.

Pittosporum ferrugineum W.T.Aiton, *Hort. Kew.* 2nd edn, 2: 27 (1811)

T: cult., Royal Gardens, Kew; holo: BM. Epithet is the Latin for rusty coloured in reference to the indumentum.

P. nativitatis Baker in C.W.Andrews, *Monogr. Christmas Is.* 171, t. 17 (1900). T: Christmas Is., 1898, *C.W.Andrews 150*; holo: BM; iso: K.

Illustrations: J.Sims, *Bot. Mag.* 46: t. 2075 (1819); C.W.Andrews, *loc. cit.*, as *P. nativitatis*; T.C.Whitmore, *Tree Fl. Malaya* 2: 310, fig. 1 (1972).

Small tree to 6 m tall. Leaves narrowly elliptic, cuneate at base, entire, slightly undulating, acute to slightly acuminate, when young rusty-pubescent, becoming almost glabrous; lamina 5–20 cm long, 5 cm wide; petiole 1–2 cm long. Inflorescence a terminal or axillary, clustered, globular panicle, corymbose to umbel-like; peduncle pubescent. Flowers occasionally unisexual, scented. Sepals free, lanceolate, acute to acuminate, rusty-pubescent. Petals free, ligulate or widened towards apex, 6–8 mm long, acute, yellowish white. Ovary rusty-pubescent; style short; stigma 2-lobed. Fruit globose-ellipsoidal, 2-valved, orange; valves c. 7–10 mm long, 9–12 mm wide, notched at apex. Seeds 8–24, bright red-coated, viscid, coherent.

Christmas Is. Grows on the upper terraces and on the plateau favouring full sun and poor, dry soil conditions, and is commonly found in abandoned mining sites. Widespread from SE Asia, throughout Malesia and Melanesia to northern Australia.

Ch.Is.: no precise locality, *H.N.Ridley 32, 32A* (K); no precise locality, *A.Pearson & D.A.Powell P35* (K); no precise locality, *D.A.Powell 38* (K); Andrews Lookout, Phosphate Hill, *B.A.Mitchell 20* (CBG, K); Cemetery Rd, North East Point, *B.A.Mitchell 36* (CBG, K).

Pittosporum nativitatis was distinguished by the congested inflorescences. However, these were young inflorescences and similar to those of *P. ferrugineum* at an equivalent stage of development. Specimens from Christmas Is. have slightly larger than normal, less acuminate leaves. The sticky, red-coated seeds are probably dispersed by birds.

38. CRASSULACEAE

I.R.H.Telford (C.K.Is.)
A.E.Orchard (M.Is.)

Annual or perennial herbs or soft-wooded shrubs. Leaves opposite, whorled or alternate, usually simple, usually entire, succulent, exstipulate. Inflorescence an axillary or terminal cyme or panicle, rarely flowers solitary. Flowers actinomorphic, usually bisexual. Sepals usually 3–5, free or connate. Corolla tubular, 3–5-lobed or petals 3–5. Stamens equal to or twice as many as corolla parts, epipetalous, inserted in corolla tube or free; anther 2-locular, dehiscing longitudinally. Ovary superior; carpels usually 3–5, ±free; placentation submarginal; ovules few to many per carpel, anatropous; style 1 per carpel; stigma ±linear. Fruit of 3–5, usually many-seeded follicles. Seeds small, with little endosperm.

An almost cosmopolitan family of c. 35 genera and c. 1500 species, with centres of diversity in southern Africa, Mexico and Asia; 1 genus with 1 species naturalised on Cocos (Keeling) Is.; 1 genus with 1 species native on Macquarie Is.; in Australia 6 genera.

G.Bentham, Crassulaceae, *Fl. Austral.* 2: 450–452 (1864); T.F.Cheeseman, Crassulaceae, *Vasc. Fl. Macquarie Is.* 24 (1919); B.W.Taylor, Crassulaceae, *Fl. Veg. Soils Macquarie Is.* 121–122 (1955); H.H.Allan, Crassulaceae, *Fl. New Zealand* 1: 196–200 (1961); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Crassulaceae, *Fl. Java* 1: 201–202 (1963); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 53 (1984); G.E.Wickens, Crassulaceae, *Fl. Trop. E. Africa* 1–66 (1987); C.J.Webb *et al.*, Crassulaceae, *Fl. New Zealand* 4: 571–583 (1988).

KEY TO GENERA

Erect herb; inflorescence paniculate; petals pink, fused (C.K.Is.)	**1. BRYOPHYLLUM**
Mat-forming herb; flowers solitary; petals white, ±free (M.Is.)	**2. CRASSULA**

1. BRYOPHYLLUM

Bryophyllum Salisb., *Parad. Lond.* t. 3 (1805); from the Greek *bryos* (life) and *phyllum* (a leaf), in reference to the foliar bulbils of some species

Type: *B. calycinum* Salisb. = *B. pinnatum* (Lam.) Oken

Erect herbs, rarely shrub-like, monocarpic. Leaves opposite or whorled, usually simple, sometimes trifoliolate or pinnate, succulent, often bearing bulbils on margins. Inflorescence terminal or terminal and axillary paniculate cymes. Flowers pendulous. Sepals 4, connate, persistent. Corolla tubular, 4-lobed; lobes shorter than tube. Stamens 8 in 2 series, inserted near base of corolla tube. Nectary scales 4. Carpels 4, free or ±connate; ovules many. Fruit of 4 follicles.

A genus of c. 30 species mainly in Madagascar, 1 widespread through the Tropics; 1 species naturalised on Cocos (Keeling) Is.

***Bryophyllum pinnatum** (Lam.) Oken, *Allg. Naturgesch.* 3: 1966 (1841)

Cotyledon pinnata Lam., *Encycl.* 2: 141 (1786). T: Mauritius, *P.Sonnerat*, holo: P *n.v.*, *fide* G.E.Wickens, *op. cit.* 28. Epithet from the Latin *pinnatus* (pinnate), in reference to the leaves.

Bryophyllum calycinum Salisb., *Parad. Lond.* t. 3 (1805). T: not designated.

Stout, erect herb, to 2 m, perennial; stems obtusely quadrangular or subterete, usually

unbranched, except inflorescence. Leaves usually simple, 3–5-foliolate in vigorous plants, crenate or 2-crenate, often shed before anthesis; lamina of simple leaves ovate to oblong, 4–20 cm long, 2.5–15 cm wide; petiole 1.5–6 cm long; lateral leaflets ±sessile. Inflorescence to 80 cm tall; flowers pendulous. Calyx 25–40 mm long, green and red. Corolla 35–55 mm long, pink; lobes ovate-lanceolate, obtuse, 12–17 mm long. Follicles 8–14 mm long, acute.

A garden escape naturalised on Cocos (Keeling) Is. near the kampong on Home Is. in disturbed places in coral rubble; also naturalised in mainland Australia; native to tropical Africa.

C.K.Is.: Home Is., *I.R.Telford 10060 & C.Howard* (CBG).

Often included in *Kalanchoe*, but here following G.E.Wickens, *op. cit.* 27.

2. CRASSULA

Crassula L., *Sp. Pl.* 1: 282 (1753); *Gen. Pl.* 5th edn, 136 (1754); from the Latin diminutive of *crassus*, thick, referring to the fleshy stems and leaves of most species.

Type: *C. perfoliata* L.

Annual or perennial herbs; leaves opposite, connate at base. Inflorescence a thyrse, of 1–several dichasia, or flowers solitary in leaf axils. Flowers erect, usually 4-merous, sometimes 3- or 5-merous. Sepals 3–5, free or shortly connate basally, persistent. Corolla of 3–5 ±free petals. Stamens equalling sepals and petals in number. Nectary scales 3–5. Carpels 3–5, free; ovules 1–several. Fruit of 3–5 follicles.

About 170 species, widespread in temperate areas of the world but concentrated in southern Africa. In Australia, 15 species; 1 extends to Macquarie Is.

H.R.Toelken, The species of *Crassula* L. in Australia, *J. Adelaide Bot. Gard.* 3: 57–90 (1981); H.R.Toelken, Additions to 'the species of *Crassula* L. in Australia', *J. Adelaide Bot. Gard.* 6: 193–196 (1983).

Crassula moschata G.Forst., *Commentat. Soc. Regiae Sci. Gott.* 9: 26 (1787)

Bulliarda moschata (G.Forst.) d'Urv., *Mem. Soc. Linn. Paris* 4: 618 (1826); *Tillaea moschata* (G.Forst.) DC., *Prodr.* 3: 382 (1828). T: Statenland [Staten Is.], Tierra del Fuego, S America, *J.R. & G.Forster*; holo: BM *n.v.*, *fide* H.R.Toelken, *loc. cit.* (1981). Epithet from the Latin *moschatus* (musk scented).

Illustrations: D.M.Moore, Vasc. Fl. Falkland Is., *Brit. Antarct. Surv. Rep.* 60: pl. 4d (1968); D.M.Moore, *Fl. Tierra del Fuego* fig. 107 (1983); R.A.Rossow, *Fl. Patagonica* 4b: fig. 417 (1984).

Mat-forming, glabrous, succulent herb; main stems prostrate, rooting at nodes; lateral stems erect. Leaves spathulate to oblanceolate, concave above, convex below, with a row of c. 3 sunken stomata in each side of midrib on lower surface near tip, reddish at least at base; lamina 2.8–4.2 mm long, 1.1–1.5 mm wide. Inflorescence reduced to a single flower in axil of one of upper leaves. Flowers 4-merous; pedicel 1.5–2.1 mm long. Sepals shortly connate at base, pink. Petals 2.5 mm long, white. Stamens 4. Follicles obovoid, truncate, 0.8 mm long, with a persistent, oblique, curved style. Seeds 4. Fig. 80.

Macquarie Is. Widespread near the coast, particularly in the west, on rock ledges in the salt-spray zone above wave reach. Also found in S America (Fuegia to southern Chile – c. 40°S) and Falkland, Marion, Prince Edward, Crozet and Kerguelen Islands, New Zealand (North, South, Chatham and Stewart Islands) and Snares, Campbell, Auckland and Antipodes Islands, and in southern Tas. Flowers Jan.–Mar.; fruits from Apr.

M.Is.: W coast, 18 Feb. 1949, *N.R.Laird* (AD, AK, CANB, CHR, H, HO, NSW, WELT); north side of Handspike Corner, *R.D.Seppelt 11295* (HO); 400 m N of Tussock Point, *R.D.Seppelt 12407* (HO, MEL); Handspike Point, Nov. 1976, *P.Tyler* (HO).

The Macquarie Is. plants differ from those described by H.H.Allan, *Fl. New Zealand* 1: 197 (1961) from N.Z. and by D.M.Moore, *op. cit.* 74 (1968), from the Falkland Islands in their

shorter stems, their smaller leaves, and in having only 4 seeds per follicle. But they do closely match in all these respects the plants from Gull Reef, Tas., accepted by H.R.Toelken, *loc. cit.* (1981) as belonging to this species. More work is obviously needed on this complex throughout its range.

39. ROSACEAE

A.E.Orchard (M.Is., H.Is.)

Trees, shrubs or herbs. Leaves usually alternate, simple, or more commonly compound or dissected, usually stipulate. Inflorescence capitate or (not in our area) spicate, cymose, racemose, paniculate or umbel-like, rarely of solitary flowers. Flowers actinomorphic, usually bisexual, with a distinct hypanthium or calyx tube. Sepals and petals usually 5 but from 3–10. Stamens 1–many, often a multiple of 5. Gynoecium of 1–several carpels, free or united, mostly with free styles and 1–many ovules. Fruits various. Endosperm lacking, scant or rarely copious.

An almost cosmopolitan family of c. 100 genera and 3000 species, most strongly developed in northern temperate and subtropical regions. In Australia 23 genera and c. 65 species of which all except 7 genera and c. 25–30 species are introduced; 1 genus (2 species) is found on the Australian subantarctic islands. The Rosaceae include many species of horticultural and agricultural importance.

G.Bentham, Rosaceae, *Fl. Austral.* 2: 425–435 (1864); T.F.Cheeseman, Rosaceae, *Vasc. Fl. Macquarie Is.* 21–23 (1919); B.W.Taylor, Rosaceae, *Fl. Veg. Soils Macquarie Is.* 118–121 (1955).

ACAENA

Acaena Mutis ex L., *Mant. Pl.* 2: 145 (1771); from the Greek *akaina* (a thorn), in reference to the spines on the fruiting receptacle.

Type: *A. elongata* L.

Perennial herbs forming clumps or mats; stems sometimes rooting at nodes. Leaves imparipinnate; leaflets serrate; stipules adnate. Inflorescence capitate or (not in our area) spicate. Flowers bisexual (in our area), sometimes otherwise. Sepals usually 4. Petals absent. Stamens 2–5, rarely to 7. Carpels usually 1, sometimes 2, each with a separate fimbriate style and solitary ovule. Cupule with 4 barbed spines at apex. Fruit a 1-seeded achene enclosed in the coriaceous cupule (receptacle) which is almost closed at the top and bears the enlarging spines.

About 150 species, mainly in the southern hemisphere; 6 species in mainland Australia and Tas., and 2 more on the subantarctic islands.

G.Bitter, Die Gattung *Acaena*, *Biblioth. Bot.* 74: 1–336 (1911); H.H.Allan, *Fl. New Zealand* 1: 354–365 (1961); A.E.Orchard, Revision of the *Acaena ovina* A.Cunn. (Rosaceae) complex in Australia, *Trans. Roy. Soc. S. Austral.* 93: 91–109 (1969); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie island, *ANARE Res. Notes* 18: 48–49 (1984).

Stamens 4; styles deep purple; tips of leaflet teeth glabrous or uniformly pilose as for rest of margin **1. A. magellanica**

Stamens 2; styles white; tips of leaflet teeth with a tuft of hairs **2. A. minor**

1. **Acaena magellanica** (Lam.) Vahl, *Enum. Pl.* 1: 297 (1804)

Ancistrum magellanicum Lam., *Tabl. Encycl.* 1: 76 (1791). T: Patagonia, *coll. unknown*; *n.v.* Epithet refers to the straits of Magellan, site of its discovery.

Acaena adscendens Vahl, *Enum. Pl.* 1: 297 (1804). T: Straits of Magellan, *P.Commerson*; syn: ?P, *n.v*; *loc. id.*, *A.Thouin*; syn: ?MPU *n.v.*

Illustrations: B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* 2: pl. 28 (1955); D.M.Moore, *Fl. Tierra del Fuego* fig. 104 (1983); E.M.Grondona, Rosaceae, *Fl. Patagonica* 4B: fig. 446 (1984).

Procumbent herb; main stems prostrate, usually to 40 cm long; lateral branches erect, 3–12 cm tall, sparsely pilose. Leaves 2–10 cm long, 1–3.5 cm wide in outline, moderately to densely pilose below and on margin, or hairs confined to midrib, ±glabrous above; leaflets in 5–8 pairs, shortly petiolulate, obovate, 7–20 mm long; teeth 6–12, blunt. Inflorescence scape to 5–7 cm long; head to 14 mm diam. Stamens 4; anthers red to purple. Style 1, deep purple. Fruiting scape to 9 cm long; head to 2.5 cm diam. including spines; cupule sparsely pilose except glabrous base of spines, or almost glabrous except a few hairs near apex. *n* = 42, D.M.Moore, *Bot. Not.* 113: 187, 1960. Fig. 59.

Macquarie Is., Heard Is. Widespread on Macquarie Is., particularly in sites with a high water-table. Extends to Patagonia, western Argentina and eastern Chile north to c. 27°S, Falkland, South Georgia, Prince Edward, Marion, Crozet and Kerguelen Islands. Flowers Sept.–Feb.; fruits Nov.–May.

M.Is.: between Aurora Cove and Cormorant Point, *D.Montgomery & G.Leaman 36* (HO); Green Gorge, *R.D.Seppelt 12027* (CHR, HO, MEL); North Mountain, *R.D.Seppelt 12742* (AD, AK, CHR, HO). H.Is.: Skua Beach, *A.McGregor 5* (HO); Fairchild Beach, 23 Dec. 1986, *J.J.Scott* (HO).

The Macquarie Is. and Heard Is. plants are a reasonable match with *A. magellanica* as described from the Falkland Is. by D.M.Moore, *Fl. Tierra del Fuego* 133 (1983), but differ in the number of stamens being strictly 4, and in having a longer style, spines strictly 4 and more or less equal, and larger sepals. On Macquarie Is. where the two species grow together, *A. magellanica* is more variable than *A. minor*, but is distinguished by its generally larger size, 4 stamens, red to purple style, glabrous cupule (or if pilose then the hairs usually concentrated at top rather than bottom), leaflets shortly petiolulate, uniformly distributed along rachis, and usually lacking tufts of hairs on tips of teeth.

2. **Acaena minor** (Hook.f.) Allan, *Fl. New Zealand* 1: 363 (1961)

A. sanginsorbae var. *minor* Hook.f., *Fl. Antarct.* 1: 9 (1844). T: Macquarie Is., *J.D.Hooker*; *n.v.* Epithet from the Latin *minor* (smaller).

Prostrate herb; main stems to 70 cm long; lateral branches erect, 5 cm tall, sparsely pilose. Leaves 1.5–8 cm long, 1–2.5 cm wide in outline, glabrous above, long silky-haired below; leaflets in 6 or 7 pairs, the lowermost very reduced and remote, others crowded into distal half of leaf, sessile, ovate to orbicular, 3–15 mm long; teeth 12–16 (rarely 5) each blunt with terminal tuft of white hairs. Inflorescence scape 3–4 cm long; head to 14 mm diam. Stamens 2; anthers purple. Style 1, white. Fruiting scape to 8 cm long; head to 2.5 cm diam. including spines; cupule densely white silky.

Macquarie Is. Widespread but found in generally drier sites than *A. magellanica*. Confined to Macquarie, Auckland and Campbell Islands. Flowers from Sept.–Jan.; fruits Jan.–Apr.

M.Is.: Gentoo Flat, *D.Montgomery & G.Leaman 24* (HO); coastal scree slope east of Boiler Rocks, *R.D.Seppelt 12516* (AD, CHR, HO, MEL); 500 m west of Brothers Point, *R.D.Seppelt 12402* (AK, CHR, HO, MEL); 1.5 km west of Perseverance Bluff, *R.D.Seppelt 12273* (HO, MEL); Bauer Bay, *R.D.Seppelt 12143* (AD, HO, MEL).

40. SURIANACEAE

I.R.H.Telford (C.K.Is., A.R.)

Shrubs or (not on the oceanic islands) trees. Leaves alternate, petiolate, simple; stipules absent or small. Inflorescence an axillary or terminal cyme or (not in our area) panicle, or flowers solitary, bracteate. Flowers actinomorphic, bisexual, hypogynous. Sepals 5, free. Petals 5, free or (not in our area) absent. Stamens 10, the inner 5 sometimes shorter and/or staminodal; anthers 2-locular, dehiscing longitudinally. Ovary superior, of 5 or (not in our area) 1 or 2 free carpels; placentation marginal or marginal-basal; ovules 2 per carpel, anatropous; style inserted at base of ovary or (not in our area) ventrally; stigmas capitate. Fruit of 1–5 indehiscent nut-like segments or drupes, 1-seeded. Seed with little or no endosperm.

A family of 4 genera and 6 species; 3 genera are endemic in mainland Australia; 1 widespread on tropical coasts occurring on Cocos (Keeling) Is. and Ashmore Reef; also in northern Australia.

Surianaceae has been regarded as monotypic in earlier works. Included in the broader circumscription of the family by A.Cronquist, *An Integrated System of Classification of Flowering Plants* (1981), are the genera *Cadellia* F.Muell., *Guilfoylia* F.Muell. (both often included in Simaroubaceae) and *Stylobasium* Desf. (Stylobasiaceae, Chrysobalanaceae or Rosaceae).

H.P.Nooteboom, Surianaceae, *Fl. Males. ser.* I, 6: 193–226 (1962); F.R.Fosberg & S.A.Renvoize, Surianaceae, The Flora of Aldabra and neighbouring islands, *Kew Bull. Add. Ser.* 7: 76–77 (1980).

SURIANA

Suriana L., *Sp. Pl.* 1: 284 (1753); *Gen. Pl.* 5th edn, 137 (1754); honouring Joseph Surian, French physician of the late 17th century, who studied medicinal uses of plants.

Type: *S. maritima* L.

Shrubs. Leaves sessile, entire, obtuse, exstipulate. Inflorescence an axillary, few-flowered cyme. Sepals broadly lanceolate to elliptic, acute or acuminate, persistent. Petals obovate. Inner stamens slightly shorter, usually staminodal. Ovary of 5 free, ±globose carpels; style inserted at base of ovary. Fruit of 1–5 indehiscent, nut-like segments surrounded by enlarged calyx; epicarp thin; endocarp crustaceous.

A monotypic genus, the species widespread on tropical coasts including Cocos (Keeling) Is. and northern mainland Australia.

Suriana maritima L., *Sp. Pl.* 1: 284 (1753)

T: Bermuda, Jamaica, *n.v.* Epithet from the Latin *maritimus* (growing by the sea), in reference to the habitat.

Illustrations: H.P.Nooteboom, *op. cit.* 197, fig. 1; A.Cronquist, *An Integrated System of Classification of Flowering Plants* 583, fig. 5.14 (1981); A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 199 (1985).

Shrub to 3 m, rigid, much-branched; most parts except petals grey-puberulous. Leaves linear to narrowly spathulate, 2–3.5 cm long. Sepals 6–9 mm long. Petals 5–9 mm long, glabrous, yellow. Stamens slightly shorter than petals. Styles equal to stamens. Carpels c. 1.5 mm diam. Fruit segments ±globose, 4–6 mm diam. Fig. 11.

Cocos (Keeling) Is., Ashmore Reef. On Cocos (Keeling) Is. grows in strand shrub communities with *Argusia argentea* in calcareous sand. On Ashmore Reef recorded as not common on the foredunes of West and Middle Islands. Widespread on tropical coasts of the

Indian and Pacific Oceans.

C.K.Is.: Direction Is., *I.R.Telford 10079 & C.Howard* (CBG, K); by loading jetty, West Is., *A.S.George 16260* (CBG); northern shoreline, Pulu Siput, *D.G.Williams 176* (CBG). A.R.: West Is., *K.F.Kenneally 6357* (PERTH); Middle Is., *D.B.Carter 2* (CANB, CBG).

41. MIMOSACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees, shrubs, woody herbs, or lianes, sometimes scandent, sometimes armed. Leaves alternate, bipinnate, bigeminate, pinnate (not in our area) or replaced by phyllodes; rachis sometimes with extra-floral nectaries; stipules occasionally spinescent. Inflorescence axillary, spicate, capitate or racemose. Flowers actinomorphic, usually small and clustered, with conspicuous and sometimes showy stamens, bisexual. Calyx usually 5-dentate, usually valvate. Petals 4 or 5, inconspicuous, free or usually fused below, valvate. Stamens 4–many, exserted, often coloured, sometimes fused at base to corolla or to each other; anthers small, longitudinally dehiscent, sometimes with an apical gland. Ovary superior, unilocular; ovules 2–many. Fruit often a 2-valved legume, sometimes indehiscent, or a lomentum fragmenting and leaving a persistent margin, often clustered. Seeds usually with a pleurogram visible as a ±circular scar on both surfaces; endosperm scarce or absent.

A pantropical and subtropical family with greatest diversity in the southern hemisphere. The c. 60 genera contain 3000 species, 2000 of which are in the 3 largest genera, *Acacia*, *Mimosa* and *Inga*; 3 genera (4 species) naturalised on Christmas Is., 1 of which also on Cocos (Keeling) Is.

They occur in lowland habitats, including rainforest, and are sometimes characteristic of scrub forests, dry savanna or desert. This family is mainly useful for its many decorative species, especially in the genera *Acacia*, *Calliandra* and *Albizzia*. Both the finely bipinnate leaves and the clustered flowers with many, long, coloured stamens make these species attractive.

Samanea saman (Jacq.) Merr. is cultivated on Home Is., Cocos (Keeling) Is., as a shade tree but is not naturalised. On Christmas Is. it has been cultivated as a garden tree since 1954. Commonly called the Rain Tree, it is locally known as Pokok Hujan in Cocos Malay.

Adenanthera pavonia L., the Red Bead Tree, was introduced to Christmas Is. soon after it was settled, perhaps by children who use the red seeds as beads.

Pithecellobium dulce (Roxb.) Benth., the Madras Thorn, is cultivated on Christmas and Cocos (Keeling) Is. It is grown throughout the Tropics as a street tree and hedge plant. On Christmas Is. a line of these was planted by the Drumsite water tanks.

T.S.Elias in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 152 (1981) recognised 5 tribes in subfam. Mimosoideae of family Leguminosae, the species on Christmas Is. being distributed through 3 of them: Mimoseae (incl. *Entada*, *Leucaena*, *Mimosa* and *Adenanthera*); Acacieae (incl. *Acacia*); Ingeae (incl. *Samanea* and *Pithecellobium*).

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Mimosaceae, *Fl. Java* 1: 547–565 (1963); B.Verdcourt, subfam. Mimosoideae, *A Manual of New Guinea Legumes* 125–266 (1979); A.J.G.H.Kostermans, Mimosaceae, in M.D.Dassanayake & F.R.Fosberg (eds), *Revis. Handb. Fl. Ceylon* 1: 459–508 (1980); O.N.Allen & E.K.Allen, *The Leguminosae, A Source Book of Characteristics, Uses and Nodulation* 812 pp. (1981); R.M.Polhill & P.H.Raven (eds), subfam. Mimosoideae, *Advances in Legume Systematics* 1: 143–190 (1981); A.C.Smith, Mimosaceae, *Fl. Vit. Nova* 3: 53–86 (1985).

KEY TO GENERA

1 Leaves replaced by sickle-shaped phyllodes with parallel veins **4. ACACIA**

1: Leaves bipinnate or bigeminate, the leaflets with pinnate veins

2 Leaves with 1 pair of pinnae, each pinna with 1 pair of leaflets (4 leaflets in total); stipules spinescent **†PITHECELLOBIUM**

2: Leaves bipinnate, with numerous leaflets; stipules not spinescent (although plants may be otherwise armed – see *Mimosa*)

3 Flowers tightly clustered in spherical or hemispherical heads

4 Woody herbs or subshrubs; stems with sharp prickles; leaves without glands, folding when touched; fruit up to 3.5 cm long, with numerous stiff bristles **2. MIMOSA**

4: Unarmed trees or large shrubs; leaves with glands at least between lowest pair of pinnae, not touch-sensitive; fruit 10 cm or more long, glabrous or minutely pubescent

5 Leaves with a single gland between lowest pair of pinnae; leaflets less than 2 cm long; petals free; stamens whitish; anthers sparsely pilose; fruit bivalved **3. LEUCAENA**

5: Leaves with several glands on rachis between pairs of pinnae; leaflets 2–6 cm long; petals connate, forming a funnel; stamens crimson; anthers glabrous; fruit indehiscent **†SAMANEA**

3: Flowers in slender, elongated spikes or racemes

6 Gigantic liane; rachis of leaf terminating in a bifid tendril; flowers sessile; fruit up to c. 1 m long, segmented, the segments eventually released leaving persistent woody margin; seeds c. 4–4.5 cm diam., brown, glossy, often washed up on beaches **1. ENTADA**

6: Tree; tendrils absent; pedicels c. 2 mm long; fruit up to 25 cm long, splitting into 2 spirally twisting valves; seeds c. 0.9 cm diam., bright red **†ADENANTHERA**

The genera marked with a dagger (†) are introduced but not naturalised and are not treated further in this text.

1. ENTADA

Entada Adans., *Fam.* 2: 318, 554 (1763), *nom. cons.*; from the Malabar name for lianes in this genus.

Type: *E. monostachya* DC.

Lianes, shrubs or trees; mostly unarmed. Leaves bipinnate, the rachis sometimes extended into a bifid tendril; leaflets few to many, opposite. Inflorescences usually axillary, spicate, solitary or clustered. Flowers small, sessile, bisexual or male. Calyx 5-toothed, campanulate. Petals 5, free or shortly connate at base. Stamens 10, long exserted, connate, adnate to petals at base, forming a short tube; anthers with a caducous, apical gland. Ovary short-stalked; ovules many. Fruit a lomentum, oblong, flat, pendulous, often very large, eventually fragmenting into 1-seeded segments, leaving a persistent woody margin. Seeds compressed.

A pantropical genus of c. 30 species, mainly in Africa and Madagascar; 1 species on Christmas Is.

Entada species contain large amounts of saponin in the bark, wood and seeds. In Malaya the stems are cut into short lengths, beaten and dried, and in this form are used as soap. The half-ripe seeds may be beaten into a paste and mixed with a little water for washing hair,

and its slightly poisonous nature controls head pests. If a stem is cut, potable water will run out.

J.P.M.Brenan, Notes on Mimosoideae: I, *Kew Bull.* 10: 161–170 (1955); J.P.M.Brenan, Leguminosae subfamily Mimosoideae, *Fl. Trop. E Africa* 1: 9–19 (1959); G.P.Lewis & T.S.Elias, Mimoseae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 155–168 (1981).

Entada rheedii Spreng., *Syst. Veg.* 2: 325 (1825)

T: Malabar Coast; India, based on illustrations in H.A.Rheede, *Hort. Malabar.* 8: t. 32–34 (1688). Named after H.A. van Rheede tot Draakestein, a 17th century botanist and author of the *Hortus Malabaricus*.

A gigantic, woody liane reputed to reach 50 m long; stems often coiled. Leaves mostly with 2 pairs of pinnae, the rachis ending in a bifid tendril, each pinna with 4–6 pairs of leaflets; leaflets elliptic to obovate-elliptic, 2.5–6.5 cm long, obtuse to rounded to emarginate. Spikes axillary, with many flowers, usually somewhat clustered on lateral branches, 10–20 cm long, slender, cylindrical. Calyx c. 1.25 mm long, slightly toothed. Petals c. 4 mm long, cream, pale yellow or greenish. Fruit to c. 1 m long, almost straight. Seeds circular or elliptic, c. 4–4.5 cm diam., brown, shiny.

Christmas Is. Occurs on the east coast, on the shore terrace and the lower slopes behind Greta Beach. Drift seeds are commonly found on Dolly and Greta Beaches on the east coast. A widespread species in Africa, SE Asia, Malesia, New Guinea and N Australia, usually in rainforest, often along rivers.

Ch.Is.: drift seed, washed up on beach, Flying Fish Cove, Jan. 1898, *C.W.Andrews* (BM); drift seeds, common on Dolly Beach, very common on Greta Beach, *D.A.Powell 416* (K); Greta Beach, *D.A.Powell 586* (K); behind Greta Beach, *D.A.Powell 643* (K).

The specimens from Christmas Is. have unusually long petals and an unusually large number of leaflets on each pinna, the normal number being 3 or 4 pairs in this species. The stems reach c. 20 cm diam. on Christmas Is., and are often coiled, twisting first one way, then the other. This species is often named *E. pursaetha* DC., *Prodr.* 2: 425 (1825), in other studies. Some of the drift seeds probably belong to a closely related species, *E. phaseoloides* (L.) Merr., which differs in having c. 2 pairs of leaflets on each pinna, but has not otherwise been collected on the island (see C.W.Andrews, *Monogr. Christmas Is.* 177 (1900); H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 190 (1906) both as '*E. scandens* Benth.').

2. MIMOSA

Mimosa L., *Sp. Pl.* 1: 516 (1753); *Gen. Pl.* 5th edn, 233 (1754); from the Greek *mimos* (mimic, mime), in reference to the leaves of some species which fold up and droop when touched, the plant then appearing to be dead.

Type: *M. sensitiva* L.

Mostly herbs or shrubs, sometimes scrambling or scandent, armed with recurved prickles. Leaves bipinnate or pinnae subdigitate with a short rachis, often folding up when touched, rarely phyllodal; leaflets opposite, small. Inflorescence axillary, spicate, cylindrical to globose, sometimes terminal and compound. Flowers small, sessile, usually 4- or 5-merous, bisexual or male. Calyx minute, irregularly dentate. Petals usually 4, small. Stamens as many as or twice the number of petals, free, long-exserted, often pink; anthers without an apical gland. Ovary sessile; ovules 2–many. Fruit oblong, flat, usually bristly, usually a lomentum. Seeds flat.

Predominantly a South and Central American genus of c. 400–450 species, with a few species endemic to SE Asia; 2 introduced, weedy species occur on Christmas Is.

Many *Mimosa* species are ornamental, but they are not widely cultivated. *Mimosa pudica*, with sensitive leaves, is commonly grown as a curiosity.

G.P.Lewis & T.S.Elias, Mimoseae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 166 (1981).

Stems angled, with many prickles; leaves with 2–5 pairs of pinnately arranged pinnae; leaflets up to 6 mm long, finely pubescent; petiole prickly; stamens 8; fruit with bristles on margins and on surface of valves **1. M. invisa**

Stems terete, with scattered prickles; leaves mostly with 2 pairs of subdigitate pinnae; leaflets up to 15 mm long, ciliate; petiole bristly; stamens 4; fruit with marginal bristles only **2. M. pudica**

1. *Mimosa invisa Mart. ex Colla, *Herb. Pedem.* 2: 255 (1834)

T: *C.F.P. von Martius*, Herb. Fl. Brasil. n. 172; iso: K. Epithet from the Latin word for hated or hostile, from the capacity of this plant to form dense thickets covered in sharp, recurved spines.

Illustrations: B.Verdcourt, *A Manual of New Guinea Legumes* 149, 150, figs 38 & 39 (1979).

Spreading, scrambling herb or shrub up to 2 m tall; stems angled, pubescent, with many recurved prickles on the angles. Leaves bipinnate, touch-sensitive, mostly with 2–5 pairs of pinnae 1.5–4 cm long, each with 8–30 pairs of leaflets; leaflets linear-oblong, 2–6 mm long, finely pubescent; petiole prickly. Spikes 1–3 in each axil, globose, 0.5–1 cm diam., peduncle 0.3–1 cm long, prickly, pubescent. Calyx minute or absent. Corolla 4-lobed, 1.5–2 mm long. Stamens 8; filaments pink. Fruit clustered, 1–3.5 cm long, oblong, mostly 3–5-jointed, bristly on margins and surfaces of valves. Seeds c. 3.5 mm long, somewhat glossy. *Giant Sensitive Plant*. Fig. 21.

Christmas Is. First recorded on Christmas Is. in 1963, at South Point. Originally from tropical America, this species is now a common introduced weed in the Old World Tropics, colonising roadsides, pastures, cultivated and disturbed areas and plantations.

Ch.Is.: no precise locality, *D.A.Powell 485* (K).

Recommendations (B.Molesworth-Allen, *pers. comm.*) for its eradication from Christmas Is. were ineffective, and by 1973 this aggressive weed had become a major problem. It seeds abundantly, and forms dense, impenetrable thickets covered in sharp, recurved spines. It quickly invades areas planted for reafforestation, smothering the young trees. It appears to require full sunlight, eventually retreating as secondary forest is established.

2. *Mimosa pudica L., *Sp. Pl.* 1: 518 (1753)

T: Herb. Hort. Cliff. 208, *Mimosa* 3 (excluding inflorescences); lecto: BM, *fide* J.P.M.Brenan, *Kew Bull.* 10: 185 (1955). Epithet from the Latin word for modest or chaste, because the leaves fold themselves up when touched.

Illustrations: A.B.Graf, *Tropica* 546 (1978); B.Verdcourt, *A Manual of New Guinea Legumes* 152, fig. 40 (1979).

Decumbent or scrambling herb or shrub to 1.5 m tall; stems terete, glabrous to hispid, with scattered prickles. Leaves bipinnate, very touch-sensitive, unarmed, mostly with 2 pairs of subdigitate pinnae 2–6 cm long, each with 5–25 pairs of leaflets; leaflets linear, 4–15 mm long, acute, ciliate; petiole bristly. Spikes 1–4 in each axil, globose or ovoid, 1–1.5 cm diam.; peduncle 1–2.5 cm long, bristly. Calyx minute or absent. Corolla 4-lobed, 1.5–2 cm long. Stamens 4; filaments pale pink to lavender. Fruit clustered, oblong, 0.7–1.5 cm long, mostly 2–4-jointed, densely bristly on margins only. Seeds c. 2.5 mm long, with a finely granular surface. *Sensitive Plant*.

Christmas Is. This species also became apparent at South Point during the early 1960s, and has since spread widely. Probably S American in origin, this is now a pantropical weed, growing in cultivated areas, pastures, roadsides, disturbed land and along river banks.

Ch.Is.: no precise locality, *D.A.Powell 486* (K); roadside near Central Workshops, colonising bare ground, *B.A.Mitchell 94* (CBG).

It has weaker, more mat-forming growth than *M. invisa*, but is still an unpleasant weed. It has longer, straighter prickles which can cause infected wounds. The leaflets rapidly fold up

when stimulated, and the pinnae and rachis droop if sufficiently disturbed. It is occasionally used in Malesia as a fodder crop, and is reputed to enhance dairy production if present in the pasture, although it is suspected of poisoning cattle especially when cut and dried. It contains mimosine, a hydroxyamino acid, which is reputed to cause loss of hair in non-ruminant herbivores.

3. LEUCAENA

Leucaena Benth., *Hooker's J. Bot.* 4: 416 (1842); from the Greek *leucos* (white), descriptive of the flower colour.

Type: *L. leucocephala* (Lam.) de Wit

Shrubs or small trees; unarmed. Leaves bipinnate, often with a gland on the petiole near the lowest pair of pinnae. Inflorescence axillary, capitate, pedunculate, often aggregated into terminal, compound inflorescences; heads subtended by a pair of bracts. Flowers bisexual, sessile. Calyx shortly 5-toothed, tubular or campanulate. Petals 5, free, pubescent. Stamens 10, exserted, free; anthers without glands. Ovary stalked; ovules many. Fruit a flat legume, splitting into 2 valves. Seeds compressed, brown, glossy.

A tropical American genus of 40–50 species, with 1 widely cultivated and naturalised species which also occurs on Christmas Is. and Cocos (Keeling) Is.

G.P.Lewis & T.S.Elias, Mimoseae, in R.M.Polhill & P.H.Raven (eds.), *Advances in Legume Systematics* 1: 167 (1981).

*Leucaena leucocephala (Lam.) de Wit, *Taxon* 10: 53 (1961)

Mimosa leucocephala Lam., *Encycl.* 1: 12 (1783). T: Herb. J.B.A.P. de Lamarck *s.n.*; *n.v.* Epithet from the Greek *leucos* (white) and *cephale* (head), after the globose inflorescence of white flowers.

Illustrations: A.B.Graf, *Tropica* 556 (1978); B.Verdcourt, *A Manual of New Guinea Legumes* 156, fig. 42 (1979).

Shrub or small tree, 1–7 m tall; branchlets pubescent. Leaves with 3–8 pairs of pinnae, often with a gland between the lowest pair, each with 7–16 pairs of leaflets; leaflets oblong, 6–19 mm long, unequal-sided, oblique at base, acute or mucronate; margins minutely pubescent. Inflorescence globose, 1.5–2 cm diam.; peduncle 1–4 cm long. Calyx c. 2.5 mm long, tubular, slightly toothed. Petals narrowly spathulate, c. 4.5 mm long, white or greenish. Stamens c. 8 mm long, whitish; anthers pilose, buff. Legume linear-oblong, flat, 10–18 cm long, minutely pubescent, pendulous, often clustered. Seeds 10–25, 7–9 mm long, brown, shiny. *Lead Tree*.

Christmas Is., Cocos (Keeling) Is. Naturalised and common throughout Christmas Is., in cleared ground both in forest and disturbed areas. On Cocos (Keeling) Is., naturalised around the kampong on Home Is. Probably native to tropical America, widely cultivated throughout the tropics, often naturalised, sometimes forming impenetrable thickets and replacing indigenous vegetation such as in northern Australia.

Ch.Is.: near radio stn, *A.Pearson P62* (K); Phosphate Hill area, *B.A.Mitchell 141* (CBG); central area work quarry, *R.Shivas 895A* (PERTH). C.K.Is.: Home Is., *I.R.Telford 10064 & C.Howard* (CBG, K); kampong, Home Is., *D.G.Williams 208* (CBG, PERTH).

Although this species has been introduced relatively recently to Christmas Is., it has spread rapidly across the island. The rapid, dense growth makes it a useful hedge plant and shade plant in plantations, and the foliage makes a good green manure. However, on Christmas Is. it is proving difficult to control, often competing successfully against the natural regrowth in cleared areas. Leaf-eating insect infestations have recently been noted on Christmas Is. The taller shoots are killed and the vigour of the plants is reduced so that it has become less invasive.

Leucaena leucocephala produces high yields of protein-rich fodder, and is often used as a browse shrub for cattle or goats, although it is poisonous to non-ruminant animals, causing

loss of hair. It contains mimosine. It coppices well, and propagates freely from its abundant seeds. It produces good fuel wood, and the seeds are used to make necklaces. It has a very deep tap root, and radiating lateral roots with nitrogen-fixing root nodules, making it valuable for erosion control, soil and water conservation, reafforestation and improvement of poor soils. The leaves fold up at night and when picked. Young pods may be used as a vegetable. It is commonly called *L.* '*glauca*' *sensu* Bentham.

4. ACACIA

Acacia Mill., *Gard. Dict.* abridg. 4th edn (1754); from the Greek *akakia* (*Acacia nilotica* subsp. *tomentosa*), from *akis* (sharp point), referring to the plant's spines.

Shrubs, trees or climbers. Leaves bipinnate or (on cult. species, Christmas Is.) modified to phyllodes; glands usually present on leaf rachis; stipules sometimes spinescent. Inflorescence an axillary, globular head or (in cult. species) spike, sometimes grouped into racemes. Calyx campanulate, 4- or 5-lobed or truncate. Corolla usually 4- or 5-lobed. Stamens many; filaments free; anthers ±glandular. Fruit a pod, curved or straight, compressed or swollen, 1–many-seeded. Seeds bearing a funicle, lacking albumen.

A genus in the broad sense of c. 1200 species, mainly tropical and subtropical, particularly in the Southern Hemisphere; 1 species recorded for Cocos (Keeling) Is. but possibly extinct there. The generic delimitation is currently under review. The Cocos (Keeling) Is. species belongs to *Acacia* Mill. *s. str.* Many species are widely cultivated for reafforestation and ornament. *Acacia auriculiformis* Cunn. ex Benth., a phyllodinous species, has been cultivated on Christmas Is. since the early 1960s as a decorative plant.

***Acacia farnesiana** (L.) Willd., *Sp. Pl.* 4: 1083 (1806)

Mimosa farnesiana L., *Sp. Pl.* 521 (1753). T: Aldinus, Exact. Descr. Rar. Pl. Romae, in *Horto Farnesiano* t. 4 (1625), *fide* J.H.Ross, *Bothalia* 11: 471 (1975). Epithet from the gardens of the Farnes Palace, Rome, where the species may have been first cultivated in the 17th century.

Shrub to 3 m. Leaves 3–7 cm long; pinnae 2–8 pairs; leaflets 7–20 pairs; leaflets narrowly oblong, 2–10 mm long; petiole 5–20 mm long with a round gland. Stipular spines 5–15 mm long. Inflorescence globose, 11–16 mm diam.; peduncles 10–35 mm long. Flowers fragrant. Calyx shortly 5-lobed, c. 1.5 mm long. Corolla 5-lobed, c. 2 mm long. Stamens c. 5 mm long. Legume indehiscent, terete, usually curved, 4–7 cm long, c. 1 cm diam., glabrous. Seeds 4 or 5, embedded in pith, 6–7 mm long.

Cocos (Keeling) Is. A widespread pantropical species, including northern Australia, perhaps originally from tropical America.

C.K.Is.: Keeling Is., East Indies, Apr. 1836, *C.Darwin* (CGE).

Collected by C.Darwin from an island in the main atoll, 'on the same islet as the last specimen [Caesalpinia bonduc]', *fide* D.W.Porter, *J. Linn. Soc., Bot.* 93: 123 (1986). Also recorded by H.Forbes, *A Naturalist's Wanderings in the Eastern Archipelago* 42 (1885) but not reported since. *Caesalpinia bonduc* has been almost eradicated from the main atoll by clearing for coconut plantations. *Acacia farnesiana* is probably extinct on the islands for the same reason. The description is drawn partly from Javan and tropical Australian material as Darwin's specimen is sterile.

42. CAESALPINIACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees, erect or scandent shrubs or occasionally herbs; sometimes armed, sometimes with tendrils. Leaves alternate, bipinnate, pinnate, bifoliolate or (on Christmas Is.) bilobed; rachis sometimes with extra-floral nectaries; pinnae and leaflets mostly opposite, paripinnate; stipules usually small, caducous. Inflorescence axillary or terminal, racemose, sometimes combined into panicles. Flowers usually zygomorphic, often showy, occasionally unisexual. Hypanthium sometimes present. Sepals 4 or 5, imbricate or rarely valvate, usually free to the hypanthium rim, sometimes fused or spathaceous. Petals usually 5, free, sometimes rudimentary, imbricate; upper petal often distinctive and enclosed by adjacent petals in the bud. Stamens usually 10, variously modified or partly staminodal, occasionally connate; anthers usually dehiscing by longitudinal slits, without apical glands. Ovary superior, sometimes stalked, unilocular, with 1–many ovules; style simple. Fruit usually 2-valved, often dehiscent, sometimes winged, often woody. Seeds 1-many, rarely with an areole; endosperm usually sparse or absent.

This principally pantropical and subtropical family contains 151 genera with over 2,500 species; 6 genera (10 species) naturalised or native on Christmas Is.; 2 genera (1 naturalised) and 2 species on Cocos (Keeling) Is. Members of this family are usually not well adapted to dry or cool climatic conditions, the majority being trees, shrubs or woody climbers found in the tropics.

The family is sometimes treated as a subfamily of the Leguminosae. R.S.Cowan, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 64 (1981) divided subfam. Caesalpinioideae into 5 tribes as follows: Caesalpinieae (incl. *Delonix*, *Caesalpinia* & *Peltophorum*); Cassieae (incl. *Senna* & *Cassia*); Cercideae (incl. *Bauhinia*); Detarieae (incl. *Cynometra* & *Hymenaea*); Amherstieae (incl. *Tamarindus*).

The family is mainly useful for its decorative species, especially in the genera *Cassia*, *Senna*, *Caesalpinia*, *Delonix*, *Peltophorum* and *Bauhinia*. On Christmas Is. there are 3 genera (5 species) purely cultivated. Nitrogen-fixing root nodules are rarely formed.

Peltophorum pterocarpum (DC.) Backer ex K.Heyne, the Yellow Flame Tree, was planted on Christmas Is. in the 'Old European Cemetery' near Flying Fish Cove c. 1907. Seedlings from these plants have been planted elsewhere on Christmas Is.

Cassia fistula L., the Golden Shower, has been introduced to Christmas Is. as an ornamental, but does not set seed there.

Senna alata (L.) Roxb., the Golden Candelabra Tree, is persisting in a neglected garden in the central area of Christmas Is. but is apparently not producing seed. *Senna siamea* (Lam.) Irwin & Barneby, is recorded from Christmas Is. by C.W.Andrews, *Monogr. Christmas Is.* 177 (1900) as an introduced tree but it has not been collected recently.

Hymenaea verrucosa Gaertn., grows on Christmas Is. on the eastern shore terrace near the golf course. It resembles *Cynometra ramiflora* but can be distinguished by its smaller leaflets with translucent dots, its long petals with long slender claws, and by its warty glossy fruit. It was probably introduced as a decorative species, or for the varnish which can be produced from its fruit.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Caesalpiniaceae, *Fl. Java* 1: 523–547 (1963); B.Verdcourt, subfam. Caesalpinioideae, *A Manual of New Guinea Legumes* 11–125 (1979); O.N.Allen & E.K.Allen, *The Leguminosae, A Source Book of Characteristics, Uses and Nodulation* 812 pp. (1981); R.M.Polhill *et al.*, subfam. Caesalpinioideae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 81–142 (1981); K.Larsen, S.S.Larsen & J.E.Vidal, Leguminosae – Caesalpinioideae, *Fl. Thailand* 4(1):

1–129 (1984); A.C.Smith, Caesalpiniaceae, *Fl. Vit. Nova* 3: 86–141 (1985).

KEY TO GENERA

1 Leaves bipinnate

2 Sepals valvate in bud, narrowly oblong; petals 40 mm or more long, with a long, slender claw, scarlet; fruit 30–60 cm long **1. DELONIX**

2: Sepals imbricate in bud, rounded; petals less than 30 mm long, short-clawed, yellow (sometimes orange-red in *Caesalpinia pulcherrima*); fruit less than 12 cm long

3 Lower sepal hooded and covering the other sepals in bud; petals not red-hairy at base; stigma inconspicuous; fruit not winged **2. CAESALPINIA**

3: Lower and upper sepals similar, both outside the other sepals in bud; petals red-hairy at base; stigma peltate; fruit broadly winged **+PELTOPHORUM**

1: Leaves bilobed, bifoliolate or once pinnate

4 Leaves pinnate, with 3–20 pairs of leaflets

5 Leaves mostly with 12–20 pairs of leaflets, each less than 2.5 cm long; hypanthium present; bracteoles sepaloid, enclosing bud; 3 upper petals subequal, the lower 2 minute, scale-like; staminal filaments connate in basal half, forming a sheath **6. TAMARINDUS**

5: Leaves with 3–12 pairs of leaflets, mostly longer than 2.5 cm; hypanthium absent; buds not enclosed by bracteoles; petals 5, subequal; staminal filaments free

6 Racemes 20–40 cm long, pendulous; 3 stamens much longer than the rest, with curved filaments 6–10 times longer than their anthers **+CASSIA**

6: Inflorescence not as above, erect or suberect; 1 or 2 stamens longer than the rest, with ±straight filaments up to 2 times as long as their anthers **3. SENNA**

4: Leaves bilobed or bifoliolate (occasionally some leaves with 2 pairs of leaflets in *Cynometra*)

7 Tree with bilobed leaves and large, showy flowers, or a straggling shrub with tendrils and bifoliolate leaves; leaves or pinnae palmately nerved; fruit 9–20 cm long, flattened, oblong to linear-ligulate, with 6–20 seeds **4. BAUHINIA**

7: Tree with bifoliolate leaves and small flowers; leaflets pinnately nerved, oblique; fruit 2.5–3.5 cm long, slightly compressed, obliquely ellipsoidal or obovoid, with 1 or 2 seeds

8 Leaflets large, up to 30 cm long, without translucent dots; petals 5–8 mm long, short-clawed; fruit dull, deeply wrinkled, with a short, oblique beak **5. CYNOMETRA**

8: Leaflets less than 9 cm long, densely dotted with translucent glands; petals 15–20 mm long, long-clawed; fruit glossy, warty, without a beak **+HYMENAEA**

The genera marked with a dagger (+) are introduced but not naturalised and are not treated further in this text.

1. DELONIX

Delonix Raf., *Fl. Tellur.* 2: 92 (1837); from the Greek *delos* (striking) and *onyx* (claw), descriptive of the conspicuously long-clawed petals.

Type: *D. regia* (Bojer ex Hook.) Raf.

Trees. Leaves bipinnate, without extrafloral nectaries; leaflets many, small, opposite. Inflorescence axillary, racemose, clustered towards end of branchlets. Flowers zygomorphic, bisexual, large and showy, subtended by a caducous bract. Hypanthium absent. Sepals 5, subequal, valvate in bud, narrowly oblong. Petals 5, subequal, on long, slender claws. Stamens 10, exserted, subequal; filaments shortly villous at base; anthers dorsifixed, dehiscing by longitudinal slits. Ovary shortly stalked with many ovules. Fruit large, bilaterally flattened, broadly septate between the seeds; valves woody or leathery. Seeds many.

A genus of 10 showy species, mainly endemic in Madagascar, but 1 NE African species and another distributed from E Africa to India; 1 species naturalised on Christmas Is.

*Delonix regia (Bojer ex Hook.) Raf., *Fl. Tellur.* 2: 92 (1837)

Poinciana regia Bojer ex Hook., *Bot. Mag.* 56: t. 2884 (1829). T: illustration in W.J.Hooker, *loc. cit.*, based on collection from Foule Point, Madagascar. Epithet from the Latin *rex* (king) or *regius* (kingly, regal).

Illustrations: A.B.Graf, *Tropica* 537, 540, 543 (1978); B.Verdcourt, *A Manual of New Guinea Legumes* 31, fig. 5 (1979).

Deciduous tree, 6–10 m tall, with a spreading crown; branchlets glabrous, white-spotted. Leaves with 10–20 pairs of pinnae; pinnae to 20 cm long, each with 10–25 pairs of pinnules; rachis with pubescent projections between pairs of pinnae; pinnules oblong, 4–10 mm long, obliquely rounded at base, rounded, mucronulate. Racemes 5–20 cm long, with 6–12 flowers. Petals 4–6 cm long; limb almost circular, crenulate, scarlet, upper petal pale yellow with scarlet blotches; claw slender, yellowish. Stamens fertile, alternately slightly longer and shorter; filaments red. Fruit linear-oblong, 30–60 cm long, flattened, woody, long-persistent, eventually dehiscent. Seeds c. 15–40. *Flame Tree, Poinciana, Flamboyant.*

Christmas Is. There are several hundred plants scattered throughout the island. Endemic in Madagascar, but widely cultivated throughout the tropics.

Ch.Is.: no precise locality, *D.A.Powell 484* (K); central plateau, adjacent to camp 4, *B.A.Mitchell 200* (CBG, K).

Cultivated for its rapid growth, fine foliage, and its brilliant red floral display during Nov. and Dec., although the flowers may suffer from rain damage. It is used to rehabilitate mining sites, and is now self-sown. A highly ornamental and very striking tree.

2. CAESALPINIA

Caesalpinia L., *Sp. Pl.* 1: 380 (1753); *Gen. Pl.* 5th edn, 178 (1754), as *Caesalpina*; after Andreas Caesalpini (1519–1603), an early Renaissance, Italian botanist, physician and Professor of Medicine at Pisa.

Type: *C. brasiliensis* L.

Shrubs, trees or climbers; usually armed. Leaves mostly alternate, bipinnate; rachis often with prickles below; leaflets few to many, usually opposite; stipules various. Inflorescences axillary, racemose and terminal, paniculate by loss of upper leaves, bracteate. Flowers zygomorphic, mostly bisexual (except *C. bonduc*); pedicel usually jointed below flower. Hypanthium short. Sepals 5, rounded, the lower one largest, occasionally shortly joined at base, imbricate. Petals 5, subequal or the uppermost smaller and long-clawed. Stamens 10, alternately slightly longer and shorter, villous or glandular at base; anthers dorsifixed, dehiscing by longitudinal slits. Ovary subsessile or shortly stalked, with 1–10 ovules. Fruits

various, 1–5 times as long as broad, usually flattened, sometimes armed. Seeds 1–9.

A pantropical genus of c. 100 species, with greatest diversity in America and SE Asia, commonly on dry, sandy or rocky areas and on seashores, often in scrubby vegetation; 3 species on Christmas Is., 1 of which also on Cocos (Keeling) Is. Several species are widely grown as ornamentals. The fruits of many species are rich in tannin, used for tanning leather, and to make inks and dyes. The fruits are often useful for identification.

H.A.Hattink, A revision of Malesian *Caesalpinia*, *Reinwardtia* 9: 1–69 (1974)

1 Erect shrub or small tree , ±unarmed; leaflets less than 25 mm long; stamens 5–7.5 cm long; fruit linear-oblong with 8 or 9 seeds **1. C. pulcherrima**

1: Climbing or scrambling shrub, prickly; leaflets mostly more than 30 mm long; stamens 0.6–1 cm long; fruit broadly oblong to elliptic, with 1 or 2 seeds

2 Stems, leaves and inflorescences pubescent; leaves with 3–9 pairs of pinnae, each with 5–9 pairs of leaflets; stipules pinnate, persistent; petals as long as sepals; fruit spiny; seeds spherical, grey **2. C. bonduc**

2: Stems, leaves and inflorescences glabrous; leaves with 2–4 pairs of pinnae, each with 2 or 3 pairs of leaflets; stipules minute, soon falling; petals exceeding sepals; fruit unarmed; seeds flattened, black **3. C. crista**

1. *Caesalpinia pulcherrima (L.) Sw., *Observ. Bot.* 166 (1791)

Poinciana pulcherrima L., *Sp. Pl.* 1: 380 (1753). T: Herb. C.Linnaeus 529.1; lecto: LINN, *fide* J.P.M.Brenan, *Fl. Trop. E. Africa*, Leguminosae, Caesalpineaceae: 31 (1967). Epithet is the superlative of the Latin *pulcher* (beautiful), descriptive of the brightly coloured flowers.

Illustrations: A.B.Graf, *Tropica* 548 (1978); B.Verdcourt, *A Manual of New Guinea Legumes* 28, fig. 4 (1979).

Shrub or small tree 2–5 m tall; branchlets unarmed or sparsely prickled. Leaves ±unarmed, c. 20–30 cm long, with 3–9 pairs of pinnae, each with 6–12 pairs of shortly stalked leaflets; leaflets oblong, 5–25 mm long, oblique at base, rounded to emarginate; stipules minute, caducous. Racemes axillary, many-flowered, 15–40 cm long, glabrous, occasionally branched; pedicels 5–7 cm long. Petals 15–25 mm long, yellow or orange-red, often with yellow margins; upper petal smaller with a slender claw 10–15 mm long. Stamens 5–7.5 cm long, slender, greatly exserted, hairy at base. Fruit linear-oblong or broader apically, 8–10 cm long, flattened, glabrous, dehiscent, dark brown. Seeds 8–9, obovoid. *Barbados Pride*, *Peacock Tree*, *Paradise Flower*.

Christmas Is. It was introduced in the early 1900s as a garden plant, but now frequently occurs as a roadside tree. Probably indigenous to tropical America, but widely cultivated throughout the tropics and often naturalised.

Ch.Is.: no precise locality, *D.A.Powell 695* (K).

Flowers continuously and on very young plants. Both red- and yellow-flowered variants are present on the island. Becomes untidy if not pruned. The fruit is reputed to be edible.

2. Caesalpinia bonduc (L.) Roxb., *Fl. Indica* 1832 edn, 2: 362 (1832), corrected by J.E.Dandy & A.W.Exell, *J. Bot.* 76: 177 (1938)

Guilandina bonduc L., *Sp. Pl.* 1: 381 (1753); *Guilandina bonducella* L., *Sp. Pl.* 2nd edn, 545 (1762), *nom. illeg.*; *Caesalpinia bonducella* (L.) Fleming, *Asiat. Res.* 11: 159 (1810), *nom. illeg.* T: Sri Lanka, Herb. P.Hermann 156, vol. 3, fol. 35; lecto: BM, *fide* J.E.Dandy & A.W.Exell, *loc. cit.* Epithet is a Latin corruption of the Arabic *bondoq* (hazel nut), because of the superficial similarity of the seed to a hazel nut.

Illustration: A.C.Smith, *Fl. Vit. Nova* 3: 93, fig. 20 (1985).

Strong, prickly, climbing shrub, to 15 m, pubescent. Leaves c. 10–50 cm long; pinnae 3–9 pairs with 5–9 leaflets pairs, shortly stalked; rachis prickles recurved; leaflets oblong-elliptic, 1.5–6 cm long, obliquely rounded at base, rounded to acute, mucronate; stipules pinnate, persistent. Racemes unisexual, supra-axillary and terminal, 7–35 cm long, occasionally branched; pedicels 5–7 mm long; flowers many, clustered. Petals spathulate, c.

7 mm long, yellow; upper petal claw 3 mm long. Stamens 6–10 mm long, green, hairy towards base; staminodes slightly shorter in female flowers. Pistil 7–8 mm long; pistillode 1 mm in male flowers. Fruit broadly oblong-elliptic, 5–6 cm long, flattened, woody, strongly spiny, dehiscent. Seeds 1 or 2, large, spherical, greyish.

Christmas Is., Cocos (Keeling) Is. Common throughout Christmas Is. Once frequent on Cocos (Keeling) Is., though largely eradicated from the southern atoll for *Cocos* plantations, now recorded only from Horsburgh Is. and North Keeling Is. Pantropical, including N Australia, usually coastal or in secondary forest, often forming dense thickets.

Ch.Is.: Smith Point, *H.N.Ridley 153* (K); SE coast between Greta and Dolly Beaches, *B.A.Mitchell 1* (CBG, K); between Lily Beach and Waterfall, *B.A.Mitchell 17* (CBG, K). C.K.Is.: NW end of lagoon, North Keeling Is., *I.R.Telford 10028 & C.Howard* (AD, CBG, K); eastern most point, Horsburgh Is., *D.G.Williams 34* (CBG).

The seeds float, and can remain viable in water for several years, explaining the frequency of this species on tropical coasts. They contain a bitter glycoside, bonducin, which can be used as a quinine substitute for the treatment of fevers, and also yield oils useful in cosmetics and medicines. The seeds are also used as beads, or as marbles by children. This and several related species are sometimes placed in the genus *Guilandina* L.

3. Caesalpinia crista L., *Sp. Pl.* 1: 380 (1753)

T: Sri Lanka, Herb. P.Hermann 157, vol. 1, fol. 68; lecto: BM, *fide* J.E.Dandy & A.W.Exell, *J. Bot.* 76: 179 (1938). Epithet is from the Latin *crista* (crest) and refers to the plume of hairy filaments.

Illustration: B.Verdcourt, *A Manual of New Guinea Legumes* 25, fig. 3 (1979).

Prickly, climbing shrub, to 15 m, glabrous. Leaves c. 10–30 cm long, with 2–4 pairs of pinnae, each with 2 or 3 pairs of stalked leaflets; rachis armed with recurved prickles; leaflets ovate to elliptic, 3–8 cm long, obliquely obtuse at base, subacute, shining above; stipules minute, caducous. Racemes supra-axillary and terminal, 5–20 cm long, branched and combined into large, terminal panicles; pedicels 8–15 mm long; flowers many, clustered. Petals obovate, 8–10 mm long, yellow; upper petal with a 5 mm long claw, orange-veined. Stamens c. 10 mm long, woolly below, orange. Fruit broadly elliptic, 4.5–6.5 cm long, beaked, flattened, glabrous, unarmed, eventually dehiscent. Seed usually 1, reniform, flattened, black.

Christmas Is. Occurs between the golf course and Waterfall on the east coast, but may be more widely distributed on the terraces. Distributed throughout coastal SE Asia and Malesia to New Guinea, New Caledonia and northern Australia (Qld), often on sandy beaches, mangrove swamp and river margins, on limestone rocks or in secondary scrub.

Ch.Is.: shore terrace, north of Norris Point, *D.A.Powell 306* (K).

Caesalpinia crista resembles *C. bonduc*, but is less common. The wood is hard, dense and strong, and has a rich red colour when seasoned. The seeds contain bonducin (see *C. bonduc*).

3. SENNA

Senna Mill., *Gard. Dict. Abr.* 4th edn, (1754); from the Arabic *sana*, for species which have leaves and pods with cathartic and laxative properties.

Type: *S. alexandrina* Mill.

Trees, shrubs or herbs, often with extrafloral nectaries on leaves. Leaves alternate, pinnate, with opposite leaflets. Inflorescence axillary, racemose, often becoming paniculate towards branchlet ends by reduction of leaves. Flowers bisexual, zygomorphic, subtended by a bract. Hypanthium absent. Sepals 5, unequal. Petals 5, usually heteromorphic, usually yellow. Stamens usually 10, the adaxial 3 usually reduced to staminodes (but see *S. sulfurea*); filaments not more than twice as long as anthers; anthers usually basifixed, dehiscing apically. Ovary sessile to shortly stalked, with many ovules. Fruit terete, 4-angled or

bilaterally flattened, transversely septate, indehiscent, fragmenting, or splitting along 1 or both sutures; valves never elastically coiling. Seeds many.

A genus of c. 250 pantropical and warm temperate species mostly from the New World, especially the neotropics. It is relatively poorly represented in SE Asia and the Pacific islands. All 4 species recorded from Christmas Is. are introduced, with only 2 forming naturalised populations; 1 species also naturalised on Cocos (Keeling) Is.

Many species are cultivated as ornamentals. The dried pods and leaves of several species are used as powerful cathartics and laxatives, the active chemicals being emodin and related glucosides.

H.S.Irwin & R.C.Barneby, Cassieae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 105 (1981); H.S.Irwin & R.C.Barneby, American Cassiinae, *Mem. New York Bot. Gard.* 35: 64–635 (1982).

Senna Mill. is treated here as distinct from *Cassia* L., following H.S.Irwin & R.C.Barneby, *loc. cit.* (1981), and *loc. cit.* (1982).

1 Leaves usually with 4–6 pairs of leaflets; extrafloral nectaries (glands) present on petiole or rachis of leaf; inflorescence with less than 15 flowers; naturalised

2 Woody herb; leaves with a raised gland above the swollen petiole base; peduncle 0.3–0.4 cm long; petals 9–15 mm long; fertile stamens 6, 2 long and 4 medium length; staminodes 4; fruit erect **1. S. occidentalis**

2: Small tree; leaves with clavate glands on rachis between lower pinna pairs; peduncle 3–7 cm long; petals 20–30 mm long; fertile stamens 10, 1 longer than the rest; fruit pendulous **2. S. sulfurea**

1: Leaves usually with 7–10 pairs of leaflets; extrafloral nectaries absent; inflorescence usually with more than 20 flowers; small, cultivated tree

3 Leaflets broad, oblong; inflorescence racemose; floral bracts 20–30 mm long, broadly ovate, orange, giving the young racemes a cone-like appearance; fruit winged **+S. alata**

3: Leaflets narrowly elliptic; inflorescence paniculate; floral bracts inconspicuous, 3–5 mm long, somewhat 3-lobed, the central lobe acuminate; fruit not winged, with thickened margins **+S. siamea**

Species marked with a dagger symbol (+) are introduced but not naturalised and are not treated further in the text.

1. *Senna occidentalis (L.) Link, *Handb.* 2: 140 (1821)

Cassia occidentalis L., *Sp. Pl.* 1: 377 (1753). T: cultivated, Herb. Hort. Cliff. 159, *Cassia*; lecto: BM, *fide* H.S.Irwin & R.C.Barneby, *op. cit.* 436 (1982). Epithet from the Latin *occidens* (the west), as this species was first collected from the West Indies.

Illustration: B.Verdcourt, *A Manual of New Guinea Legumes* 53, fig. 12 (1979).

Annual or short-lived perennial herb, 40–120 cm tall; stems glabrous. Leaves 12–20 cm long, with 4–6 pairs of leaflets which are larger distally; leaflets ovate, 2.5–8 cm long, rounded at base, acute to acuminate, ciliate, foetid; petiole with a dark purple gland above the swollen base. Racemes with 1–5 flowers; peduncle 0.3–0.4 cm long; bracts oblong, 4–5 mm long. Petals 9–15 mm long, bright yellow. Stamens 10, 2 much longer, 4 medium and 4 staminodal. Fruit linear, 9–13 cm long, flattened, erect, usually slightly curved, drying with a longitudinal, dark-brown stripe. Seeds 30–40, ovate to rounded, c. 5 mm long, with an areole on each face.

Christmas Is., Cocos (Keeling) Is. Naturalised and spreading along the roads and tracks on Christmas Is.; on Cocos (Keeling) Is. occasionally naturalised around the kampong on Home Is. Possibly native to the Old World. Now a weed with pantropical and warm-temperate distribution, preferring dry or seasonal climates, typically found on roadsides, waste places, gardens and as an invader of heavily grazed pastures.

Ch.Is.: 13.7 km from South Point, South Point road, *A.Pearson P59* (K); no precise locality, *D.A.Powell 887* (K); central plateau, roadside near Central workshop, *B.A.Mitchell 98* (CBG, K); roadside, 1 km S of airport, *R.Shivas 950* (PERTH). C.K.Is.: kampong, Home Is., *D.G.Williams 160 & Amat Noor* (CBG, K).

The whole plant has purgative properties but these are destroyed in the seeds when they are roasted for use as a coffee substitute. May prove to be a useful ground cover for the revegetation of quarries, although it becomes too woody for use as a green manure.

2. *Senna sulfurea (Collad.) Irwin & Barneby, *Mem. New York Bot. Gard.* 35(1): 78 (1982)

Cassia sulfurea DC. ex Collad., *Hist. Casses* 84 (1916). T: Mauritius or Reunion; iso: G-DC *n.v.*, *fide* H.S.Irwin & R.C.Barneby, *loc. cit.* (1982). Epithet from the Latin *sulfur* (sulphur), descriptive of the bright yellow flowers.

Illustration: A.B.Graf, *Tropica* 550 (1978), as *Cassia surattensis*.

Shrub or small tree to 7 m tall; young branchlets minutely strigose. Leaves 5–10 cm long, with 4 or 5 pairs of leaflets which are larger distally; leaflets ovate-elliptic, 1.5–6 cm long, obtuse at base, subacute, mucronulate or minutely emarginate, glaucous beneath with appressed hairs on veins; rachis with clavate glands between lower leaflet pairs. Racemes usually with 7–15 flowers; peduncle 3–7 cm long; bracts ovate, 5–6 mm long, recurved. Petals 20–30 mm long, bright yellow. Stamens 10, 1 long, 9 short, all fertile. Fruit 10–14 cm long, ligulate, flattened, pendulous, often narrowed across infertile seeds, dark brown. Seeds 20–35, oblong, beaked, c. 5 mm long, lustrous.

Christmas Is. Introduced and growing in a single stand on the shore terrace, North West Point, with many self-sown seedlings present. A native of India and Burma, widely cultivated in the New World and Malesia as an ornamental and shade tree, often naturalised in disturbed areas and thickets, especially in coastal areas.

Ch.Is.: no precise locality, 2 Feb. 1980, *D.A.Powell* (K); shore terrace, North West Point, *D.A.Powell 445* (K).

Until recently this species was confused with *S. surattensis* (Burm.f.) Irwin & Barneby, commonly known as *Cassia surattensis* Burm.f. (H.S.Irwin & R.C.Barneby, *Mem. New York Bot. Gard.* 35: 78, 1982).

4. BAUHINIA

Bauhinia L., *Sp. Pl.* 1: 374 (1753); *Gen. Pl.* 5th edn, 177 (1754); after the 16th Century Swiss botanists Caspar and Jean Bauhin, the deeply bilobed leaf being symbolic of these two brothers.

Type: *B. divaricata* L.

Small trees, shrubs or climbers; occasionally with tendrils. Leaves alternate, entire, bilobed or occasionally bifoliolate, palmately nerved. Inflorescence terminal or lateral, usually racemose, bracteate. Flower zygomorphic, usually bisexual, often large and showy; pedicel often with bracteoles. Hypanthium cup-shaped to tubular. Calyx spathaceous or 2–5-lobed or -fid. Petals mostly 5, subequal, the uppermost often distinctive. Stamens 10, variously staminodal or absent; anthers usually dorsifixed, dehiscing by longitudinal slits. Ovary stalked, with 2–many ovules; stigma usually peltate. Fruit oblong to linear, flattened, membranous, leathery or woody, often bivalved and explosively dehiscent, with few to many seeds.

A pantropical, subtropical and warm-temperate genus of c. 250 species; 2 species occur on Christmas Is., 1 of which was originally introduced as a garden tree. *Bauhinia* species are important ornamental trees in parks, gardens and on roadsides. The wood is often fine-grained, dense and decorative, but is not available in large enough quantities to be commercially useful.

Several sections of *Bauhinia* were raised to generic rank by H.C.D. de Wit, *Reinwardtia* 3:

381–539 (1956), in his study of the genus in Malesia. However, the broader definition of the genus, given by R.P.Wunderlin *et al.*, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 114 (1981), is accepted here.

H.C.D. de Wit, A Revision of Malaysian Bauhinieae, *Reinwardtia* 3: 381–539 (1956); R.P.Wunderlin, K.Larsen & S.S.Larsen, Cercideae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 114–116 (1981); K.Larsen & S.S.Larsen, The genus *Bauhinia* in Australia. Taxonomy and palynology, *Bot. Helvetica* 93: 23–220 (1983).

Scandent shrub with tendrils; leaves bifoliolate, 2.5–4.5 cm long; petals 1.5–2 cm long, white; stamens 10, all fertile **1. B. binata**

Tree without tendrils; leaves bilobed, 5–15 cm long; petals 4–5 cm long, strongly marked with crimson; fertile stamen solitary **2. B. monandra**

1. **Bauhinia binata** Blanco, *Fl. Filip.* 331 (1837), as *binnata*

T: Luzon, Philippines, Merrill Species Blancoanae *n. 998*; neo: L, *fide* E.D.Merrill, *Species Blancoanae* 172–173 (1918). Epithet from the Latin *bi-* (twice) and *natus*, from *nascor* (to be born, to be produced), in reference to the pair of leaflets comprising each leaf.

Illustration: B.Verdcourt, *A Manual of New Guinea Legumes* 111, fig. 26 (1979), as *Lysiphyllum binatum* (Blanco) de Wit.

Straggling or scandent shrub to 5 m tall; branchlets unarmed, glabrous, with woody, coiled tendrils. Leaves bifoliolate; leaflets obliquely ovate, 2.5–4.5 cm long, broadly rounded, glabrous; rachis extending beyond leaflets as a small, caducous mucro; petiole 1.5–2.5 cm long. Racemes 2–6 cm long, corymb-like, sparsely hairy; flowers many; pedicels 10–15 mm long, with a pair of bracteoles in basal half. Hypanthium c. 7 mm long, tubular. Sepals 5, ovate, 7–9 mm long, acute. Petals oblong-obovate, 1.5–2 cm long, with a claw 1–2 mm long, woolly outside, white. Stamens 10, all fertile, 2–3 cm long, red. Fruit oblong, 9–15 cm long, flattened, curved, corky, indehiscent. Seeds 6–10, brown.

Christmas Is. Occurs on the shore and lower terraces on the northern coast between North West Point and West White Beach; flowers Jan.–Feb. Distributed from southern Thailand through Malesia to the Philippines, New Guinea and coastal northern Australia, but rare in Java. It is a seashore plant, usually found in sandy soil or among rocks, and often on coral islets.

Ch.Is.: behind the sea cliffs, 1 Feb. 1980, *D.A.Powell* (K); no precise locality, *D.A.Powell 542* (K).

The corky walls of the fruit have many air cavities, allowing it to float well. This species is tolerant of dry, sandy soils with a high salinity and produces a good, evergreen ground cover, suggesting that it could prove useful in the revegetation of dry regions. It is reputed to be effective in stopping bleeding and against dysentery.

This species is sometimes included in the genus *Lysiphyllum*, following H.C.D. de Wit, *Reinwardtia* 13: 432 (1956), on the basis of its climbing or trailing habit, the presence of tendrils, and the absence of spines. This treatment is rejected by R.P.Wunderlin *et al.*, *Advances in Legume Systematics* 1: 116 (1981). The species appears very close to *B. hookeri* F.Muell., a small tree from northern Australia. *Bauhinia binata* differs in its shrubby habit, the presence of tendrils, and in its shorter hypanthium which does not elongate substantially after anthesis (K.Larsen & S.S.Larsen, *Bot. Helvetica* 93: 214, 1983).

2. ***Bauhinia monandra** Kurz, *J. Asiat. Soc. Bengal* 42: 73 (1873)

T: Martaban, Burma, *D.Brandis*; *n.v.* Epithet from the Greek *monos* (single, one) and *andros* (male), descriptive of the flower with a single fertile stamen.

Illustration: A.B.Graf, *Tropica* 541 (1978).

Shrub or small tree 3–7 m tall; young branchlets pubescent. Leaves broadly ovate, deeply bilobed, shallowly cordate at base; nerves puberulous beneath; lamina 5–15 cm long; petiole 2.5–6 cm long. Racemes 2.5–7 cm long, pubescent, with several large flowers; pedicels 10–20 mm long, with apical bracteoles. Hypanthium narrowly tubular, 23–30 mm long.

Calyx 15–20 mm long, spathe-like, tomentose. Petals obovate, 4–5 cm long, tapering to claw, undulate, cream with pink streaks; upper petal yellow with strong crimson markings; all soon becoming pink. Stamen solitary, 3.5–4.5 cm long; staminodes 9, c. 0.3 cm long. Fruit linear-ligulate, 15–20 cm long, thick, flattened, explosively dehiscent. Seeds 10–20, black. *Orchid Tree*.

Christmas Is. Commonly planted as a garden tree although somewhat short-lived. Produces copious seed and is now naturalised in the Drumsite area in the marginal vegetation. Also naturalised in N Australia (Qld). This species is unknown in the wild, but probably originated in tropical America. Now widely cultivated in the tropics.

Ch.Is.: Drumsite, *D.A.Powell 825 & H'ng Kim Chey* (K); South Point railway, c. 2 km north of old settlement, *B.A.Mitchell 187* (CBG, K).

5. CYNOMETRA

Cynometra L., *Sp. Pl.* 1: 382 (1753); *Gen. Pl.* 5th edn, 179 (1754); from the Greek *kuon, kunos* (dog) and *metra* (womb), derived from the Malay name for *C. cauliflora* L., *poeki andjing* (dog's pudenda), alluding to the unusual shape of the fruit.

Type: *C. cauliflora* L.

Evergreen trees and shrubs; growth in flushes from resting buds. Leaves pinnate with few pairs of opposite leaflets, or rarely unifoliolate; leaflets large, oblique and unequal-sided, coriaceous, limp when young. Racemes axillary or cauliflorous, dense, sessile, bracteate. Flowers bisexual, small. Hypanthium short, campanulate. Sepals usually 4, reflexed. Petals 5; lower petal sometimes very small. Stamens usually 10, free; anthers small, dorsifixed, cleft at base, dehiscing by longitudinal slits. Ovary stalked, with 1 or 2 ovules; stigma small. Fruit obliquely ellipsoidal, deeply wrinkled, warty, woody, indehiscent, or flattened with 2 smooth valves (not on Christmas Is.). Seeds 1 or 2.

A pantropical genus containing c. 100 species; 1 species native on Christmas Is. The more widespread species often occur in damp habitats such as river banks and mangrove swamps.

M.S.Knaap-van Meeuwen, The Indo-Malesian and Pacific Cynometreae, *Blumea* 18: 1–31 (1970); R.S.Cowan & R.M.Polhill, Detarieae in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 122–124 (1981).

Cynometra ramiflora L., *Sp. Pl.* 1: 382 (1753)

T: based on *Cynomorium sylvestre* Rumph., *Herb. Amboin.* 1: 167, t. 63 (1741); *fide* M.S.Knaap-van Meeuwen, *op. cit.* 23. Epithet from the Latin *ramus* (branch) and *flos* (flower), this species flowering on its branchlets in contrast to from the bole and older branches as in the type species.

Illustration: B.Verdcourt, *A Manual of New Guinea Legumes* 84, fig. 19 (1979).

Small to medium tree, 5–20 m tall. Leaves distichous, mostly with 1 pair of ±sessile leaflets; leaflets oblong-elliptic, unequal-sided, 6–30 cm long, oblique at base, shortly acuminate, glabrescent; petiole 3–10 mm long, glabrous; young foliage drooping, cream or pinkish. Racemes axillary, sometimes paired; rachis 10–25 mm long; pedicels 6–15 mm long, with bracteoles near base. Hypanthium c. 1 mm long. Sepals 4–6 mm long, usually pubescent at tips, white, reflexed. Petals narrowly ovate, 5–8 mm long, white. Stamens usually 10, glabrous. Ovary densely hairy; stalk 1 mm long. Fruit obliquely ellipsoidal, 2.5–3.5 cm long, deeply wrinkled, woody, shortly pubescent; beak short, oblique. Seed 1. *Wrinklepod Mangrove*. Fig. 41D–E.

Christmas Is. A single stand S of Ross Hill, at 300 m alt., in the eastern peripheral zone of the primary forest as part of the understorey vegetation in basaltic soil. Distributed from India, through SE Asia and Malesia, to the Pacific islands. The species does not occur in Australia, where it is replaced by the closely related *C. iripa* Kostel.

Ch.Is.: 1000 m south of Ross Hill, 2 Mar. 1980, *D.A.Powell* (K).

This is another example of a typically coastal mangrove species being maintained in an inland ecosystem (see also *Heritiera littoralis*). It is characteristic of the vegetation towards the drier and less saline back of mangrove forest, and is also found on coral platforms, in strand vegetation, along rivers, in damp grassland and occasionally as an upland species. It has heavy, hard, dark brown timber, but is not very durable. The fruit is well suited to sea dispersal, as the layers of fibre in the pericarp enclose many small air pockets, giving the fruit buoyancy.

6. TAMARINDUS

Tamarindus L., *Sp. Pl.* 1: 34 (1753); *Gen. Pl.* 5th edn, 20 (1754); from the Arabic *tamr-hindi* (Indian dried date) because it is widely cultivated in India, and the pod contains an edible, fibrous pulp.

Type: *T. indica* L.

Trees; branchlets glabrescent. Leaves pinnate; leaflets opposite, small, many, somewhat fleshy. Racemes terminal and axillary towards branchlet tips, few-flowered, lax, bracteate. Flowers bisexual, zygomorphic. Hypanthium narrowly obconical. Sepals 4. Petals 5, the upper 3 subequal, the lower 2 minute. Fertile stamens 3; filaments connate into a sheath in basal half; staminodes 4 or 5 at apex of sheath; anthers dorsifixed, dehiscing by longitudinal slits. Ovary stalked, pubescent; stipe adnate to hypanthium; stigma subcapitate; ovules 8–14. Fruit linear-oblong, blunt, slightly compressed, often curved and irregularly constricted, indehiscent, pulpy inside. Seeds up to 12, compressed, areolate.

A monotypic genus, probably originating in NE Africa; naturalised on Christmas Is.

R.S.Cowan & R.M.Polhill, Amherstieae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 141 (1981).

Tamarindus indica L., *Sp. Pl.* 1: 34 (1753)

T: Herb. Hort. Cliff. 18, Tamarindus 1; syn: BM; Herb. P.Hermann 88, vol. 2, fol. 73, 80; syn: BM; Herb. C.Linnaeus 49.2, 49.3; syn: LINN. Epithet from the Latin *Indus* (India, Indian), although this species is probably African in origin, but is widely cultivated in India.

Illustration: B.Verdcourt, *A Manual of New Guinea Legumes* 109, fig. 25 (1979).

Tree to 20 m tall. Leaves 8–14 cm long, with 12–20 pairs of subsessile leaflets; leaflets oblong, unequal-sided, 10–25 mm long, oblique at base, rounded to emarginate, glabrous. Racemes 2–10 cm long; pedicels 8–16 mm long, jointed behind flower, with caducous, reddish bracteoles enclosing bud. Hypanthium c. 4 mm long, flared. Sepals 4, oblong, 10–12 cm long, acute, pale yellow inside, reddish outside. Upper petals 11–13 mm long, pale yellow with red veins; lower petals 1–2 mm long, scale-like. Fertile stamens c. 12 mm long; staminal sheath 6–7 mm long, densely hairy at base. Fruit 3.5–20 cm long, thick; exocarp thin, brittle, dull, pale brown; mesocarp pulpy, fibrous. Seeds 1–10, glossy, brown. *Tamarind*.

Christmas Is. Occurs mainly along the shore terrace between Settlement and Waterfall, and also among the limestone pinnacles in old quarries. Widely cultivated in the tropics, especially in Africa and SE Asia. Often planted as a shade and fruit tree in villages, and is commonly naturalised. Occurs chiefly in dry grassland and in poor soil in lowland areas, often naturalised along river banks.

Ch.Is.: cliffs overlooking Isabel Beach, *D.A.Powell 487* (K).

An attractive shade tree for gardens, parks and roadsides. Mainly cultivated for its fruit which contains a sticky, tart pulp, used as a flavouring in curries, chutneys, jams, confectionery and beverages, and as a gentle laxative. The taste is given by tartaric acid, and by lesser amounts of citric, malic, acetic and succinic acids. The seeds may be eaten raw, boiled, fried or ground into flour, and they yield a useful oil. The pod may be crumbled

into tobacco to make an aromatic cigarette. The leaves produce a yellow dye. The bark has a high tannin content, and when burnt can be used to make ink. There are also many medicinal uses, the bark being used in a lotion for sores, and the leaves for fevers. The wood is hard and takes a fine polish, and produces a good charcoal.

43. FABACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R., C.S.Is.)

Trees, shrubs or herbs, sometimes scandent. Leaves alternate, often pinnately compound, imparipinnate or paripinnate, sometimes trifoliolate, occasionally palmate or palmately compound, sometimes simple or unifoliolate; stipules caducous or persistent, occasionally adnate to petiole, or peltate; stipels often present. Inflorescence usually an axillary or terminal raceme, or pseudoraceme with flowers in clusters along rachis, occasionally a spike or pseudopanicle, or flowers solitary, paired or in axillary clusters. Flowers usually strongly zygomorphic, pea-flower shaped (except *Inocarpus* on Christmas Is.), sometimes showy, usually bisexual. Hypanthium rarely present. Calyx tubular, 5- or apparently 4-lobed; lobes variously connate, imbricate or valvate; bracteoles usually subtending calyx. Petals 5, imbricate, often clawed and auriculate at base; upper petal (the standard) usually largest, erect or porrect; lateral petals (the wings) 2; lower petals 2, usually fused to form a keel; keel often enclosed by wings, enclosing stamens and style. Stamens 10, usually connate in lower half and forming a tube; upper stamen sometimes free; anthers longitudinally dehiscent. Ovary superior, unilocular; ovules 1–many. Fruit usually an oblong legume; valves spirally twisting on dehiscence, sometimes indehiscent or fragmenting. Seeds 1–many; hilum small to linear.

A family of c. 12,000 species in 440 genera, together with the Caesalpiniaceae and Mimosaceae known as the legumes. Twenty four genera (27 species) native or naturalised on Christmas Is.; 9 genera and 9 species on Cocos (Keeling) Is.; 1 species native to Ashmore Reef; 1 species native to the Coral Sea Is. The Fabaceae have a wide distribution, occurring in most habitats from tropical rainforest to the margins of cold deserts. Woody forms and climbers predominate in the tropics, while the majority of temperate species are herbaceous.

On Christmas Is. and to a lesser extent on Cocos (Keeling) Is. some genera and species do not occur outside cultivation; several others have been introduced recently as cultivated species and have now escaped and become naturalised to some degree. *Dioclea reflexa* Hook.f. has been collected only as drift seed from Dolly and Greta Beaches (*D.A.Powell 417*). The seed is subcircular, 2.5–3 cm diam., somewhat compressed, light brown in colour, and has a long hilum extending three-quarters of the way round the margin.

The family contains many important food and fodder crops. The seeds are vital sources of protein and in many regions provide the major protein in an otherwise carbohydrate-based diet. Similarly, the plants provide high quality fodder rich in protein and are often mixed with grasses to improve pasture land. Most species develop a symbiotic relationship with nitrogen-fixing bacteria, forming nitrogen-rich nodules on the roots. They therefore improve the fertility of the soil and are used either as an important phase in crop rotations or are ploughed in as a green manure. Some species are able to colonise low-fertility soils and can provide a good ground cover which helps to prevent erosion as well as increase soil fertility. This adventive characteristic has allowed several species to become troublesome weeds. Numerous species are cultivated as ornamentals, and other useful products include timber, dyes and chemicals used as insecticides or medicinally. The pea-flower shape is characteristic of the family (but see *Inocarpus*).

Pterocarpus indicus Willd. (Narra), a recent introduction to Christmas Is., is used as a shade tree at Poon Saan.

Gliricidia sepium (Jacq.) Kunth ex Walp. (Madre de Cacao or Quick Stick) is an ornamental tree introduced to Christmas Is. from Singapore. In S America the powdered seeds are used as a rodent poison.

Sesbania grandiflora (L.) Poir. (Hummingbird Tree), probably of Indo-Malesian origin, is a short-lived ornamental on Christmas Is. and a useful colonising species on mined areas.

Cajanus cajan (L.) Millsp. (Pigeon Pea) was collected on Christmas Is. as a cultivated plant at the turn of the century (*C.W.Andrews 100,* K) but has not been recorded recently. It was recorded as *C. indicus* by Andrews (*Monogr. Christmas Is.* 177, 1900).

Arachis hypogaea L. (Groundnut or Peanut) is commonly cultivated by the Chinese on Christmas Is.

Lalab purpureus (L.) Sweet (Hyacinth Bean) is cultivated in Cocos Malay gardens on Home Is., Cocos (Keeling) Is. as a vegetable.

The family is alternatively known as the Papilionaceae, or is sometimes treated as a subfamily, the Papilionoideae, of the Leguminosae, along with the Mimosoideae and the Caesalpinioideae. R.M.Polhill, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 205–208 (1981) recognised 32 tribes in subfam. Papilionoideae, the species on Christmas Is. Cocos (Keeling) Is. and the Coral Sea Is. being included in 8 of them:- Dalbergieae (*Pterocarpus* and *Inocarpus*); Tephrosieae (*Derris* and *Pongamia*); Robinieae (*Gliricidia* and *Sesbania*); Indigofereae (*Indigofera*); Desmodieae (*Desmodium* and *Alysicarpus*); Phaseoleae (*Erythrina*, *Strongylodon*, *Mucuna*, *Canavalia*, *Pachyrhizus*, *Galactia*, *Calopogonium*, *Pueraria*, *Centrosema*, *Clitoria*, *Psophocarpus*, *Lablab*, *Vigna*, *Macroptilium*, *Phaseolus* and *Cajanus*); Aeschynomeneae (*Stylosanthes* and *Arachis*); Crotalarieae (*Crotalaria*). The tribe Phaseoleae contains about half the species which occur on Christmas, Cocos (Keeling) and the Coral Sea Is. and is characterised by having an often climbing habit, usually pinnately trifoliolate leaves with a basal pulvinus and free stipules, pseudoracemose inflorescences, a tendency to have appendages on the standard petal and a flattened, thickened or bearded style, and pod-like fruits.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Papilionaceae, *Fl. Java* 1: 565–645 (1963); J.B.Gillett, R.M.Polhill & B.Verdcourt, Leguminosae subfamily Papilionoideae, *Fl. Trop. E. Africa*, Leguminosae: 1–1108 (1971); B.Verdcourt, subfam. Papilionoideae, *Man. New Guinea Legumes* 267–591 (1979); O.N.Allen & E.K.Allen, The Leguminosae, *A Source Book of Characteristics, Uses and Nodulation* 812 pp. (1981); R.M.Polhill, subfam. Papilionoideae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 191–425 (1981); A.C.Smith, Fabaceae, *Fl. Vit. Nova* 3: 142–273 (1985).

KEY TO GENERA

1 Leaves unifoliolate or simple

2 Herbs; flowers pea-like; petals modified into standard, wings and keel; fruit not woody, dehiscent, with more than one seed

3 Stipules conspicuous, papery and sheathing the stems; flowers orange or purplish; fruit fragmenting at maturity into 4–7 articles **7. ALYSICARPUS**

3: Stipules inconspicuous, filiform; flowers yellow with standard sometimes reddish; fruit not fragmenting into articles **24. CROTALARIA**

2: Trees; stipules minute, caducous; flowers not pea-like; petals subequal and connate into a tube at base; fruit woody, indehiscent, with a single, large seed **1. INOCARPUS**

1: Leaves with more than one leaflet

4 Leaves trifoliolate, sometimes unifoliolate

5 Climbing or long-trailing herbs or shrubs

6 Keel spiralling or twisted to one side of flower

7 Stems and undersurface of leaves silvery-hairy; leaflet margins sinuate, the lateral leaflets usually ±lobed; calyx tube c. 5 mm long, with 5 subequal, acute teeth; wings purplish-black, much larger than other petals **21. MACROPTILIUM**

7: Stems and leaves not silvery-hairy; leaflet margins entire, not sinuate or lobed; calyx tube c. 2.5 mm long, the upper calyx teeth connate and forming a broadly emarginate lip, the lower teeth obtuse; wings yellow or greenish and blue, not greatly exceeding other petals

8 Stems with long, spreading yellowish or ferruginous hairs; stipules extended above and below point of attachment; flowers yellow; standard c. 1.3–1.6 cm long; keel twisted to one side, with a conical spur on one petal; fruit narrowly oblong or linear, hairy, with 6–14 seeds **20. VIGNA**

8: Stems shortly hairy, glabrescent; stipules ovate; flowers usually greenish with pale blue wings; standard 0.5–0.6 cm long; keel spirally coiled for 1 1/2 turns, without a spur; fruit broadly oblong, curved, glabrous, with 2–4 seeds **22. PHASEOLUS**

6: Keel not twisted to one side of flower

9 Flowers small, the standard 0.8–1.1 cm long

10 Leaflets dimorphic, the terminal leaflet often 3-lobed and lateral leaflets strongly unequal-sided; fruit transversely indented between seeds, appearing segmented **14. CALOPOGONIUM**

10: Leaflets ±similar; fruit ±linear

11 Leaflets acuminate; calyx with subequal, acuminate teeth; flowers pink **13. GALACTIA**

11: Leaflets obtuse; calyx 5-toothed, 2-lipped; flowers yellow **20. VIGNA**

9: Flowers larger, the standard 1.5–3.5 cm long

12 Standard much shorter than keel or wings; keel distinctly beaked and horny, 3.5–6 cm long; fruit with many long, bristly, irritant hairs **10. MUCUNA**

12: Standard longer than or subequal to keel; keel without a horny beak, less than 3 cm long; fruit mostly subglabrous, sometimes shortly hairy

13 Bracteoles large, ovate, with many, closely spaced, parallel striations, enclosing calyx; lowest tooth of calyx linear and far exceeding others; standard petal shortly spurred at base, mauve with a cream centre surrounded by magenta lines, yellowish outside; fruit slender, linear, with a straight, needle-like beak c. 2 cm long **16. CENTROSEMA**

13: Bracteoles not as above; calyx not as above; standard petal not saccate, coloured otherwise; fruit without an acicular beak, or if beaked with a longitudinal rib on each valve near margin

14 Stipules extending above and below point of attachment; fruit with 4 longitudinal, broad, serrated wings **18. PSOPHOCARPUS**

14: Stipules ovate to linear, attached at or near base; fruit wingless

15 Flowers inverted; calyx tube c. 10 mm long; standard petal c. 2–3.5 cm long; fruit with a secondary rib on each valve, below margin **11. CANAVALIA**

15: Flowers not inverted; calyx tube 3–5 mm long; standard petal 1.5–1.8 cm long; fruit without secondary ribs

16 Calyx lobes very short, rounded; flowers pink; wings much shorter than keel; fruit subspherical to oblong-ellipsoidal, not strongly compressed; seeds 1 or 2 **9. STRONGYLODON**

16: Calyx lobes obtuse, acute or acuminate; flowers blue, purple or white; wings and keel subequal in length; fruit elongate to linear, or if oblong then strongly compressed; seeds 2–20

17 Stems and leaves densely covered in long, rust-coloured hairs; petals purple with white margins; style slender, not hairy; fruit slender, linear, c. 3–4 mm wide; seeds 14–20 **15. PUERARIA**

17: Stems and leaves shortly hairy to sparsely pubescent; petals white or blue; style flattened apically, bearded; fruit elongate, more than 4 mm wide; seeds 2–11

18 Leaflet margins entire; flower white; keel much narrower than wings, the tip turned upwards at a right angle; fruit glabrous, curved; seeds 2–5, with a linear hilum extending half-way round seed **19. LABLAB**

18: Leaflet margins distantly toothed to shallowly lobed; flower blue; keel as broad as wings, the tip not sharply angled upwards; fruit appressed-hairy, straight; seeds 6–11, with a short, elliptic hilum **12. PACHYRHIZUS**

5: Trees, shrubs or herbs, erect, ascending or prostrate with short, non-twining stems

19 Trees; flowers bright red; calyx spathaceous; standard c. 4.5 cm long; stamens far exserted from keel; fruit 15–30 cm long **8. ERYTHRINA**

19: Herbs or shrubs; flowers yellow, pinkish, purple or white; calyx deeply 4- or 5-lobed; standard less than 1.5 cm long; stamens not exserted from keel; fruit less than 7 cm long

20 Erect shrubs or woody herbs; flowers in axillary or terminal racemes or pseudoracemes with caducous bracts; flowers conspicuous; standard 12–15 mm long

21 Terminal leaflet not stalked, the leaves palmately trifoliolate, sometimes unifoliolate; racemes terminal and leaf-opposed, many-flowered; flowers deflexed against pedicel; calyx base flattened; keel narrow, sharply curved upwards, acutely beaked, longer than wings; fruit inflated, smooth, rattling when shaken **24. CROTALARIA**

21: Terminal leaflet stalked, the leaves pinnately trifoliate; pseudoracemes mostly axillary, with up to 10 flowers; flowers erect; calyx base not flattened; keel broad, curved, obtuse, equalling wings; fruit compressed, impressed between seeds, not inflated **†CAJANUS**

20: Prostrate or ascending herbs; flowers solitary or in axillary clusters, from a cluster of bracts; flowers inconspicuous; standard 4–5 mm long

22 Leaflets obovate, shallowly emarginate; flowers usually purple, occasionally white; hypanthium absent; fruit long exserted from bracts, not conspicuously beaked, fragmenting into 2-5 fertile articles **6. DESMODIUM**

22: Leaflets narrowly elliptic, acute; flowers yellow, the standard red at base; hypanthium slender, stalk-like, c. 6 mm long, hidden by large bracts; fruit enclosed in a cluster of bracts, conspicuously beaked, 2-valved, with 1 fertile article **23. STYLOSANTHES**

4: Leaves with more than 3 leaflets

23 Leaves imparipinnate (i.e. with a single terminal leaflet)

24 Trees; leaflets alternate; flowers yellow; fruit almost circular, flat, beaked on one side, with a broad, marginal wing **†PTEROCARPUS**

24: Trees, shrubs, herbs or climbers; leaflets opposite; flowers pink, brick red, lilac or blue; fruit not as above

25 Flowers predominantly bright blue, inverted, solitary or paired in leaf axils; bracteoles conspicuous, 7–10 mm long, broadly ovate, foliaceous, enclosing calyx; standard 4–5 cm long, sheathing the much smaller wings and keel **17. CLITORIA**

25: Flowers pink, brick red or lilac, not inverted, in a many-flowered inflorescence; bracteoles less than 7 mm long or absent; standard less than 4 cm long, subequal in length to wings and keel

26 Herbs; leaflet hairs mostly 2-armed; calyx deeply divided into 5 acuminate teeth; fruits overlapping in crowded racemes, 1.4–2 cm long, densely covered in stiff, spreading, brown hairs **5. INDIGOFERA**

26: Trees or woody climbers; leaflet hairs simple or absent; calyx cup-shaped, truncate to very shallowly toothed; fruit 2.5–18 cm long, glabrous or pubescent

27 Woody climbers, densely covered in velvety, rust-coloured hairs; flowers in stalked clusters of 3, combined into pseudoracemes **2. DERRIS**

27: Trees, glabrous or minutely hairy; flowers single or in pairs, never in stalked clusters, produced directly from rachis of inflorescence

28 Leaflets 5–7; flowers c. 1 cm long, in pseudoracemes, produced on leafy shoots; fruit ellipsoidal, 2.5–3 cm long, flattened; seeds 1 or occasionally 2 **3. PONGAMIA**

28: Leaflets 7–17; flowers c. 2 cm long, in dense, true racemes produced before the leaves; fruit narrowly oblong, 7.5–17 cm long, flat; seeds 3–8 **†GLIRICIDIA**

23: Leaves paripinnate (i.e. with a pair of leaflets at the apex)

29 Herbs; leaflets 4; stipules conspicuous and persistent, 1.5–4 cm long, partially adnate to petiole; flowers yellow with red veins; calyx 5-lobed, the upper 4 connate, the lower free almost to base; fruit developing underground, oblong **†ARACHIS**

29: Trees or tall herbs; leaflets 12–80; stipules much less than 1.5 cm long, free, usually caducous; flowers very large and white, or small and yellow with brown mottling outside; calyx 2-lipped or subequally 5-toothed; fruit developing above ground, narrowly linear **4. SESBANIA**

Genera marked with a dagger (†) are introduced but not naturalised and are not treated further in this text.

1. INOCARPUS

Inocarpus J.R.Forst. & G.Forst., *Char. Gen. Pl.* 33 (1775), *nom. cons.*; from the Greek *is*, *inos* (fibre, thread) and *karpos* (fruit), descriptive of the fibrous pod.

Type: *I. edulis* J.R.Forst. & G.Forst.

Trees, often with buttresses. Leaves simple, large; petiole short; stipules minute, caducous. Flowers sessile, on old wood or in axillary, sometimes branched, spikes, not pea-flower shaped; bracts small, cupular. Calyx campanulate, bilobed or spathaceous, membranous. Petals usually 5, imbricate, connate into a tube in basal half. Stamens usually 10, of 2 lengths, alternating; filaments connate and forming a tube, almost entirely adnate to corolla tube; anthers at two levels, inside and at the rim of corolla tube. Ovary pubescent; ovule solitary; style very short. Fruit obliquely ovoid or ellipsoidal, compressed, indehiscent. Seed 1.

There are probably 3 species in Malesia and the Pacific islands with 1 species on Christmas Is.

R.M.Polhill, Dalbergieae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 235, 242 (1981).

This genus is closely related to *Etaballia* Benth. from S America. The simple leaves and tubular corolla base with adnate stamens are unusual in the family, but R.M.Polhill, *loc. cit.*, included the genus as an aberrant member of the tribe *Dalbergieae*.

Inocarpus fagifer (Parkinson) Fosberg, *J. Washington Acad. Sci.* 31: 95–96 (1941), as *I. fagiferus*

Aniotum fagiferum Parkinson, *J. Voy. Endeavour* 39 (1773). T: Tahiti, *J.Banks & D.C.Solander s.n.*; syn: BM, *fide* A.C.Smith, *Fl. Vit. Nova* 3: 161 (1985). Epithet from the Latin *fagus* (Beech tree) and *ferre* (to bear), because of the similarity of the edible seed to that of the sweet chestnut (*Castanea sativa*) in the Beech family, Fagaceae.

I. edulis J.R.Forst. & G.Forst., *Char. Gen. Pl.* 33, t. 33 (1775). T: Herb. G.Forster 102.197; lecto: BM, *fide* A.C.Smith, *Fl. Vit. Nova* 3: 161 (1985).

Illustrations: D.Oliver, *Hooker's Icon. Pl.* 19: t. 1837 (1889); B.Verdcourt, *Man. New Guinea Legumes* 303, fig. 67 (1979).

Tree to 30 m tall; trunk irregularly fluted and buttressed. Leaves oblong, cordate at base, entire, acuminate to emarginate, glabrous, glossy, coriaceous; lamina 9–35 cm long; petiole 4–10 mm long. Spikes 1–10 cm long, subsessile, simple or branched from base. Flowers scented. Calyx c. 5 mm long, broadly bilobed, whitish. Petals linear, subequal, c. 12 mm long, crumpled, white to pale yellow; tubular base c. 6 mm long. Stamens alternating, c. 3 mm and c. 5 mm long, enclosed by corolla tube. Fruit broadly ovoid to ellipsoidal, 5–9 cm long, oblique, somewhat compressed, obliquely beaked, narrowly keeled on one side, indehiscent, woody, fibrous, glabrous, yellow when mature. Seed large. *Tahitian Chestnut*, *Gatet*. Fig. 41A–C.

Christmas Is. Indigenous, forming about 15% of the main canopy of primary forest over deep soil. Also occurring on all the terraces and throughout the plateau. Almost pure stands occur at the Dales, at Ross Hill Springs, and at other places where there is surface water or water seepage. A native of Malesia and the Pacific islands.

Ch.Is.: Flying Fish Cove, *J.J.Lister 14* (K); no precise locality, *C.W.Andrews 28* (K); no precise locality, *D.A.Powell 500* (K); South Point track, near Tait Point, beside Smithsons Bight, *B.A.Mitchell 189* (CBG, K).

Sometimes grown for its seed, which has a flavour similar to sweet chestnut and may be boiled or roasted, or crushed and made into bread or puddings. The wood is suitable for interior furnishings. The fruits are sea dispersed, the tough, fibrous husk protecting the seed. B.Verdcourt, *loc. cit.*, reported that it is also dispersed by bats. On Christmas Is. the red land crabs (*Gecarcinus* spp.) eat the green pod, dragging the fruit to their burrows where it is not unusual to find seedlings.

2. DERRIS

Derris Lour., *Fl. Cochinch.* 432 (1790), *nom. cons.*; the Greek word for skin, alluding to the texture of the pod of the type species.

Type: *D. trifoliata* Lour.

Mostly lianes and scandent shrubs. Leaves pinnate or trifoliolate, imparipinnate; leaflets opposite; stipules small, caducous. Flowers in few-flowered clusters, combined into axillary or terminal pseudoracemes or pseudopanicles. Calyx cup-shaped, truncate or weakly toothed, subtended by 2 bracteoles. Petals purple, pink or white; standard obovate or circular; keel petals cohering apically. Stamens all connate into a tube with holes either side of the upper stamen at base. Ovary densely hairy; ovules 2 or few. Fruit elliptic to linear-oblong, flat, membranous to thinly coriaceous, indehiscent, winged along one or both edges. Seeds 1–6.

A pantropical genus with over 50 species in SE Asia, 1 in Africa, 4 in S America, 1 on

Christmas Is. and 3 in Australia.

R.Geesink, Tephrosieae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 256–257 (1981).

The single species on Christmas Is. is included in section *Paraderris* Miq., which may be considered as a separate genus (R.Geesink, *loc. cit.)*.

Derris elliptica (Wall.) Benth., *J. Proc. Linn. Soc. Bot.* 4: suppl. 111 (1860)

Pongamia elliptica Wall., *Pl. Asiat. Rar.* 3: 20, t. 237 (1832). T: Amboina, cult. Bot. Gard. Calcutta, *N.Wallich* Cat. 5881A; holo: K; iso: K. Epithet from the Latin *ellipticus* (elliptic), probably referring to the leaflet shape.

Illustration: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 343 (1938).

Scandent shrub or liane 5–12 m long, velvety pubescent; shoot apex often leafless for several metres. Leaves pinnate, 15–30 cm long, mostly with 11–15 leaflets; leaflets narrowly oblong-obovate, 4–25 cm long, rounded at base, entire, rounded to shortly acuminate, rusty-velvety, somewhat glabrescent, glaucous beneath; petiole 3–7 mm long. Flowers usually in stalked clusters of 3, combined into pseudoracemes 15–25 cm long, rusty pubescent. Calyx 6–8 mm long, shallowly toothed. Petals pink; standard 13–17 mm diam., with 2 auricles at base, softly ferruginous-hairy outside; wings and keel with interlocking longitudinal folds. Fruit elliptic to oblong-elliptic, 3.5–7 cm long, flat, leathery, narrowly winged. Seeds 1–3, reniform, flat. Fig. 42A–D.

Christmas Is. Competes well in secondary growth in disturbed areas, often indicating previously cultivated land. Distributed from India to Malesia, introduced and often naturalised in many tropical areas, and commercially cultivated in S America.

Ch.Is.: no precise locality, *D.A.Powell 420* (K).

The crushed roots may be used as a potent fish poison. The active chemical is rotenone which stupifies the fish but has a very low toxicity to man, allowing the fish to be eaten with impunity. It has also been used in arrow poisons and in shampoos to eliminate lice. Rotenone is also an effective insecticide, and the species was cultivated for its roots to produce an insecticide as early as 1877 in Singapore. It is a strongly growing plant with many nitrogenous root nodules, making it useful as a green manure.

3. PONGAMIA

Pongamia Vent., *Jard. Malmaison* t. 28 (1803), *nom. cons.*; from the Tamil name, *pongam*, for this species.

Type: *P. glabra* Vent., *nom. illeg.* = *P. pinnata* (L.) Pierre

Trees. Leaves imparipinnate, with opposite leaflets; stipules caducous. Inflorescence axillary, raceme-like; flowers solitary or often in unstalked clusters of 2 at nodes of rachis; pedicels with a pair of minute bracteoles. Calyx cup-shaped, very weakly toothed. Petals pink and white; standard broadly obovate; keel cohering apically. Stamens with the upper stamen free at base but otherwise connate to staminal tube. Ovary hairy; ovules usually 2. Fruits oblong-elliptic, somewhat flattened, 2-valved; indehiscent or eventually dehiscent. Seeds 1 or 2.

Probably a single species widely distributed from SE Asia to the Pacific islands and N Australia. It usually occurs in coastal vegetation.

S.S.R.Bennet, The taxonomic status of the genus *Pongamia* Vent. (Pap.), *J. Bombay Nat. Hist. Soc.* 68: 302–303 (1972); R.Geesink, Tephrosieae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 259 (1981); R.Geesink, Scala Millettiearum – A survey of the genera of the tribe Millettieae (Legum.–Pap.) with methodological considerations, *Leiden Bot. Ser.* 8: 102–106 (1984).

This genus has been placed in *Derris* by S.S.R.Bennet, *loc. cit.* and in *Millettia* by R.Geesink, *op. cit.* 102 (1984), this latter being likely to be correct. However, due to the complex taxonomic discussion still continuing over these transfers, the traditional usage of *Pongamia* is continued here (see R.Geesink, *loc. cit.*, 1984). Furthermore, the combination placing *P. pinnata* in *Millettia* does not appear to have been published.

Pongamia pinnata (L.) Pierre, *Fl. Forest. Cochinch.* sub. t. 385 (1899)

Cytisus pinnatus L., *Sp. Pl.* 2: 741 (1753). T: illustration in L.Plukenet, *Phytographia* t. 104, fig. 3 (1691–1696) & Herb. C.Linnaeus (Stockholm), microfiche n. 300.16, syn: S, microfiche seen. Epithet from the Latin *pinna* (feather), hence pinnate, a botanical term used to describe the compound leaf shape.

P. glabra Vent., *Jard. Malmaison* t. 28 (1803), *nom. illeg.*

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 313, fig. 70 (1979).

Tree or shrub 1.5–25 m tall, without buttresses; branchlets glabrous. Leaves pinnate, 13–33 cm long, mostly with 5–7 leaflets; leaflets elliptic, 4–20 cm long, cuneate to rounded at base, entire, usually acuminate, glabrous, glossy. Pseudoracemes 4–20 cm long, suberect; pedicels 0.7–1.5 cm long, finely pubescent. Calyx 4–5 mm long, finely pubescent. Standard broadly obovate, 1.1–1.8 cm long, with basal auricles, softly brown-hairy outside, pale pink, greenish at base inside; wings adhering to keel, deep pink. Fruit oblong-ellipsoidal, 2.5–3 cm long, oblique, with an apical beak, somewhat flattened, rather woody, eventually dehiscent. Seed usually solitary, reniform, 1.6–2 cm long, compressed; testa brittle. *Kayu Kwat*.

Christmas Is. Common as a tree on all terraces on the east of the island, and as shrubs among limestone pinnacles and rocks. Mainly found in coastal forest in tropical Asia, Malesia, New Guinea, Pacific islands, northern Australia (Qld) and the Mascarene Islands, but locally also in inland vegetation.

Ch.Is.: no precise locality, *C.W.Andrews 31* (K); Flying Fish Cove, *H.N.Ridley 64* (K); terrace immediately below Ross Hill Gardens, *D.A.Powell 30* (K); small inland cliff below Drumsite, *D.A.Powell 52* (K).

H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 188 (1906), stated that the trees were remarkably straight and tall in comparison with specimens commonly found in the Malay Peninsula. The fruit is sea-dispersed, dehiscence and seed germination occurring after it has reached fresh water. A useful timber tree, producing hard wood with a beautiful grain but not very durable and mainly used in cabinet making. The bark can be used to make ropes. The foliage is a good fodder and green manure. The black, foetid roots contain a fish poison. Extracts from the root have been used to treat sores and stomach ulcers. The seeds yield pongam oil, reputed to heal herpes, scabies and rheumatism. A common ornamental and street tree. It is a host plant for lac insects which cause the tree to secrete a resinous substance (lac) which is used as varnish.

4. SESBANIA

Sesbania Scop., *Intr. Hist. Nat.* 308 (1777), *nom. cons.*; from the French word *sesban* for the type species, itself derived from the Arabic *Seisaban* or the Persian *Sisaban*.

Type: *S. sesban* (L.) Merr.

Erect herbs, shrubs or small trees. Leaves paripinnate, usually with more than 10 pairs of leaflets; stipules usually caducous. Inflorescence axillary, racemose. Flowers bisexual or male; pedicels articulated near calyx and with 2 caducous bracteoles. Calyx campanulate, shortly toothed or irregularly splitting. Petals long-clawed; standard almost circular, with various appendages at top of claw; keel cohering at apex. Stamens connate into a tube; upper stamen free, curved at base. Ovary glabrous; ovules many. Fruit narrowly linear, usually terete, septate, 2-valved, dehiscent. Seeds 6–50.

A genus of 50–55 species, widely distributed in the tropics and subtropics, generally in wet or seasonally wet habitats; 1 species occasionally naturalised on Christmas Is., another on

Cocos (Keeling) Is. and Ashmore Reef.

J.B.Gillett, *Sesbania* in Africa, *Kew Bull.* 17: 91–159 (1963); J.B.Gillett, *Fl. Trop. E Africa*, Leguminosae 3: 330–351 (1971); N.T.Burbidge, The Australian species of *Sesbania* Scopoli (Leguminosae), *Austral. J. Bot.* 13: 103–141 (1965); R.M.Polhill & M.Sousa, Robinieae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 286–288 (1981).

1 Flowers white, 8–10 cm long; leaflets more than 20 mm long **†S. grandiflora**

1: Flowers cream to yellow, the standard mottled brown or black on back; leaflets less than 15 mm long

2 Leaves 10–25 cm long; rachis with minute prickles **1. S. bispinosa**

2: Leaves 4–12 cm long; rachis smooth **2. S. cannabina**

†*Sesbania grandiflora* (L.) Poir., a short-lived, small tree, is planted to rehabilitate mined areas or sometimes cultivated in gardens on Christmas Is.

1. *Sesbania bispinosa (Jacq.) W.F.Wright, *U.S. Dept. Agric. Bur. Pl. Indust. Bull.* 137: 15 (1909)

var. **bispinosa**

Aeschynomene bispinosa Jacq., *Icon. Pl. Rar.* 3: 13, t. 564 (1792). T: illustration in N.J. von Jacquin, *loc. cit.* Epithet from the Latin *bis* (twice, in two ways) and *spina* (thorn), referring to the prickles on the stems and leaf rachises.

Annual herb to 2 m tall; stems glabrous or sparsely pilose when young, with scattered, minute prickles. Leaves 10–25 cm long, mostly with 25–40 pairs of leaflets; leaflets oblong, 4–15 mm long, rounded and mucronate, obtuse at base, glabrous; rachis with minute prickles. Racemes 3–9 cm long, lax, with 2–6 flowers; rachis prickly; pedicels 5–10 mm long. Flowers bright yellow or cream, the standard mottled purple-brown on back. Calyx 3–4 mm long, sharply toothed. Standard c. 9 mm diam., with 2 minute appendages at top of claw, mottled with brown outside; keel and wings long-clawed, with retrorse teeth at base; keel cream. Fruit very slender, terete, 20–25 cm long, 2-valved. Seeds many.

Christmas Is. It has only been collected once on Christmas Is., growing among *Leucaena leucocephala* as a roadside weed. Distributed from India and China through Africa to Madagascar.

Ch.Is.: Lower Drumsite, *D.A.Powell 578* (K).

A variable, weedy species, probably introduced over much of its range, and in other tropical areas. The specimen from Christmas Is. is attributable to the type variety (J.B.Gillett, *Kew Bull.* 17: 129, 1963) which is characterised by its more numerous leaflets (up to 55), its larger number of flowers (3–12) and its longer filament sheath length (9–12 mm).

2. *Sesbania cannabina (Retz.) Poir., *Encycl.* 7: 130 (1806)

var. **cannabina**

Aeschynomene cannabina Retz., *Obs. Bot.* 5: 26 (1789). T: not designated. Epithet from the Latin *cannabis* (hemp), referring to the fibre yielded by var. *cannabina*.

Illustrations: N.T.Burbidge, *Austral. J. Bot.* 13: 120, fig. 6 (1965); B.Verdcourt, *Man. New Guinea Legumes* 361, fig. 82 (1979).

Erect annual herb or shrub to 3 m; stems sparsely hairy, glabrescent, striate. Leaves 3–12 cm long, of usually 11–30 pairs of leaflets, fewer on secondary branchlets; leaflets narrowly elliptic, rounded or truncate, mucronate; 6–12 mm long. Racemes usually 1–3-flowered; rachis 1.5–6 cm long. Calyx 3–5 mm long. Corolla cream; standard 8–12 mm long, cream, mottled and streaked brown or purple on back. Pod 11–22 cm long, 2–3 mm diam., almost straight or curved. Seeds 20–35, cylindroidal, c. 3 mm long, dark brown.

Cocos (Keeling) Is., Ashmore Reef. On Cocos (Keeling) Is. occurs occasionally in strand

forest and in disturbed sites around the kampong on Home Is. On Ashmore Reef, common on the islands, often forming thickets in inland depressions in coralline sand. Widespread from tropical Africa through southern Asia, Malesia, northern Australia (W.A., N.T., Qld, N.S.W.) and the W Pacific islands. Perhaps native to tropical Australia.

C.K.Is.: Home Is., *I.R.Telford 10067 & C.Howard* (AD, CBG, K); 700 m NW of Possession Point, Horsburgh Is., *D.G.Williams 29* (CBG); centre of Horsburgh Is., *D.G.Williams 182* (BISH, CBG, K, PERTH). A.R.: West Is., 8 July 1989, *M.D.Hinchey & D.Barrett* (CBG); East Is., *K.Kenneally 6368* (PERTH).

Cutivated for its fibre and as a green manure.

5. INDIGOFERA

Indigofera L., *Sp. Pl.* 2: 751 (1753); *Gen. Pl.* 5th edn, 333 (1754); from the Latin *indicus* (indigo) and *ferre* (to bear, produce), as the type species is a source of the dark blue dye, indigo.

Type: *I. tinctoria* L.

Herbs or shrubs; unarmed, often with 2-branched hairs. Leaves pinnate, trifoliolate, unifoliolate or simple, imparipinnate when compound; stipules often filiform. Inflorescence usually a stalked, axillary raceme. Flowers usually red to pink; bracteoles absent. Calyx small, campanulate, lobed to deeply toothed. Standard elliptic, shortly clawed, without basal auricles; keel with a retrorse spur interlocking with the wings. Stamens united into tube; upper filament free. Ovary usually sessile; ovules many. Fruit linear to ovoid, terete, 4-angled or flattened, often curved, septate, 2-valved, usually dehiscent. Seeds 1–many.

A genus of over 700 species; 1 species on Christmas Is. and Cocos (Keeling) Is. Many species are tolerant of dry and poor soil conditions. Several species, including *I. tinctoria* L., yield the pigment and dye indigo from their leaves and young stems. Once an extremely important commercial commodity, it has now been largely replaced by synthetic dyes.

J.B.Gillett, *Indigofera* (*Microcharis*) in Tropical Africa, *Kew Bull.*, Add. Ser. 1: 1–166 (1958); J.B.Gillett, *Indigofera hirsuta* L. and *I. astragalina* DC., *Kew Bull.* 14: 290–295 (1960); R.M.Polhill, Indigoferae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 289–291 (1981).

Indigofera hirsuta L., *Sp. Pl.* 2: 751 (1753)

T: Ceylon [Sri Lanka], Herb. P.Hermann 272, vol. 1, fol. 60; lecto: BM, *fide* J.B.Gillett, *Kew Bull.* Add. Ser. 1: 109 (1958). Epithet from the Latin *hirsutus* (hairy, shaggy), descriptive of the hairiness of this species.

Illustration: J.B.Gillett, *Fl. Trop. E. Africa*, Leguminosae: 311, fig. 45 (1971).

Erect or spreading, annual herb to 1.5 m tall; stems and inflorescences covered in stiff, spreading, brown hairs. Leaves pinnate, to 8 cm long, with 3–9 leaflets; leaflets oblong-obovate, 0.8–3 cm long, obtuse at base, rounded and often mucronulate, glaucous, white-hairy; stipules filiform. Racemes 4–25 cm long, stalked, dense, many-flowered; pedicels c. 1.5 mm long. Flowers rose or brick red. Calyx 4–5 mm long, divided almost to base into 5 linear, hairy teeth. Standard elliptic, c. 5 mm long; keel connate along lower margin. Fruit terete, 14–20 mm long, deflexed and overlapping, densely covered in stiff, spreading, brown hairs. Seeds cuboid, 6–9.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. grows among limestone pinnacles and in poor soil in disused quarries and on cleared ground, often with the two invasive *Mimosa* species, *M. invisa* and *M. pudica*. Also on Cocos (Keeling) Is. A widespread species in tropical Africa, Madagascar and S Asia, through Malesia to New Guinea and northern Australia, now widely naturalised elsewhere.

Ch.Is.: South Point quarries, *D.A.Powell 42* (K); South Point, *D.A.Powell P46* (K); roadside at Drumsite, *D.J. & B.P.Du Puy CI91* (CBG, K). C.K.Is.: southern lagoon shoreline, Home Is., *D.G.Williams 169 & Amat Noor* (CBG, K, NSW).

Introduced in many areas as a soil cover-crop and green manure. Tolerates poor soil and increases the fertility of soil with nitrogen-fixing root nodules.

6. DESMODIUM

Desmodium Desv., *J. Bot. Agric.* 1: 122 (1813), *nom. cons.*; a Latin transcription of the Greek *desmodion*, from *desmos* (a chain), alluding to the jointed and incised shape of the pod, which resembles a chain.

Type: *D. scorpiurus* (Sw.) Desv.

Erect to prostrate herbs, shrubs or occasionally small trees. Leaves usually pinnately trifoliolate or unifoliolate; stipules often persistent. Inflorescence an axillary or terminal pseudoraceme, pseudopanicle or umbel; flowers single or in clusters on rachis, which may be very short. Flowers commonly pink to pale purple; bracteoles absent or minute. Calyx campanulate, 5-lobed or 2-lipped. Petals purple, red, pink, blue or white; standard broadly obovate to circular, without basal appendages. Stamens connate into tube; upper filament free or partially fused. Ovary with 2–many ovules. Fruit usually flat, transversely jointed, fragmenting into 1–several articles, indehiscent or eventually dehiscent.

A genus of c. 300 species, distributed throughout tropical and temperate regions except Europe, western U.S.A. and New Zealand, with centres of diversity in E Asia, Mexico and Brazil; 1 species occurs on Christmas Is. and Cocos (Keeling) Is. *Desmodium* species are used for pasture improvement and fodder, as cover-crops and as green manure. Some are important pioneer plants in providing ground cover and erosion control on open land, usually disappearing as shading from other vegetation increases.

M.S.Knaap-van Meeuwen, A census of the genus *Desmodium* in Malaysia, *Reinwardtia* 6: 239–276 (1962); H.Ohashi, The Asiatic species of *Desmodium*, *Ginkgoana* 1: 1–318 (1973); H.Ohashi, R.M.Polhill & B.G.Schubert, Desmodieae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 296–299 (1981).

***Desmodium triflorum** (L.) DC., *Prodr.* 2: 334 (1825)

Hedysarum triflorum L., *Sp. Pl.* 2: 749 (1753). T: Sri Lanka, Herb. P.Hermann 297, vol. 1, fol. 4, 20, 21, 23 & vol. 3, fol. 57 & vol. 4, fol. 75; syns: BM. Epithet from the Latin *tri* (three) and *flos*, *floris* (flower), this species often producing flowers in groups of three.

Illustrations: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 333 (1938); T.D.Stanley & E.M.Ross, *Fl. SE Queensland* 1: 312, fig. 51 H1, H2 (1983).

Prostrate, mat-forming herb or subshrub; stems 8–50 cm long, much branched, with spreading hairs; rooting at nodes. Leaves trifoliolate; leaflets obovate, 3–12 mm long, obtuse at base, shallowly emarginate, sparsely hairy; petiole 6–13 mm long; stipules c. 4 mm long, acuminate, scarious, persistent. Inflorescence usually a cluster of 1–3 flowers, from a cluster of leaf-opposed bracts. Flowers purple, sometimes pink or white; pedicels 6–9 mm long. Calyx 2.5–3 mm long, deeply toothed, hairy. Standard obovate, c. 4 mm long, long-clawed; keel partly connate above. Upper stamen free. Fruit 6–17 mm long, articulate; articles 2–5, semicircular, with raised, reticulate veins. *Tropical Trefoil*.

Christmas Is., Cocos (Keeling) Is. Naturalised in grassland and mown lawns on Christmas Is.; a weed of grassy areas in coralline sand on Cocos (Keeling) Is. A pantropical species, widespread in SE Asia, Malesia, New Guinea and Australia.

Ch.Is.: Waterfall, *D.A.Powell 382* (K). C.K.Is.: N end of runway, West Is., *D.G.Williams 172* (CBG); settlement, West Is., *D.G.Williams 268* (CBG, K, MEL, PERTH).

7. ALYSICARPUS

Alysicarpus Desv., *J. Bot. Agric.* 1: 120 (1813), *nom. cons.*; from the Greek *halysis* (chain) and *karpos* (fruit), from the resemblance of the jointed pod to a chain.

Type: *A. bupleurifolius* (L.) DC.

Annual, biennial or perennial, erect to prostrate herbs, sometimes woody. Leaves usually unifoliolate; stipules glumaceous, persistent, conspicuous. Inflorescence usually terminal, mainly pseudoracemose; flowers mostly paired on rachis; bracteoles absent. Calyx scarious, deeply 4-lobed; upper lobe sometimes notched. Petals variously coloured, small; standard obovate to circular, without basal appendages. Stamens connate into a tube; upper stamen free. Ovary with several to many ovules; stigma broadly capitate. Fruit linear-oblong, slightly compressed, transversely jointed, fragmenting into several articles, weakly constricted between the articles, indehiscent.

The 25–30 species in this genus are found throughout the Old World tropics; 1 species naturalised on Christmas Is. and Cocos (Keeling) Is. Several species are considered valuable fodder plants.

M.S.Knaap-von Meeuwen, C.G.G.J. van Steenis & J.Stemmerik, Preliminary revisions of some genera of Malaysian Papilionaceae – *Alysicarpus* Desv., *Reinwardtia* 6: 86–89 (1961); H.Ohashi, R.M.Polhill & B.G.Schubert, Desmodieae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 296–300 (1981).

***Alysicarpus vaginalis** (L.) DC., *Prodr.* 2: 353 (1825)

Hedysarum vaginale L., *Sp. Pl.* 2: 746 (1753). T: Sri Lanka, Herb. P.Hermann 287, vol. 1, fol. 27, 59 & vol. 3, fol. 23 & vol. 4, fol. 49; syns: BM. Epithet from the Latin *vagina* (sheath), descriptive of the stipules which sheath the stem.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 421, fig. 98 (1979).

Erect or spreading to prostrate herb; stems 10–70 cm long, radiating from a perennial rootstock, glabrous to loosely hairy. Leaflet solitary; lamina elliptic to narrowly oblong, 6–40 mm long, subcordate at base, acute to emarginate and mucronulate, pubescent beneath, with conspicuous veins; petiole 4–15 mm long; stipules narrowly ovate, 5–15 mm long, acuminate, striate, papery, sheathing. Flowers paired, in terminal or leaf-opposed pseudoracemes; pseudoracemes 2–10 cm long; pedicels 5–20 mm long. Standard elliptic, c. 6 mm long, orange, purplish or occasionally white; other petals often darker. Fruit subterete, 1.2–2.5 cm long; articles c. 4–7, slight constriction between them. *Wire Grass*.

Christmas Is., Cocos (Keeling) Is. Naturalised and common on Christmas Is., especially on waste ground, quarries and roadsides; rare and localised on Cocos (Keeling) Is. as a weed of gardens. Distributed throughout tropical Africa and Asia, also in Australia (Qld, N.T.) and introduced into America.

Ch.Is.: Waterfall Rd, *D.A.Powell 305* (K); entrance to golf course, *R.Shivas 835* (PERTH); along NE coast road to Waterfall, *R.Shivas 891* (PERTH). C.K.Is.: Home Is., *I.R.Telford 10065 & C.Howard* (AD, CBG, K).

An exceptionally variable species in habit, in leaflet size and shape, in the present or absence of blotches on the leaf and in flower colour. An often abundant weed, considered to be of little value, although sometimes used as a fodder crop.

8. ERYTHRINA

Erythrina L., *Sp. Pl.* 2: 706 (1753); *Gen. Pl.* 5th edn, 316 (1754); from the Greek *erythros* (red), referring to the striking flower colour.

Type: *E. herbacea* L.

Mostly trees or shrubs, sometimes with branched hairs, often armed with woody prickles; branchlets thick. Leaves pinnately trifoliolate, with glandular stipels; stipules small, often caducous. Inflorescence usually a terminal, many-flowered pseudoraceme, with flowers in clusters of 2–5; flowers often showy, red; bracteoles caducous. Calyx campanulate, truncate, spathaceous or with 1–5 teeth. Standard far exceeding the others, without basal appendages. Stamens connate into a tube; upper stamen free or partly connate. Ovary pubescent, with 2–many ovules. Fruit various, generally linear-oblong, 2-valved, woody or leathery, constricted between the seeds, dehiscent. Seeds often red.

A pantropical and subtropical genus of c. 108 species, many cultivated as ornamental trees, and with many cultivars and hybrids; 1 species native on Christmas Is. and Cocos (Keeling) Is. Most are fast growing and easy to propagate from cuttings, several species being used as nurse trees on coffee and cocoa plantations. Prickly species can be used as hedging plants. Poisonous alkaloids commonly occur, some acting like curare and causing muscular paralysis. Some species are used as fish poisons, narcotics, soporifics or diuretics.

B.A.Krukoff & R.C.Barneby, Conspectus of the genus *Erythrina*, *Lloydia* 37: 332–459 (1974); J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 312 (1981).

Erythrina variegata L., *Herb. Amboin.* 10 (1754)

T: illustration of 'Gelala alba' in G.E.Rumphius, *Herb. Amboin.* 2: 235, t. 77 (1741); holo, *fide* B.Verdcourt, *Fl. Trop. E Africa, Leguminosae*: 549 (1971). Epithet from the Latin *variegatus* (variously coloured), in reference to the bi-coloured leaves of some variants of this species.

E. indica Lam., *Encycl.* 2: 391 (1786). T: illustrations in H.A. van Rheede, *Hort. Malab.* 6: 13, t. 7 (1686); syn; illustration of '*Gelala litorea*' in G.E.Rumphius, *Herb. Amboin.* 2: 233, t. 76 (1741); syn.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 428, fig. 100 (1979).

Deciduous tree to 25 m tall, stellately pubescent and armed with large, scattered prickles. Leaves trifoliate; leaflets triangular or broadly rhombic to ovate, 4–20 cm long, rounded to shallowly cordate at base, acute or acuminate. Pseudoracemes c. 20–40 cm long, including the long peduncle, erect, dense, pyramidal, with a tomentum of stellate, brown hairs; flowers many. Calyx 2–4 cm long, eventually deeply spathaceous. Petals bright red; standard elliptic, c. 4.5 cm long. Anthers red, far exserted from keel and wings. Fruit cylindrical, c. 15–30 cm long, somewhat constricted between seeds, glabrous, prominently veined. Seeds 1–12, 1.5–2.2 cm long, reddish brown. *Indian Coral Tree*, *Dadup Keyu Dedap*.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. occurs in the vegetation behind sandy beaches with *Pisonia grandis*, and on the higher terraces. On Cocos (Keeling) Is. present only on North Keeling Is. in strand forest with *P. grandis* in coralline sand, but recorded by H.B.Guppy, *J. Trans. Victoria Inst. (London)* 267–301 (1890) from the main atoll. Flowers Aug.–Sept. Distributed from eastern Africa, India and China, through Malesia and New Guinea to the Pacific islands, and widely cultivated elsewhere, including Australia and America.

Ch.Is.: between 2nd & 3rd cliffs on road to summit, 3 Oct. 1887, *J.J.Lister* (K); near Smiths Point, *H.N.Ridley 40* (K); Flying Fish Cove to Waterfall Rd, *A.Pearson P93* (K); along walk to West White Beach, *R.Shivas* (PERTH). C.K.Is.: North Keeling Is., *D.G.Williams 53* (CBG, K).

This tree is usually of moderate size, with the trunk up to about a metre in diameter. The species seems to reach larger proportions on Christmas Is. than elsewhere, one specimen being recorded by C.W.Andrews, *Monogr. Christmas Is.* 176 (1900), as having a trunk

about 1.8 m in diameter. The larger specimens tend to occur on the terraces, rather than among the strand vegetation. A variant with variegated leaves also occurs but has not been reported from Christmas Is. The slightly poisonous alkaloids hypophorine and erythrinine have been isolated from this species. Nevertheless the leaves and seeds may be eaten after cooking, and are said to ensure a deep sleep. The leaves and pounded seeds may be used as a poultice for sores. On Cocos (Keeling) Is., the wood has been used for making small trays. The seeds are probably dispersed by the sea.

9. STRONGYLODON

Strongylodon Vogel, *Linnaea* 10: 585 (1836); from the Greek *strongylos* (rounded) and *odontos* (tooth), in reference to the rounded calyx teeth.

Type: *S. ruber* Vogel

Climbing shrubs. Leaves pinnately trifoliolate, with conspicuous stipels; stipules small. Inflorescence axillary, pedunculate, pseudoracemose; flowers showy in small clusters from nodules on rachis; bracteoles caducous. Calyx campanulate, truncate or with 5 broad, rounded lobes. Petals orange to red or blue-green; standard with 2 auricles above claw; wings much shorter than standard or keel; keel coherent. Stamens connate into a tube; upper stamen free. Ovary with 1–several ovules. Fruit broad, oblong to ellipsoidal, flattened, 2-valved, dehiscent, usually with prominent veins. Seeds rounded; hilum long.

A genus of 15–20 species distributed from Madagascar to the Pacific islands, with a centre of diversity in the Philippines; 1 widespread and variable species on Christmas Is. There are several decorative climbers in the genus, including *S. macrobotrys* A.Gray from the Philippines which has long racemes of luminous blue-green flowers. The taxonomy of the genus is poorly understood and is in need of revision.

J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 312 (1981).

Strongylodon lucidus (G.Forst.) Seem., *Fl. Vit.* 61 (1865), as *S. lucidum*

Glycine lucida G.Forst., *Prodr.* 51 (1786). T: 1769, *J.Banks & D.C.Solander s.n.*; lecto: BM, *fide* A.C.Smith, *Fl. Vit. Nova* 3: 208 (1985). Epithet from the Latin for bright or shining, from *lux* (light), descriptive of the brightly coloured flowers.

[*S. ruber auct. non* Vogel: C.W.Andrews, *Monogr. Christmas Is.* 176 (1900)]

Illustration: W.G.Craib, *Bot. Mag.* 139: t. 8494 (1913), as *S. pseudolucidus*.

A scrambling climber; stems slender, to 10 m long. Leaflets ovate to elliptic, 5–14 cm long, rounded at base, acuminate and finally obtuse, glabrous; petiole and rachis 6–12 cm long. Pseudoracemes 7–20 cm or more long, unbranched; flowers many, closely spaced; pedicels 0.8–2 cm long. Calyx 5–6 mm long; lobes rounded, imbricate. Petals salmon-pink; standard oblong, c. 1.5 cm long; keel connate, curved, acute, darker at tips. Fruit subspherical to broadly oblong-ellipsoidal, 5–7 cm long, obliquely beaked, leathery with prominent veins, eventually dehiscent. Seeds 1 or 2, c. 1.5 cm diam., blackish; hilum long. Fig. 24.

Christmas Is. Grows mainly in the old quarries around South Point, in light woodland in loose soil. It is distributed from Madagascar, the Indian Ocean islands and Sri Lanka, through Malesia, New Guinea, the Philippines and Australia (Qld) to the Pacific islands and Hawaii.

Ch.Is.: no precise locality, *C.W.Andrews s.n.* (K); Phosphate Hill, *H.N.Ridley 65* (K); South Point quarries, *D.A.Powell 18* (K); South Point, *B.Molesworth Allen P14* (K); north side of Waddal Hill, *D.J. & B.P.Du Puy CI68* (CBG, K).

The pods are slow to dehisce and are able to float, allowing dispersal by sea. A variable species in the branching of the inflorescence (branching occurs predominantly in specimens from New Guinea, Samoa and Melanesia), in the size of the flowers and fruit (the largest

from Hawaii, Samoa and Tonga) and in flower colour (red in plants from the Pacific islands). There is a range of intermediate specimens linking the extremes of this variation, precluding the possibility of recognising distinct species. The specimens from Christmas Is. have relatively small flowers, simple inflorescences and pink flowers. The use of *S. lucidus* as the earliest published name (see A.C.Smith, *Fl. Vit. Nova* 3: 207, 1985) for this complex is therefore followed here, but the variation patterns merit further investigation.

10. MUCUNA

Mucuna Adans., *Fam. Pl.* 2: 325, 579 (1763), *nom. cons.*; from Mucanan, the Brazilian Indian name for the type species.

Type: *M. urens* (L.) DC.

Mostly woody lianes or climbing herbs, often with irritant hairs. Leaves pinnately trifoliolate, often stipellate; stipules caducous. Inflorescence an axillary or cauline pseudoraceme or pseudopanicle; flowers showy, usually in 3-flowered clusters; bracteoles caducous. Calyx campanulate, with 2–5 lobes, often hairy. Petals variously coloured; standard shortest, with 2 basal auricles; keel strengthened apically, forming a straight beak. Stamens connate into a tube; upper stamen free. Ovary sessile, pubescent; ovules few. Fruits ovoid to oblong, 2-valved, often with irritant hairs, septate between seeds, usually dehiscent; valves thick, often ribbed or winged. Seeds subspherical with short hilum, or discoid with a long linear hilum.

A pantropical and subtropical genus of c. 100 species; 2 species on Christmas Is. The species with a short hilum on the seed are sometimes placed in a separate genus, *Stizolobium*. Several species have spectacular inflorescences, including *M. novoguineensis* Scheff. and *M. bennettii* F.Muell., and several are rated highly as soil renovators, cover crops and green manures, such as *M. pruriens* var. *utilis* (Wight) Burck. Many species have irritant hairs, especially on the pods, and can be troublesome weeds.

J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 312 (1981).

Herbaceous climber; stems 2–3 m long; leaves with whitish hairs; flowers purple; standard petal c. 2 cm long; pod longitudinally ribbed and densely hairy; hilum short **1. M. pruriens**

Woody climber; stems 5–20 m long; leaves rusty-pubescent; flowers greenish or white; standard petal 3.5–4 cm long; pod winged on margins and obliquely across valves, with scattered bristles; hilum very long, encircling seed **2. M. albertisii**

1. Mucuna pruriens (L.) DC., *Prodr.* 2: 405 (1825)

Dolichos pruriens L., *Herb. Amboin.* 23 (1754). T: illustration in G.E.Rumphius, *Herb. Amboin.* 5: t. 142 (1747); holo, *fide* B.Verdcourt, *Fl. Trop. E Africa, Leguminosae* 566 (1971). Epithet from the Latin *prurire* (to itch), because of the irritant hairs on the pod.

Illustration: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 353 (1938).

Climbing herb; stems 2–3 m long, hairy. Leaflets rhombic to ovate, 5–18 cm long, rounded, obtuse or truncate at base, obtuse, with appressed whitish hairs; lateral leaflets very unequal-sided; petiole 2–40 cm long. Pseudoracemes 4–40 cm long, silvery pubescent, pendulous, usually with many flowers; pedicels 6–10 mm long. Calyx tube 5–7 mm long; lower lobes 3, acuminate; upper lip broadly triangular; hairs appressed, silvery and ginger. Petals purple; standard ovate, c. 2 cm long; keel 3.5–4 cm long, with rigid beak. Fruit narrowly oblong, slightly S-shaped, 4–10 cm long, ribbed, densely covered in stiff, irritant hairs. Seeds 4–7, ellipsoidal, mottled black; hilum short. *Velvet Bean*, *Cow Itch*.

Christmas Is. Found in a single locality on the N coast. Distributed from tropical Africa and Madagascar to tropical Asia and Malesia. It chiefly occurs in scrubby growth, on roadsides,

on forest edges, or as an annual weed in cultivated land.

Ch.Is.: between cliff and Chinese cemetery, north coast, *D.A.Powell 362* (K).

Although the large inflorescence is attractive, this species can be a troublesome weed, the pods especially being covered with sharp, barbed hairs which cause persistent skin irritation. The itchiness is in part caused by histamine-liberating alkaloids and a proteolytic enzyme, mucunin, in the hairs.

2. *Mucuna albertisii F.Muell., *Descr. Notes Papuan Pl.* 1: 64 (1876)

T: Fly River, New Guinea, 1876, *L.M. d'Albertis s.n.*; holo: MEL *n.v.* Epithet after L.M.d'Albertis, a Nineteenth Century, Italian zoologist and explorer in New Guinea.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 454, fig. 106A (1979).

Woody climber; stem 5–20 m long, softly rusty-pubescent. Leaflets ovate, 7–14 cm long, rounded at base, shortly acuminate, rusty-pubescent; lateral leaflets very unequal-sided; petiole 6–10 cm long. Pseudopanicles 7–25 cm long, silvery pubescent, somewhat branched, often 2 or 3 together, usually with many flowers. Calyx tube c. 10 mm long, broadly campanulate, the hairs appressed, silver and ginger; lower lobes 1 or 3, acuminate; upper lip broadly triangular. Petals green to white; standard ovate, 3.5–4 cm long, notched; keel 5–6 cm long, with rigid beak. Fruit oblong, 6–11 cm long, winged, with many, irritant, ginger bristles. Seeds usually 1–3, discoid, black; hilum long, almost completely encircling seed. *D'Albertis' Creeper*. Fig. 42E–H.

Christmas Is., in a single locality and may have been introduced through cultivation. Otherwise known only from New Guinea in rainforest, open forest and secondary woodland.

Ch.Is.: old clearing 600 m S of six-mile curve, *D.A.Powell 98* (K); no precise locality, *D.A.Powell 265* (K).

This is a very strong climber, smothering secondary growth and small trees.

11. CANAVALIA

Canavalia DC., *Prodr.* 2: 403 (1825), *nom. cons.*; from the Malabar Indian name *kanavala*, for one of the species.

Type: *C. ensiformis* (L.) DC.

Climbing herbs, shrubs or lianes. Leaves pinnately trifoliolate; stipules caducous. Inflorescence axillary, pseudoracemose; flowers showy, inverted, in clusters of 2–6 along rachis; bracteoles caducous. Calyx campanulate, bilabiate; lower lip broad, truncate or bilobed; upper lip narrow, 3-toothed. Petals white, pink or purplish; standard showy, reflexed, auriculate; wings and keel with basal, interlocking auricles. Stamens connate into a tube; upper stamen usually free at base only. Ovary with few to many ovules. Fruits oblong, compressed or inflated, 2-valved, thickened along upper margin, sometimes ribbed along valves, dehiscent. Seeds c. 2–15; hilum long, linear.

A largely American genus of c. 50–55 species, with some SE Asian representatives; 1 species on Christmas Is. and Cocos (Keeling) Is.; 1 species on cays of the Coral Sea. *Canavalia ensiformis* (L.) DC. is a widely grown, upright species which grows rapidly, forming a good ground cover, the nitrogen-fixing root nodules making it a good green manure.

J.Sauer, Revision of *Canavalia*, *Brittonia* 16: 106–181 (1964); J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 314–315 (1981).

Leaflets shortly acuminate; calyx 9–11 mm long **1. C. cathartica**

Leaflets obtuse or emarginate, sometimes minutely apiculate; calyx 7–9 mm long **2. C. rosea**

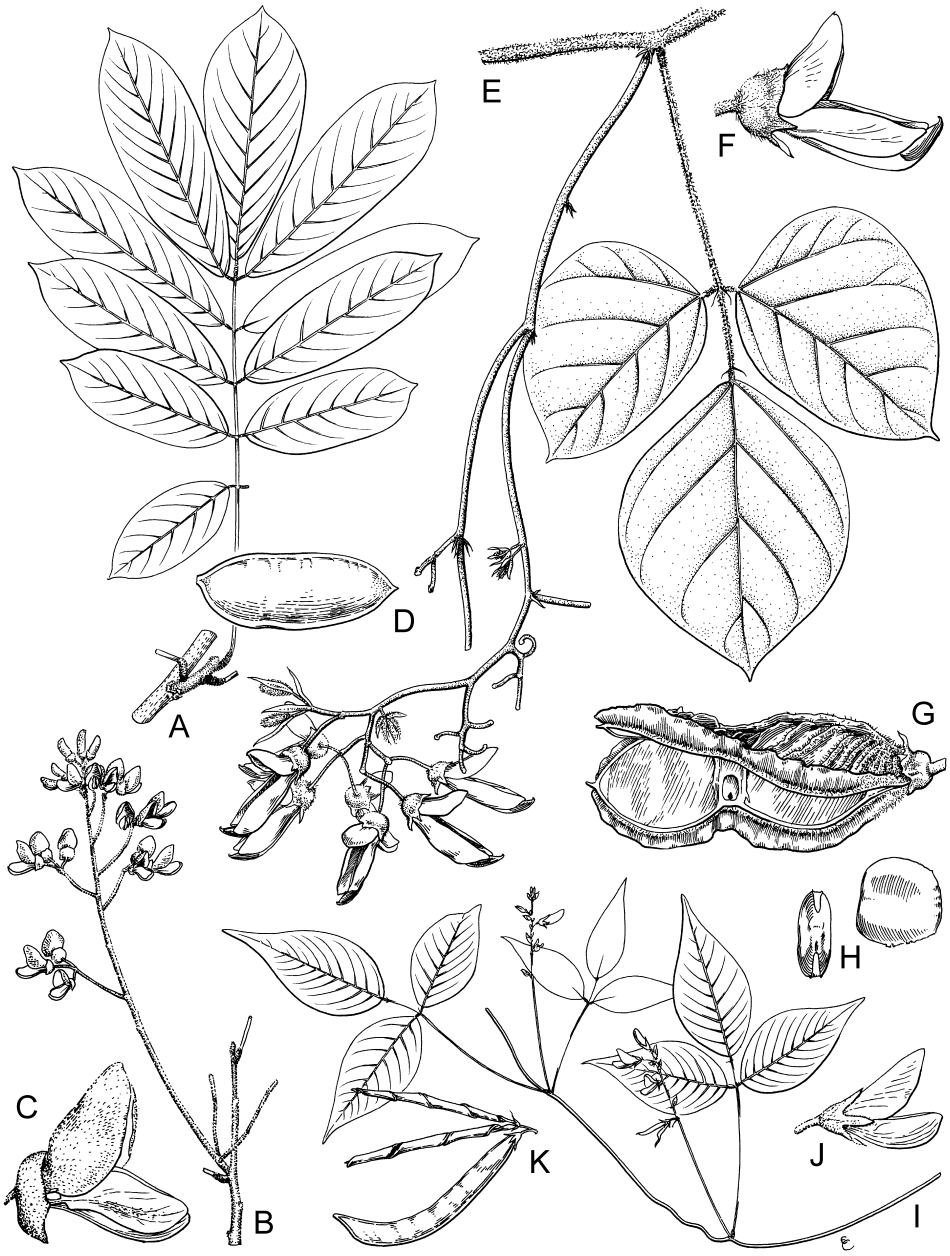

Figure 42. **A–K**, FABACEAE. **A–D**, *Derris elliptica*. **A**, leaf X0.3; **B**, inflorescence X0.3; **C**, flower X1.5 (**A–C**, D.Powell 420, K); **D**, fruit X0.5 (A.Kostermans 19337, K). **E–H**, *Mucuna albertisii*. **E**, flowering stem X0.3 (L.Brass 27746, K); **F**, flower X0.5 (D.Powell 98, K); **G**, fruit X0.5; **H**, seed X0.5 (**G–H**, D.Powell 265, K). **I–K**, *Galactia tenuiflora*. **I**, flowering stem X0.3; **J**, flower X1.5; **K**, fruits X0.5 (**I–K**, D.Powell 231, K). Drawn by E.Catherine.

1. Canavalia cathartica Thouars in A.N.Desvaux, *J. Bot. Agric.* 1: 81 (1813), as *C. catharticus*

T: illustration in H.A. van Rheede, *Hort. Malab.* 8: 87, fig. 45 (1688); lecto, *fide* J.Sauer, *Brittonia* 16: 158 (1964). Epithet is a Latin transcription of the Greek *katharticos*, from *kathairein* (to cleanse, purify), referring to its purgative properties.

C. obtusifolia var. *insularis* Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 187 (1906). T: Rocky Point Rd, Christmas Is., 1904, *H.N.Ridley 146*; iso: K.

[*C. ensiformis auct. non* (L.) DC.: C.W.Andrews, *Monogr. Christmas Is.* 177 (1900)]

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 472, fig. 111 (1979).

Perennial climbing shrub; stems slender, 3–10 m long, sparsely pubescent. Leaflets broadly ovate to elliptic, 4–24 cm long, rounded at base, shortly acuminate, glabrous; petiole 2–12 cm long. Pseudoracemes 11–38 cm long, pendulous. Flowers several, fragrant, opening singly; pedicels 3–5 mm long. Calyx tube 9–11 mm long, glabrous; lower lip bilobed. Petals cerise, white at base, fading bluish; standard obcordate, c. 2–3.5 cm long; keel connate below, curved. Fruit oblong, 8–12 cm long, beaked, somewhat inflated; valves with secondary rib below thickened upper margin, glabrous, often tardily dehiscent; endocarp papery, cream. Seeds 2–6, oblong, c. 18 mm long, dark brown.

Christmas Is., Cocos (Keeling) Is. On Christmas Is., common along the north and north-eastern shore terrace, and at South Point. On Cocos (Keeling) Is. grows only on North Keeling Is., where rare in *Pisonia grandis* forest in coralline sand as a vigorous climber to the canopy. Widespread in the tropics from coastal E Africa, through Malesia to the Pacific islands, and recorded from the northern tip of Cape York, Qld.

Ch.Is.: shore, Flying Fish Cove, *C.W.Andrews 132* (BM, K); Rocky Point Rd, *H.N.Ridley 146* (K); Waterfall, east coast, *B.A.Mitchell 82* (CBG, K); track to golf course, View Point, *D.J. & B.P.Du Puy CI25* (CBG, K). C.K.Is.: North Keeling Is., *I.R.Telford 10032 & C.Howard* (CBG, K); E of landing place, North Keeling Is., *D.G.Williams 41* (CBG, K, PERTH).

The fibrous stems may be used as twine, or the fibres may be separated out and woven into bags or other small items. Reputed to be a suitable green manure for flat land. Commonly grows on beaches throughout the tropics, around the high tide mark.

2. Canavalia rosea (Sw.) DC., *Prodr.* 2: 404 (1825)

Dolichos roseus Sw., *Fl. Ind. Occid.* 3: 124 (1788). T: from Jamaica, West Indies, *coll. unknown*; *n.v.* Epithet from the Latin for pink, referring to the flower colour.

Dolichos maritimus Aubl., *Hist. Pl. Guiane* 2: 765 (1775). T: from Guiana and Java, *coll. unknown*; *n.v.*

C. maritima Thouars in A.N.Desvaux, *J. Bot. Agric.* 1: 80 (1813). T: not cited.

Illustration: A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 127 (1985).

Perennial, trailing or climbing stems to 10 m long, silky, glabrescent. Leaflets elliptic, broadly obovate or ovate, sometimes emarginate or apiculate, usually 3–9 cm long, usually glabrous; petiolule 4–8 mm long; petiole 2–10 cm long. Inflorescence usually erect, 5–35 cm long; pedicels c. 3 mm long; peduncle 4–25 cm long. Calyx 7–9 mm long; lower lip bilobed. Corolla pink or mauve; standard elliptic, 20–30 mm long, whitish towards base. Fruit linear-oblong, compressed, 10–15 cm long, 5–8-seeded; valves with secondary rib below thickened upper margin. Seeds 15–20 mm long, brown, sometimes mottled.

Coral Sea Is. Grows in herbfield usually at tops of beaches in coralline sand where recorded from Diamond Is. and Magdelaine Cays. Pantropical and subtropical on ocean strands, including northern and eastern Australia, Lord Howe and Norfolk Is.

C.S.Is.: East Is., Diamond Is., *J.Hicks 62* (CBG); SE Cay, Magdelaine Cays, 6 Oct. 1987, *T.Scotney & W.Jeffs* (CBG).

J.Sauer, *Brittonia* 16: 165 (1964) mistakenly included *C. obtusifolia* var. *insularis* in *C. rosea* (as *C. maritima*), but did not locate the type specimen.

12. PACHYRHIZUS

Pachyrhizus Rich. ex DC., *Prodr.* 2: 402 (1825), *nom. cons.*; from the Greek *pachys* (thick, stout) and *rhizon* (root), descriptive of the tuberous roots.

Type: *P. angulatus* Rich. ex DC., *nom. illeg.* = *P. erosus* (L.) Urb.

Climbing herbs; roots tuberous. Leaves pinnately trifoliolate; leaflets often shallowly lobed or distantly toothed; stipules narrowly ovate; stipels small. Inflorescence axillary, pseudo-racemose; flowers in clusters; clusters sometimes shortly stalked; bracteoles caducous. Calyx campanulate, 5-lobed; upper two lobes forming a bifid lip. Petals purple to blue; standard reflexed, auriculate, with a transverse appendage between; keel and wings with interlocking basal auricles. Stamens connate into a tube; upper stamen free. Ovary hairy; ovules many; style flattened and broad at apex, hairy. Fruit linear-oblong, flattened, distinctly indented between seeds, 2-valved, elastically dehiscent. Seeds 4–12; hilum short.

This genus contains 4 or 5 species native to tropical and subtropical America. *Pachyrhizus erosus* and *P. tuberosus* Spreng. are now widely cultivated in the tropics for their edible tubers. The former species has become naturalised on Christmas Is.

J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 314–315 (1981).

*Pachyrhizus erosus (L.) Urb., *Symb. Antill.* 4: 311 (1905)

Dolichos erosus L., *Sp. Pl.* 2: 726 (1753). T: based on an illustration in L.Plukenet, *Phytographia* t. 52, fig. 4 (1691). Epithet is the Latin for irregularly toothed on the margin, referring to the somewhat lobed leaf which is unusual in this family.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 476, fig. 112 (1979).

Perennial, climbing herb; stems 2–6 m long, retrorsely hairy. Leaflets broadly ovate or rhomboidal, 3–18 cm long, rounded to obtuse at base, shortly acuminate, sparsely short-hairy; upper margins often shallowly lobed to distantly toothed, sparsely short-hairy; petiole 3–18 cm long. Pseudoracemes c. 10–50 cm long; pedicels 5–12 mm long. Calyx tube c. 5 mm long; bifid upper lip and 3 lower lobes subequal, as long as tube. Petals blue, green at base; standard circular, 15–18 mm long, with 2 basal auricles; keel with recurved basal spur. Fruit linear-oblong, 8–12 mm long, flattened, appressed-hairy. Seeds 6–11, c. 8 mm diam., chestnut-brown; hilum short. *Yam Bean, Turnip Tree*.

Christmas Is. Introduced as a vegetable and now a roadside plant in several areas, occasionally on the lower terraces and cliffs. Originally from America, now widely cultivated in the tropics.

Ch.Is.: no precise locality, *D.A.Powell 307* (K); sea cliffs N of Waterfall, *D.A.Powell 745* (K).

The turnip-shaped tubers are usually eaten raw, or can be cooked as yams. They are low in protein (c. 1%) and high in carbohydrate (c. 10.5%), the starch sometimes being extracted and used for thickening in custards and puddings. The young pods may also be boiled and eaten as a vegetable. The leaves and mature seeds are poisonous, containing the glucoside pachyrrhizid, pachyrrhizine and various saponins. Nodulation is sparse, but this species has also been used as a green manure.

13. GALACTIA

Galactia P.Browne, *Civ. Nat. Hist. Jamaica* 298 (1756); from the Greek *gala* or *galaktos* (milk), as some species contain a milky sap.

Type: *G. pendula* Pers.

Climbing, prostrate or erect herbs, sometimes woody. Leaves mostly pinnately trifoliolate; stipules caducous; stipels small. Inflorescence axillary, usually pseudoracemose with flowers in clusters, or occasionally reduced to a single cluster or flower; bracteoles paired

below calyx. Calyx campanulate, deeply 4-toothed; upper tooth broadest. Petals often pink or mauve, small; standard without auricles. Stamens connate into a tube; upper stamen free. Ovary pubescent; ovules usually many. Fruits usually linear to linear oblong, compressed, 2-valved, dehiscent, rarely 1-seeded and buried in the ground (not on Christmas Is.). Seeds 1–several; hilum short.

A pantropical genus of c. 50 species, with a centre of diversity in the New World; 1 species occurs on Christmas Is. *Galactia* species often occur in sandy soil in scrubby woodland, on forest margins and in open forest.

B.Verdcourt, *Fl. Trop. E. Africa*, Leguminosae, Papilionoideae: 578–580, fig. 85 (1971); A.Burkart, El genero *Galactia* en Sudamerica, *Darwiniana* 16: 663–796 (1971); J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 314–315 (1981).

Galactia tenuiflora (Willd.) Wight & Arn., *Prodr. Fl. Pen. Ind. Orient.* 206 (1834)

Glycine tenuiflora Willd., *Sp. Pl.* 3(2): 1059 (1803). T: near Pondicherry, India, *J.G.Klein*; holo: B, microfiche seen. Epithet from the Latin *tenuis* (thin) and *flos* (flower), referring to the slender inflorescences.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 479, fig. 113 (1979).

Perennial, climbing herb with a woody base; stems slender, 0.6–3.6 m long, sparsely pubescent. Leaflets ovate, 2.5–7.5 cm long, rounded at base, acuminate and finally acute to obtuse, mucronate, pale green and sparsely pubescent below; petiole 2.5–6 cm long. Pseudoracemes 1–10 cm long, lax, with 1–15 small flowers in clusters of 1–3; pedicels 3–4 mm long. Calyx tube c. 2 mm long; teeth 4, acuminate, 3–4 mm long, pubescent. Petals pink, greenish outside; standard obovate, 10–11 mm long; wings auriculate; keel connate below, blunt. Fruit linear-oblong, 5–7 cm long, curved, minutely pubescent, explosively dehiscent. Seeds usually 7–9, reniform, c. 5 mm long, mottled brown; hilum short. Fig. 42I–K.

Christmas Is. This attractive species is common on all the terraces in marginal and open forest, both in clearings and below the main canopy. It is often found scrambling over bushes. A pantropical species or species complex with a highly variable leaf morphology, the specimens from Christmas Is. differing from the Australian variants.

Ch.Is.: no precise locality, *C.W.Andrews 4* (K); Rocky Point, *H.N.Ridley 66* (K); no precise locality, *D.A.Powell 231* (K); along walk to West White Beach, *R.Shivas 926* (PERTH); North West Point at base of first inland cliff, *D.J. & B.P.Du Puy CI74* (CBG, K).

Leaf variation is a feature of many species in the tribe Phaseoleae and is especially pronounced in this species. The leaflets vary greatly in size, in shape (from elliptic with rounded or emarginate apices, through ovate and obtuse or acute, to narrow and linear), and indumentum (from velvety hairy to shortly pubescent or subglabrous). The ovate leaf shape with an acuminate apex and sparse indumentum which occurs in the variant from Christmas Is. is unusual, and all three specimens collected on Christmas Is. are remarkably uniform. This may represent an undescribed, endemic taxon, but a full revision of the species complex is required to ascertain whether the continuous variation on a world-wide scale would include this variant. The variation in Australia is great, leading B.Verdcourt (*Man. New Guinea Legumes*, 480, 1979) to comment that the specimens could hardly all belong to the same taxon.

The New World representatives of this complex group are usually named *G. striata* (Jacq.) Urb., an earlier name than *G. tenuiflora*, but the latter name is used here following the treatments of C.A.Backer & R.C.Bakhuizen van den Brink Jr, *Fl. Java* 1: 631 (1963) for Java, B.Verdcourt, *Fl. Trop. E. Africa*, Leguminosae, Papilionoideae: 578 (1971) for tropical East Africa, and B.Verdcourt, *op. cit.* 478 for New Guinea.

14. CALOPOGONIUM

Calopogonium Desv., *Ann. Sci. Nat.* 9: 423 (1826); from the Greek *kalos* (beautiful) and *pogon* (beard), referring to the golden-haired stems, leaves and pods of the type species.

Type: *C. mucunoides* Desv.

Climbing or trailing herbs, sometimes woody. Leaves pinnately trifoliolate; stipules caducous; stipels small, sometimes glandular. Inflorescence axillary, pseudoracemose; flowers small, in clusters along rachis; bracteoles paired, caducous. Calyx campanulate, deeply 5-toothed; upper 2 teeth free or partially connate and forming a bifid upper lip. Petals bluish; standard with inflexed basal auricles; keel obtuse, shorter than wings. Stamens connate into a tube; upper stamen free; anthers usually 8 or 9. Ovary sessile; ovules 5–many; stigma capitate. Fruit linear to linear-oblong, flattened, 2-valved, elastically dehiscent, mostly septate and appearing segmented. Seeds several; hilum short.

A tropical and subtropical American genus of 6–8 species; 2 species on Christmas Is. *Calopogonium mucunoides*, *C. orthocarpum* Urb. and *C. caeruleum* are used as green manures and as cattle fodder, although they are rather unpalatable. They are now planted more widely in the tropics and occasionally escape and become naturalised.

J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 314–315 (1981).

Stems commonly rooting at nodes; stems and calyx densely covered in long, spreading hairs; pods with many, long, ginger-coloured bristles **1. C. mucunoides**

Stems not frequently rooting at nodes; stems and calyx sparsely appressed-hairy; pods sparsely pubescent, almost glabrous **2. C. caeruleum**

1. *Calopogonium mucunoides Desv., *Ann. Sci. Nat.* 9: 423 (1826)

T: Guiana, *coll. unknown*; *n.v.* Epithet derived from the resemblance to *Mucuna* because of the leaflet shape, the apparently segmented pod and the ginger hairs that resemble the irritant hairs of *Mucuna*.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 482, fig. 114 (1979).

Twining or long-trailing, mat-forming, perennial herb; stems 1–4 m long, rooting at nodes, densely covered in long, golden or rusty spreading hairs. Leaflets ovate to rhombic, 3–12 cm long, rounded at base, obtuse, apiculate, appressed-hairy; lateral leaflets distinctly unequal-sided; petiole 2–16 cm long. Pseudoracemes to 30 cm long; flowers densely crowded, in clusters of 2–5; pedicels 1–2 mm long. Calyx tube c. 2 mm long, golden-hairy; teeth acuminate, the upper two partially connate. Petals blue; standard obovate, 8–9 mm long, emarginate, auriculate, yellow-green at base. Fruit linear-oblong, 20–40 mm long, densely ginger-bristly. Seeds 4–8, oblong, c. 3 mm long, light brown; hilum very small. *Calopo*.

Christmas Is. Recently introduced and reproducing satisfactorily. A native of S and Central America and the West Indies. The most widely and commonly cultivated *Calopogonium* species in tropical Asia and Africa, frequently naturalised in open ground, waste land, rough pasture, roadsides and river beds, forming a spreading, tangled mass of stems about 50 cm high.

Ch.Is.: no precise locality, *D.A.Powell 663* (K).

A fast-growing, vigorous cover crop used for erosion control on cleared land but requires a high rainfall and dries out rapidly in dry climates. It has been used as a green manure in Java. It is unpalatable to animals, although it will be eaten if necessary.

2. *Calopogonium caeruleum (Benth.) Sauvalle, *Ann. Acad. Havana* 5: 337 (1869)

Stenolobium caeruleum Benth., *Comm. Legum. Gen.* 61 (1837). T: Rio Macacu, Corumba, Brazil, *J.E.Pohl s.n.*; syn: K. Epithet from the Latin for blue, descriptive of the flower colour.

Climbing herb; stems several metres long, usually not rooting at nodes, appressed-hairy. Leaflets 4–14 cm long, densely appressed-hairy; central leaflet rhombic to weakly 3-lobed; lateral leaflets ovate, very unequal-sided; petiole 2.5–14 cm long; stipels glandular. Pseudoracemes many-flowered, to 22 cm long; flowers in clusters of 4–8, somewhat distant; pedicels 3–4 mm long. Calyx tube c. 2.5 mm long, pubescent; teeth acuminate, the upper 2 partially connate. Petals blue; standard obovate, c. 9 mm long, auriculate. Fruit linear-oblong, 4–5 cm long, sparsely pubescent. Seeds 4–8, oblong, c. 4 mm long, brown; hilum short.

Christmas Is. Recently introduced and occasionally naturalised. Native to S and Central America and the West Indies, sometimes cultivated in other tropical areas.

Ch.Is.: no precise locality, *D.A.Powell 656* (K).

This has similar uses to *C. mucunoides*. It is a vigorous coloniser and produces copious seed. It is unpalatable to animals.

15. PUERARIA

Pueraria DC., *Ann. Sci. Nat.* 4: 97 (1825); *Prodr.* 2: 240 (1825); named after M.N.Puerari, a Swiss botanist (fl. 1800), who donated his herbarium to A.P.de Candolle in 1827.

Type: *P. tuberosa* (Roxb. ex Willd.) DC.

Mostly strong, climbing shrubs; stems woody, usually hairy; roots sometimes tuberous. Leaves pinnately trifoliolate; leaflets sometimes sinuately lobed; stipules ovate or peltate; stipels subulate. Inflorescence axillary, usually pseudoracemose, the flowers in clusters; bracteoles caducous. Calyx campanulate, deeply 5-toothed; upper two teeth partially to entirely connate. Petals blue to purplish; standard often auriculate at base; keel strongly curved. Stamens connate into a tube; upper stamen free at base. Ovary pubescent; ovules many; style long, curved; stigma capitate. Fruit slender, flattened to terete, 2-valved, sometimes septate, elastically dehiscent. Seeds usually 5–20; hilum short.

A tropical and subtropical, SE Asian genus of 17 species, distributed from India and Japan through Indo-China, Malesia and New Guinea to the Pacific islands and Australia (N Qld), widely introduced in America, Africa and Australia; 1 species on Christmas Is. The species often occur in open or scrubby woodland, on forest margins and on roadsides. They are vigorous and provide a dense foliage cover, making them suitable for erosion- and weed-control. They produce nutritive fodder, although cattle do not accept it at first. The tubers of *P. triloba* (L.) Makino are cultivated in Japan for use as a vegetable, and are turned into cooking starch.

J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 316–318 (1981); L.J.C. van der Maesen, Revision of the genus *Pueraria* DC. with some notes on *Teyleria* Backer (Leguminosae), *Agric. Univ. Wageningen Pap.* 85(1): 1–132 (1985).

***Pueraria phaseoloides** (Roxb.) Benth., *J. Linn. Soc., Bot.* 9: 125 (1865)

var. **javanica** (Benth.) Baker in J.D.Hooker, *Fl. Brit. India* 2: 199 (1876)

Neustanthus javanicus Benth. in F.A.W.Miquel, *Pl. Jungh.* 2: 235 (1852). T: R. Kuning, Java, *F.W.Junghuhn s.n.*; holo: K. Epithet in reference to the type collection being from Java.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 484, fig. 115 (1979).

Climbing, perennial shrub; stems slender, 2–10 m long, rusty-hairy; roots tuberous. Leaflets rhombic to ovate, 3–15 cm long, cuneate to rounded at base, entire or slightly sinuate, acute, mucronate, appressed-hairy; lateral leaflets unequal-sided; petiole 3–11 cm long. Pseudoracemes 15–30 cm long; flowers mostly in clusters; pedicels 2–5 mm long. Calyx

tube 3–4 mm long, pubescent; upper 2 teeth connate almost to apex; lateral teeth obtuse. Petals purple, margins white; standard broadly elliptic, c. 18 mm long, auriculate at base; wings auriculate and lobed at base; keel falcate, acute. Fruit linear, 5–10 cm long, septate, slightly compressed, pubescent, dark grey. Seeds 14–20, barrel-shaped, brown; hilum circular. *Puero, Tropical Kudzu*.

Christmas Is. Recently introduced and growing vigorously, producing copious seed. Native to India, Indo-China, Malesia, the Philippines, New Guinea and the Pacific islands, and recently introduced to tropical Africa and America. Occasionally naturalised in regions where there is a dry season.

Ch.Is.: no precise locality, *D.A.Powell 655* (K).

There are three somewhat distinct varieties, discernable by their flower size, the shape of the calyx lobes and the leaflet shape (L.J.C. van der Maesen, *op. cit.*). The specimens on Christmas Is. are included in var. *javanica*, distributed in Indo-China, Malesia, and the Pacific islands, and introduced to Africa and S and Central America. It is grown as a green manure and weed suppressor in plantation crops such as coffee, rubber, coconut and citrus. The edible tubers are rarely consumed. The stems can be retted to produce a fibre. It is used medicinally in Malaya to treat boils and ulcers.

16. CENTROSEMA

Centrosema (DC.) Benth., *Comm. Legum. Gen.* 53 (1837), *nom. cons.*; from the Greek *kentron* (spur) and *sema* (standard, flag), descriptive of the standard petal which has a short spur or sac at the base.

Type: *C. brasilianum* (L.) Benth.

Climbing or trailing herbs or low shrubs; indumentum of minute, hooked hairs. Leaves mostly pinnately trifoliolate; stipules persistent; stipels subulate. Inflorescence axillary, pseudoracemose; flowers large, few; bracteoles appressed to calyx, striate. Calyx campanulate, 5-lobed; upper two teeth partially connate, forming a bifid lip. Petals white, purplish or blue; standard broad, large, shortly spurred basally, without auricles, hooked-hairy outside; keel falcate, broad. Stamens connate into a tube; upper stamen sometimes free. Ovary linear; ovules many; style curved, broad and flattened at apex. Fruit linear, flattened, 2-valved; valves with 2 marginal, raised ridges or wings, long-beaked, septate, dehiscent. Seeds 5–20; hilum short.

The 40–50 species in this genus are native to the New World tropics and subtropics. Several are now cultivated as cover crops in the Old World, and are sometimes naturalised; 1 species occurs on Christmas Is.

J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 320 (1981)

*Centrosema pubescens Benth., *Comm. Legum. Gen.* 55 (1837)

T: Tlalpuxahua, Mexico, *F.W.Keerl*; holo: BR, Herb. Martius *n.v.* Epithet is the Latin for shortly and softly hairy , in reference to the indumentum.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 500, fig. 122 (1979).

Climbing herb; stems slender, to 4 m long. Leaflets elliptic to ovate, 2–9 cm long, obtuse to shortly acuminate, mucronate, rounded at base, pubescent; petiole 1.5–3.5 cm long. Pseudoracemes 1–8 cm long; flowers several, clustered apically, opening sequentially; pedicels 1–10 mm long; bracteoles large, ovate, striate, enclosing calyx. Calyx tube c. 3 mm long; upper lip bifid; lower lip long, linear. Petals mauve, yellowish outside; standard c. 3 cm diam., spurred at base, mauve, cream centrally with magenta lines surrounding,

yellowish outside; keel semicircular, inflated. Style-tip spathulate. Fruit linear, 6–12 cm long, straight, flattened; margins thickened; beak c. 2 cm long, acicular, minutely pubescent. Seeds 6–15, oblong, 4–5 mm long, flattened; hilum short. *Butterfly Pea, Centro*.

Christmas Is. Grows in very poor soil among limestone pinnacles in disused quarries and along the railway line. A native of tropical America, now widely cultivated and often naturalised in the tropics.

Ch.Is.: South Point, *D.A.Powell P33* (K); alongside the railway, *D.A.Powell 268* (K); Central Plateau, railway line near camp 4, *B.A.Mitchell 120* (CBG, K); near railway adjacent to abandoned settlement on Central Plateau, *R.Shivas 986* (PERTH).

This vigorous, scrambling plant forms tangled mats that are an effective soil cover. It nodulates freely and produces little woody growth for the first 18 months, making it a useful green manure. Also frequently used as a pasture legume, forming a stable mixture with grass and tolerant of heavy grazing. It is shade tolerant and somewhat drought resistant and is often used as ground cover in tree plantations. Germination is aided by abrasion through shaking the seeds together in a drum.

17. CLITORIA

Clitoria L., *Sp. Pl.* 2: 753 (1753); *Gen. Pl.* 5th edn, 334 (1754); from the Greek *kleitoris* (a clitoris), from the resemblance of the small keel and sheathing standard petal to the female genitalia.

Type: *C. ternatea* L.

Mostly climbing or erect herbs or shrubs. Leaves pinnate, usually 3–9-foliolate; stipules persistent; stipels setose. Flowers showy, solitary, paired or in few-flowered pseudoracemes, axillary, inverted; bracteoles large, persistent. Calyx tubular, deeply 5–lobed. Petals blue or white; standard much larger than other petals, somewhat funnel-shaped, without auricles or appendages; keel shorter than wings, inflated. Stamens connate into a tube; upper stamen sometimes free. Ovary linear, pubescent; ovules several. Fruit linear-oblong, flattened, beaked, 2-valved, dehiscent. Seeds 3–10, oblong; hilum small.

A pantropical and subtropical genus of c. 70 species, mostly native to the New World. Several species are widely cultivated as ornamentals and are naturalised in many areas; 1 widely cultivated species occurs on Christmas Is.

J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 320 (1981).

*Clitoria ternatea L., *Sp. Pl.* 2: 753 (1753)

T: Herb. Hort. Cliff. 360, *Clitoria* 1; lecto: BM, *fide* O.O.Wijnands, *The Botany of the Commelins* 161 (1983). Epithet named after the island of Ternate in the Moluccas, from whence Jakob Breyne first reported this species in 1678.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 503, fig. 123 (1979).

Perennial, scandent herb; stems slender, 0.4–3 m long, glabrescent. Leaflets 5–7, elliptic, 1.5–6.5 cm long, rounded at base, often emarginate, sparsely pubescent beneath; petiole 1–3 cm long; petiolules 2–3 mm long; stipules c. 5 mm long. Flowers solitary or paired, resupinate, showy; pedicel and peduncle together 7–12 mm long; bracteoles 7–10 mm long, broadly ovate, foliaceous. Calyx tube 10–12 mm long, pubescent. Petals bright blue, pale yellow at base; standard broadly obovate, 4–5 cm long, undulate, sheathing wings and keel at base; wings and keel small, long-clawed. Upper stamen free. Fruit linear-oblong, c. 7–10 cm long, flattened, sparsely hairy, shortly beaked. Seeds c. 9 or 10, oblong-reniform, 6–7 mm long; hilum short. *Butterfly Pea, Bunga Biru*.

Christmas Is. Commonly cultivated by Europeans and Chinese and occurs as a garden escape especially around Settlement, Drumsite and in old quarries at South Point. The original distribution of this species has been obscured by its widespread cultivation and

naturalisation in the tropics.

Ch.Is.: South Point, *D.A.Powell P32* (K); no precise locality, *D.A.Powell 13* (K); along NW coast road to Waterfall, *R.Shivas 895* (PERTH).

The principal use of this species is as a cultivated ornamental. The blue flowers can be used to colour rice and cakes. Paper dyed with the flower pigment can be used as litmus paper to detect acidity or alkalinity. The green pods are reported to be edible. It has a very high nutritional value as a forage crop. The juice of the leaves, mixed with water, forms a jelly which has been used to treat acne, boils and gonorrhea. Extracts of the roots, bark and seeds are used as laxatives and are reputed to destroy tapeworms, but they contain poisonous alkaloids with dangerous side-effects if given in too large doses. The plant is widely considered to have aphrodisiac properties.

18. PSOPHOCARPUS

Psophocarpus Neck. ex DC., *Prodr.* 2: 403 (1825), *nom. cons.*; from the Greek *psophos* (noise) and *karpos* (fruit), in reference to the noise made by the explosively dehiscent pods.

Type: *P. tetragonolobus* (L.) DC.

Mostly climbing to long-trailing herbs, woody at base; root tuberous. Leaves pinnately trifoliolate or unifoliolate; stipules extending above and below point of attachment, persistent; stipels present. Inflorescence axillary, pseudoracemose or flowers solitary; bracteoles persistent. Calyx campanulate, 5-lobed; upper 2 lobes connate, forming an entire or bifid lip. Petals blue or purplish; standard erect, auriculate; keel sharply falcate, rounded. Stamens connate into a tube; upper stamen free or coherent. Ovary winged; ovules many; style hairy or with apical ring of hairs. Fruit oblong, septate, strongly 4-winged, 2-valved, dehiscent. Seeds 4–20, ellipsoidal; hilum short.

An Old World genus of 9 species native to tropical Africa; 1 species is widely cultivated throughout Africa and SE Asia but is not known in the wild except as a naturalised escape from cultivation; this species occurs on Christmas Is. Several species are useful as green manure, fodder, ground cover and in crop rotations.

B.Verdcourt & P.Halliday, A Revision of *Psophocarpus* (Leguminosae-Papilionoideae-Phaseoleae), *Kew Bull.* 33: 191–227 (1978); J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 322 (1981).

*Psophocarpus tetragonolobus (L.) DC., *Prodr.* 2: 403 (1825)

Dolichos tetragonolobus L., *Syst. Nat.* 10th edn, 1162 (1759). T: illustration of 'Lobus quadrangularis' in G.E.Rumphius, *Herb. Amboin.* 5: 374, t. 133 (1747); holo, *fide* B.Verdcourt & P.Halliday, *Kew Bull.* 33: 199 (1978). Epithet from the Greek *tetra* (four), *gonia* (angle, corner), and *lobos* (pod), descriptive of the four-winged pod.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 534, fig. 130 (1979).

Perennial, climbing herb; stems slender, to 4 m long, slightly spirally ridged, glabrous. Leaves trifoliolate; leaflets ovate to triangular, 3.5–15 cm long, rounded to truncate at base, acute, glabrous, glaucous beneath; petiole 3–11 cm long; stipules 6–12 mm long. Pseudoracemes 1–10 cm long; flowers 2–10, near apex; pedicels c. 1 cm long; bracteoles 3–4 mm long, rounded. Calyx tube c. 8 mm long, glabrous; lobes rounded; upper lip bifid. Petals mauve, cream or yellow at base; standard 2.5–3.5 cm diam., emarginate, auriculate, greenish-yellow outside; keel strongly curved distally. Style bearded at apex. Fruit narrowly oblong, 13–20 cm long, 4-angled, with 4 broad, serrated, longitudinal wings. Seeds subglobose, 5–21, 6–10 mm long, variously coloured; hilum elliptic. *Winged Bean, Goa Bean*.

Christmas Is. Grown as a vegetable and also occurs outside cultivation among limestone pinnacles in abandoned quarries. There is some discussion concerning its origins. No wild, natural populations are known but it is widely cultivated in W Africa, SE Asia, Malesia,

New Guinea and Australia. It is native to either Madagascar or SE Asia, or may have arisen as a selected line in cultivation.

Ch.Is.: South Point, *D.A.Powell P31* (K).

This is a useful green manure as it has an exceptional capacity to produce many, large root nodules, and will improve the soil when used in a crop rotation. However, it is mainly grown for its young pods which are an excellent vegetable. The beans are also commonly roasted like peanuts. They have an exceptionally high protein content (30–37% of the ripe, fresh bean), rivalling soya beans, and produce a similar oil which may be used for cooking and for soap production, the residual cake being fed to stock. The yield per acre is not as high as for some crops, but the species has the advantage of being perennial and the young shoots, leaves, flowers and tubers are all also edible. It has great potential as a highly nutritional and high-yielding tropical crop. As with many other beans, it contains toxins that are easily removed by soaking prior to cooking.

19. LABLAB

Lablab Adans., *Fam. Pl.* 2: 325 (1763); from the Hindustani name for the species.

Type: *L. purpureus* (L.) Sweet

Climbing or suberect herbs. Leaves pinnately trifoliolate; stipules ovate, reflexed, persistent; stipels present. Inflorescence axillary, pseudo-racemose; bracteoles appressed to calyx. Calyx campanulate, 4-lobed; upper lobe usually notched. Petals usually purple or white; standard erect, auriculate and with 2 appendages at base; keel sharply falcate. Stamens connate into a tube; upper stamen free or coherent. Ovary flattened, the margins minutely undulate; style flattened, hairy on inner edge, angled as keel, persistent. Fruits oblong-reniform, 2-valved, dehiscent, spongy inside between seeds. Seeds ellipsoidal, compressed, variously coloured; hilum linear.

A monotypic genus, widely cultivated throughout the tropics including Christmas Is. and Cocos (Keeling) Is.; naturalised on Christmas Is.

R.Marechal, J.-M.Mascherpa & F.Stainier, Étude taxonomique d'un groupe complexe d'espèces des genres *Phaseolus* et *Vigna* (Papilionaceae), *Boissiera* 28: 244–246 (1978); J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 324 (1981).

***Lablab purpureus** (L.) Sweet, *Hort. Brit.* 481 (1827)

Dolichos purpureus L., *Sp. Pl.* 2nd edn, 2: 1021 (1763). T: not designated. Epithet from the Latin for purple, and descriptive of the flower colour of the typical variant.

Dolichos lablab L., *Sp. Pl.* 2: 725 (1753). T: Herb. J.Burser, vol. XIX, fol. 55 & Herb. C.Linnaeus in Herb. B.Bergius; syn: SBT, UPS, microfiche and photos seen.

[*Phaseolus lunatus auct. non* L.: C.W.Andrews, *Monogr. Christmas Is.* 177 (1900)]

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 536, fig. 131 (1979).

Perennial, climbing herb; stems 1–5 m long, minutely rough-hairy; root tuberous. Leaflets broadly triangular-ovate, 3–10 cm long, cuneate to truncate at base, acuminate, mucronate, glabrescent; petiole 1.5–12 cm long. Pseudoracemes 10–40 cm long, erect; flowers many, c. 2–5 per cluster; pedicels 2–5 mm long; bracteoles elliptic, c. 4–6 mm long, usually exceeding calyx tube. Calyx tube 4–5 mm long; upper lip entire or minutely notched; lower lobes acute, minutely pubescent. Petals white; standard 1.6–1.8 cm diam.; keel much narrower than wings, the tip turned upwards at a right angle. Fruit narrowly oblong, c. 5–9 cm long, compressed, curved, glabrescent. Seeds 2–5, c. 1 cm long, brown; hilum extending half-way round seed. *Hyacinth Bean*, *Lablab Bean*.

Christmas Is. It has been present since about 1900, but has recently become common on roadsides, the railway, scrubby and waste ground, and on disused quarry margins in many

parts of the island.

Ch.Is.: *C.W.Andrews 93* (K); South Point, *D.A.Powell P30* (K); no precise locality, *D.A.Powell 267* (K); no precise locality, *D.A.Powell 798* (K); along NE coast road to Waterfall, *R.Shivas 893B* (PERTH).

The species is of African origin, but is now widely cultivated and naturalised. It is extremely variable, and the specific description given here refers to the white-flowered variant that occurs on Christmas Is. It tolerates poor soil and low rainfall and is an efficient nitrogen fixer, accounting for its widespread use as a green manure and as a soil-improving cover crop. It yields a high quality fodder which may be made into silage. The large, starchy root is edible, and the leaves, young pods and seeds are frequently used as vegetables. The seeds have a high protein content, with a well-balanced ratio of amino acids.

20. VIGNA

Vigna Savi, *Nuovo Giorn. Lett.* 8: 113 (1824); named after Dominico Vigna, an Italian botanist during the first half of the 17th century, who was Professor of Botany and Director of the botanical garden at Pisa, and wrote a commentary on the works of Theophrastus.

Type: *V. luteola* (Jacq.) Benth.

Mostly climbing or prostrate herbs; roots often tuberous. Leaves usually pinnately trifoliolate; stipules sometimes peltate; stipels present. Inflorescence axillary, pseudo-racemose; flowers single or paired, crowded near apex; bracteoles caducous. Calyx campanulate, 4-lobed; upper lobe sometimes notched. Petals yellow or purplish; standard erect, auriculate and with 1–4 basal appendages; keel sometimes twisted sideways, one petal with a conical sac. Stamens connate into a tube; upper stamen free. Ovules many; style thickened towards apex, hairy on inner edge, sometimes extending beyond stigma. Fruit linear-oblong, subterete to flattened, 2-valved, dehiscent. Seeds cylindrical; hilum short, sometimes with a rim-aril.

This large genus probably includes about 150 species, distributed throughout the tropics; 11 species in Australia; 2 species on Christmas Is.; 1 species on Cocos (Keeling) Is. It is a taxonomically complex genus, difficult to distinguish from *Phaseolus* and other related genera, and with an inadequate understanding of the species and their variation. Several important crop species have recently been transferred to this genus from *Phaseolus*. The cowpea or black-eyed bean, *V. unguiculata* (L.) Walp., is probably the most important species, but other pulses include gram, mung, adzuki, rice, moth and urd beans. They are a major source of protein in SE Asia.

R.Marechal, J.-M.Mascherpa & F.Stainier, Étude taxonomique d'un groupe complexe d'espèces des genres *Phaseolus* et *Vigna* (Papilionaceae), *Boissiera* 28: 160–231 (1978); J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 324 (1981).

1 Leaflets obtuse or rounded, sometimes mucronulate; keel not twisted; pod 8–9 mm wide, containing 2–6 seeds **3. V. marina**

1: Leaflets acute or acuminate; keel twisted; pod less than 7 mm wide, containing 6 or more seeds

2 Pseudoracemes 1–7 cm long, with 2–6 apical flowers; pod 7 mm broad, with 6–9 seeds; seeds 4–5 mm long, smooth, with a conspicuous, raised, white rim-aril **1. V. mungo**

2: Pseudoracemes 7–23 cm long, with up to 25 flowers; pod 3 mm broad, with 7–14 seeds; seeds c. 3 mm long, minutely ribbed, without a raised rim-aril **2. V. radiata**

1. *Vigna mungo (L.) Hepper, *Kew Bull.* 11: 128 (1956)

Phaseolus mungo L., *Mant. Pl.* 101 (1767). T: from E India, cult. Uppsala Botanic Garden; not located. Epithet is a Latin corruption of the Sanskrit name, *mung*, for this plant in India, although in modern vernacular the name *mung* is applied to *V. radiata*.

Climbing herb; stems to 0.8 m long, with long, yellowish hairs. Leaflets oblong-elliptic, sometimes elongated, 4.5–15 cm long, rounded to truncate at base, acute, sparsely hairy; petiole 2–15 cm long; stipules peltate. Pseudoracemes 1–7 cm long; flowers 2–6, apical; pedicels 2–3 mm long. Calyx tube c. 2.5 mm long; upper lip broadly emarginate; lower lobes short, obtuse. Petals yellow; standard 1.3 cm diam. (from Indian material), emarginate, auriculate and petal with a single basal appendage; keel twisted sideways, with a sac on one petal. Fruit 4.5–6 cm long, 7 mm broad, slightly flattened, yellowish-hairy. Seeds barrel-shaped, 6–9, 4–5 mm long, smooth; hilum with a raised, white rim-aril. *Urd Bean, Black Gram*.

Christmas Is. Recently collected from roadsides near habitations and probably an escape from cultivation. The species has been cultivated in India and SE Asia since ancient times and is not known in the wild. It is perhaps derived from a variety of *V. radiata* but the seeds are very distinct.

Ch.Is.: undergrowth along the Drumsite Rd, *D.A.Powell 720* (K).

This is an important source of protein in SE Asia, and many cultivars are known. The young pods may be eaten as a vegetable. The ripe seeds are often boiled and eaten, and are frequently the basis of dhal in India. The plant can be used as a cover crop or a green manure.

2. *Vigna radiata (L.) R.Wilczek, *Fl. Congo Belge* 6: 386 (1954)

Phaseolus radiatus L., *Sp. Pl.* 2: 725 (1753). T: illustration of 'Phaseolus zeylanicus siliquis radiatim digestis', from Sri Lanka, in J.J.Dillenius, *Hort. Eltham.* t. 235, fig. 304 (1732); lecto, *fide* B.Verdcourt, *Fl. Trop. E. Africa*, Leguminosae: 655 (1971). Epithet from the Latin *radius* (spoke), descriptive of the arrangement of the pods which radiate from a central point as the spokes in a wheel.

Climbing herb; stems 0.2–0.6 m long, with long, ferruginous hairs, glabrescent. Leaflets ovate to rhombic, 2–6 cm long, cuneate to truncate at base, acuminate, sparsely hairy; petiole 1.5–3 cm long; stipules peltate. Pseudoracemes 7–23 cm long; flowers 1–25; pedicels 2–3 mm long. Calyx tube c. 2.5 mm long; upper lip broadly emarginate; lower lobes short, obtuse. Petals deep yellow; standard c. 1.6 cm diam., emarginate, auriculate and with 2 basal appendages; keel twisted sideways, with a conical sac on one petal. Fruit subterete, 3.5–6 cm long, 3 mm broad, rusty-hairy. Seeds 7–14, barrel-shaped, c. 3 mm long, minutely ribbed; hilum without a raised rim-aril. *Mung Bean, Green Gram*.

Christmas Is. Recently collected from an abandoned quarry in the central area. A cultivated crop of ancient origin in SE Asia, now cultivated throughout the tropics and subtropics.

Ch.Is.: trackside, old mined-out quarry, central area, *D.A.Powell 768* (K).

This species, as represented on Christmas Is., has smaller seeds than the more commonly cultivated Mung Bean. It corresponds with var. *sublobata* of B.Verdcourt, *Man. New Guinea Legumes* 524 (1979), used to cover populations which have reverted to the wild habit. It closely resembles *V. reflexo-pilosa* Hayata, but its hairy pod and minute, ridged sculpturing on the seed prevent its inclusion there.

The young pods may be used as a vegetable, and the dried seeds may be boiled and eaten. The freshly germinated seeds are the bean sprouts used in Oriental dishes, and are rich in vitamin C, and some of the B complex. This species may also be used as ground cover and as a green manure.

3. Vigna marina (Burm.f.) Merr., *Interpr. Herb. Amboin.* 285 (1917)

Phaseolus marinus Burm.f., *Fl. Ind.* 18 (1768). T: Rumphius, *Herb. Amboin.* 5: t. 141/2 (1750), *fide* N. van Thuan, *Fl. Cambodge* 17: 180 (1979); *n.v.* Epithet from the Latin *mare* (of the sea) referring to its shoreline habitats.

V. lutea (Sw.) A.Gray, *U.S. Expl. Exp., Atlas Phan.* 1: 454 (1856); *Dolichos luteus* Sw., *Fl. Ind. Occid.* 3: 1246 (1806). T: from India; *n.v.*

Illustrations: B.Verdcourt, *Man. New Guinea Legumes* 519, fig. 127 (1979); A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 134 (1985).

Perennial herb; stems trailing or climbing, to several metres long, sparsely hairy with white hairs, glabrescent. Leaflets broadly ovate or obovate, 35–95 mm long, mucronulate, sparsely pubescent; petiole 1.5–25 cm long; petiolules 3–7 mm long; stipules ovate, c. 2.5 mm long. Inflorescence erect, 5–25 cm long, 5–12-flowered; peduncle 3–23 cm long; pedicels c. 3 mm long. Calyx tube 2–3 mm long. Corolla yellow; standard 12–13 mm long with 2 calli; keel truncate. Fruit linear-oblong, 35–60 mm long, c. 6 mm wide, slightly constricted between seeds, glabrous. Seeds 2–6, 6–7 mm long, brown; aril small.

Cocos (Keeling) Is. Collected only from Home Is. where it is common at beach tops under *Terminalia catappa* in coralline sand. Pantropical, including northern Australia, Norfolk and Lord Howe Islands, as a strand species.

C.K.Is.: Home Is., *I.R.Telford 10054 & C.Howard* (AD, CBG, K); S lagoon shoreline, Home Is., *D.G.Williams 163 & Amat Noor* (CBG).

Sometimes considered as a synonym of *V. luteola* (Jacq). Benth. as a beach ecotype. Differs from typical *V. luteola* in its obtuse leaflets and longer pods.

21. MACROPTILIUM

Macroptilium Urb., *Symb. Antill.* 9: 457 (1928); from the Greek *makros* (large) and *ptilon* (wing), the wing petals being larger than the standard petal.

Type: *M. lathyroides* (L.) Urb.

Climbing, prostrate or erect herbs. Leaves mostly pinnately trifoliolate; stipules persistent, not peltate; stipels present. Inflorescence axillary, pseudoracemose, long-pedunculate; pedicels very short; bracteoles slender, caducous. Calyx campanulate, 5-lobed; lowest lobe sometimes reduced. Petals usually crimson or purple; standard erect, without basal appendages; wings large, strongly coloured; wings and keel long-clawed, the claws partially adnate to the staminal tube; keel recurved and twisted. Stamens connate into a tube; upper stamen free. Ovules few to many; style flattened, hook-shaped and bearded apically. Fruits linear, subterete, 2-valved, dehiscent, not septate. Seeds small; hilum short.

A genus of c. 12 species, all native to the New World.; 2 species widely cultivated in the Old World tropics and subtropics; 1 of these naturalised on Christmas Is. and Cocos (Keeling) Is. They are used as ground cover, green manure and fodder.

R.Marechal, J.-M.Mascherpa & F.Stainier, Étude taxonomique d'un groupe complexe d'espèces des genres *Phaseolus* et *Vigna* (Papilionaceae), *Boissiera* 28: 151–157 (1978); J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 324 (1981).

***Macroptilium atropurpureum** (DC.) Urb., *Symb. Antill.* 9: 457 (1928)

Phaseolus atropurpureus DC., *Prodr.* 2: 395 (1825). T: Guerrero, Chilapa Mtns, Mexico, *coll. unknown*; *n.v.* Epithet from the Latin *ater* (black, dark) and *purpureus* (purple-coloured), descriptive of the flower colour.

Perennial, long-trailing or climbing herb; stems silver-hairy. Leaves trifoliolate; leaflets ovate to rhombic, 3–5.5 cm long, weakly cordate at base, sinuate, obtuse to emarginate, mucronate, densely silver-hairy beneath; lateral leaflets often lobed; petiole 2.5–6 cm long; stipules ovate, acuminate. Pseudoracemes c. 20–30 cm long; flowers subsessile, solitary or

paired towards apex. Calyx tube c. 5 mm long, silver-hairy; lobes 5, subequal, acute. Petals greenish and purple-black; standard obovate, c. 15 mm long, emarginate; wings purple-black, dominating other petals; keel recurved, twisted, obtusely hooded. Fruit linear, 7–10 cm long, acicular, covered with appressed, stiff hairs. Seeds c. 11–15, oblong-reniform, 3.5 mm long, mottled brown; hilum small, white. *Siratro*.

Christmas Is., Cocos (Keeling) Is. This species was introduced recently to Christmas Is., in grass seed used at the airport and perhaps at the golf course and is now naturalised around the airport and along roads on the east coast. Occasionally naturalised on Cocos (Keeling) Is. around the settlements. A native of tropical America, now cultivated and naturalised throughout the tropics and subtropics.

Ch.Is.: edge of road along E coast, *D.A.Powell 287* (K); airport's western flank, *D.A.Powell 764* (K); entrance to golf course, *R.Shivas 836* (PERTH). C.K.Is.: Home Is., *I.R.Telford 10056 & C.Howard* (CBG); near settlement, West Is., *I.R.Telford 10006 & C.Howard* (CBG); 200 km NW of Possession Point, Horsburgh Is., *D.G.Williams 28* (CBG, PERTH).

This is used as a cover crop and pasture legume, which produces good quality foliage for fodder. It is drought-resistant and is tolerant of a wide range of soil types. It is an efficient nitrogen-fixing species, forming many root nodules, and is prolific in its seed production.

22. PHASEOLUS

Phaseolus L., *Sp. Pl.* 2: 723 (1753); *Gen. Pl.* 5th edn, 323 (1754); a Latin transcription of the Greek *phaselos* (bean).

Type: *P. vulgaris* L.

Climbing, decumbent or erect herbs. Leaves mostly pinnately trifoliolate; stipules persistent, not peltate; stipels present. Inflorescence axillary, pseudoracemose; flowers in clusters of 1–4; bracteoles persistent. Calyx campanulate, 4-lobed; upper lobe notched or bifid. Petals blue, purple, scarlet, white or yellow; standard erect, auriculate and with 2 appendages basally; wing often twisted; keel narrow, with apex spirally coiled. Stamens connate into a tube; upper stamen free. Ovules 2–many; style coiled through at least 360°, bearded apically. Fruits oblong to linear, compressed to subterete, 2-valved, dehiscent. Seeds reniform; hilum short.

A genus of c. 50 species from the subtropics and the cooler, upland tropics of America. Although several important species have been transferred to *Vigna* (*q.v.*), this genus still contains 3 crop species of major world importance; 1 species naturalised on Christmas Is. *P. vulgaris* L., the French Bean or Kidney Bean, has been cultivated since ancient times, as indicated by a pod found in Mexico which was estimated to be nearly 7000 years old. It reached Europe around 1500 A.D., and there are now around 500 cultivars known. This species is a vital source of protein which complements the otherwise starchy diets of many peoples. The other two important species are the Scarlet Runner Bean, *P. coccineus* L., and the Lima or Butter Bean, *P. lunatus*.

R.Marechal, J.-M.Mascherpa & F.Stainier, Étude taxonomique d'un groupe complexe d'espèces des genres *Phaseolus* et *Vigna* (Papilionaceae), *Boissiera* 28: 133–151 (1978); J.A.Lackey, Phaseoleae, in R.M.Polhill & P.H.Raven (eds) *Advances in Legume Systematics* 1: 324 (1981).

***Phaseolus lunatus** L., *Sp. Pl.* 2: 724 (1753)

T: not designated; based on a description in K.A. von Bergen, *Cat. Stirp. Hort. Acad. Viadr. Compl.* 99 (1744); *fide* B.Verdcourt, *Fl. Trop. E. Africa*, Leguminosae: 615 (1971). Epithet from the Latin *luna* (moon), descriptive of the commonly white, half-moon shaped beans.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 514, fig. 126 (1979).

Perennial, climbing herb; stems 1–4.5 m long, glabrescent. Leaves trifoliolate; leaflets ovate to triangular, 3–12 cm long, rounded to truncate at base, shortly acuminate,

mucronate, glabrous; lateral leaflets unequal-sided; petiole 3–12 cm long; stipules ovate. Pseudoracemes short, usually 5–15 cm long; flowers many, small; pedicels 5–9 mm long. Calyx tube c. 2.5 mm long, hairy; upper lip truncate, shallowly notched; lower lobes obtuse. Petals greenish and blue; standard obcordate, 5–6 mm long, auriculate and with 2 basal appendages, minutely pubescent outside; keel spirally coiled for 1½ turns. Fruit broadly oblong, 4.5–13 cm long, curved, beaked, compressed. Seeds 2–4, c. 2 cm long, usually white; hilum small. *Butter Bean*, *Lima Bean*.

Christmas Is. Imported as a garden vegetable, now naturalised and a common species on roadsides. Native of tropical America, now widely cultivated and often naturalised throughout the tropics and in subtropical regions.

Ch.Is.: waysides, *D.A.Powell 402* (K).

This species is known from Peruvian archaeological sites which are 4–6000 years old. It is unusual in *Phaseolus* in that it is adapted to cultivation in the tropics at low altitudes. The leaves and young pods are edible. There are many cultivars, the most commonly cultivated having white seeds. The seeds contain a poisonous cyanogenic glucoside, linamarin, which is reduced in quantity in cultivated variants, especially those with white seeds. The seeds should be soaked and boiled before eating, the cooking water being discarded. The raw fruit induces vomiting, and raw seeds have been reported to be fatal to children. Not considered a safe forage or silage crop.

23. STYLOSANTHES

Stylosanthes Sw., *Prodr.* 7: 108 (1788); from the Greek *stylos* (pillar) and *anthos* (flower), as the floral segments are supported on a long, slender, columnar hypanthium.

Type: *S. procumbens* Sw., *nom. illeg.* = *Hedysarum hamatum* L.; *S. hamata* (L.) Taub.

Prostrate to erect herbs or subshrubs, often with stiff, glandular hairs. Leaves mostly pinnately trifoliolate; stipules adnate to petiole, bilobed, persistent; stipels absent. Flowers small, subsessile, in dense, axillary or terminal clusters; bracteoles linear, hyaline. Calyx lobes, corolla and stamens on a long, filiform, stalk-like hypanthium. Calyx 5-lobed, hairy, membranous. Petals yellow, pinkish or white; standard without basal auricles. Stamens all connate into a tube. Ovary at base of hypanthium; ovules 2 or 3. Fruit small, oblong, compressed, usually with 1 fertile and l aborted article, the venation usually raised, reticulate. Seed 1.

A pantropical and subtropical genus of c. 25 species; 1 species introduced on Christmas Is. They chiefly occur in dry, sandy or gravelly soils, often on limestone, in pasture land, open woodland and in cultivated areas. The genus is taxonomically complex. The inflorescences consist of several flowers, each of which represents a reduced spike; the rudiments of the rest of the spike are sometimes present below the flower. The presence or absence of this character has been used to divide the genus into subgenera.

R.H.Mohlenbrock, A revision of the genus *Stylosanthes*, *Ann. Missouri Bot. Gard.* 44: 299–355 (1958); H.P.Nooteboom, *Stylosanthes*, in M.S. van Meeuwen, H.P.Nooteboom & C.G.G.J. van Steenis, Preliminary revisions of some genera of Malaysian Papilionaceae I, *Reinwardtia* 5: 419–456 (1961); L.Pedley, Notes on Leguminosae I, *Austrobaileya* 1: 25–42 (1977); V.E.Rudd, Aeschynomeneae, in R.M.Polhill & P.H.Raven (eds), *Advances in Legume Systematics* 1: 354 (1981).

***Stylosanthes humilis** Kunth, *Nov. Gen. Sp.* 6: 506, t. 594 (1892)

T: Carichana, Orinoco River, Venezuela, *F.W.H.A. von Humboldt & A.J.A.Bonpland s.n.*; holo: P, microfiche seen. Epithet is the Latin for low-growing, in reference to its low, spreading habit.

Illustration: B.Verdcourt, *Man. New Guinea Legumes* 374, fig. 87 (1979).

Perennial, prostrate to ascending, much-branched herb; stems 3–40 cm long, with 2 longitudinal bands of hairs. Leaves trifoliolate; leaflets narrowly elliptic, 7–30 mm long,

acute, puberulous to glabrous; petiole 10–15 mm long; stipules long-bristly, reddish. Inflorescence 1–2 cm long, densely 3–10-flowered. Flower small, subsessile, enclosed in a large, bristly, 3-fid bract with rudimentary lamina. Hypanthium slender, c. 6 mm long, subtended by several slender, hyaline bracteoles. Calyx 5-lobed, membranous. Standard circular, 4–5 mm long, emarginate, yellow with a red base; keel curved, acute. Fruit oblong, c. 3 mm long, reticulate; beak long, curved, exserted from bracts. Seed 1, oblong, c. 1.5 mm long. *Townsville Stylo*.

Christmas Is. Introduced in grass seed for the golf course and now naturalised along the Waterfall Road and on Phosphate Hill. Probably native to S America, but is now widely introduced into many tropical areas, including Australia (Qld, N.T.) where it has become one of the most important pasture legumes.

Ch.Is.: Waterfall Rd, *D.A.Powell 581* (K); Phosphate Hill, *D.A.Powell 651* (K); roadside at Waterfall, *D.J. & B.P.Du Puy CI65* (CBG, K).

This is a useful, drought-tolerant, pasture legume. Some specimens exhibit a vestigial inflorescence axis below the flower, while others do not. This has led several authors to divide the species into two, those with the rudimentary axis being placed in *S. sundaica* S.Taub. (H.P.Nooteboom & C.G.G.J. van Steenis, *Reinwardtia* 5: 419–456, 1961). These otherwise identical species are then placed in separate sections. This is a highly artificial classification, and they are considered here to be conspecific following R.H.Mohlenbrock, *op. cit.* 345, L.Pedley, *op. cit.* 38, and B.Verdcourt, *op. cit.* 373.

24. CROTALARIA

Crotalaria L., *Sp. Pl.* 2: 714 (1753); *Gen. Pl.* 5th edn, 320 (1754); from the Latin *crotalum* [= Greek *krotalon*] (rattle), alluding to the rattling noise which the loose seeds make in the inflated, ripe pods when they are shaken.

Type: *C. lotifolia* L.

Erect to prostrate herbs or shrubs. Leaves simple or palmately compound, with 1–5 leaflets; stipules usually present; stipels absent. Flowers usually in terminal or leaf-opposed racemes; bracteoles variously positioned on pedicel or calyx base. Calyx 5-lobed; upper lobes sometimes connate. Petals usually yellow; standard with 2 basal appendages; wings with rows of crescent-shaped folds; keel rounded or angled upwards, usually prominently beaked. Stamens all connate into a tube. Ovary usually stalked; ovules 1–many; style hairy. Fruits oblong to spherical, inflated, bivalved, dehiscent, not septate. Seeds 1–many, reniform.

This large, pantropical and subtropical genus contains c. 550 species, with greatest diversity in the southern hemisphere, and especially in Africa which has over 400 species. There are c. 29 species native to or introduced to Malesia; c. 15 species in Australia; 1 species on Christmas Is.; 1 species on Cocos (Keeling) Is. Several species are cultivated as green manures, and others are a source of a strong, durable fibre (*C. juncea* L.). Many species contain alkaloids which cause severe liver damage in grazing animals. Some tolerate heavy metals in soils, such as cobalt, manganese and copper, and they can be used as indicator plants in prospecting.

W.J. de Munk, Preliminary revisions of some genera of Malesian Papilionaceae III – A census of the genus *Crotalaria*, *Reinwardtia* 6: 195–223 (1962); R.M.Polhill, Miscellaneous notes on African species of *Crotalaria*, L.: II, *Kew Bull.* 22: 169–348 (1968); R.M.Polhill, Crotalarieae in R.M.Polhill & P.H.Raven, *Advances in Legume Systematics* 1: 401 (1981); R.M.Polhill, *Crotalaria* in Africa and Madagascar, 389 pp. (1982).

Leaves trifoliolate; pod 6–8 mm wide (Ch.Is.) **1. C. pallida**

Leaves unifoliolate; pod 13–18 mm wide (C.K.Is.) **2. C. retusa**

1. Crotalaria pallida Aiton, *Hort. Kew* 3: 20 (1789)

var. **obovata** G.Don, *Gen. Hist.* 2: 138 (1832)

T: Accra, Ghana, *G.Don*; holo: BM.

Illustration: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 297 (1936), as *C. striata*.

Erect, much-branched, woody herb, 1–3 m tall; stems pubescent. Leaves palmately trifoliolate; leaflets obovate to broadly elliptic, 1.5–6.5 cm long, cuneate at base, emarginate to rounded, pubescent beneath; petiole 1.5–4 cm long; stipules caducous. Raceme 15–25 cm or more long, terminal, many-flowered; flowers deflexed against pedicel; bracts caducous; bracteoles adnate to calyx; pedicel 3–4 mm long. Calyx tube c. 3 mm long, flattened at base; lobes acuminate, subequal. Petals bright yellow, veined with purple; standard elliptic, 12–15 mm long, erect, hairy at base and with 2 basal appendages; wings shorter than the slender-beaked keel. Fruit oblong, 3.7–4 cm long, terete, inflated, appressed-hairy, glabrescent. Seeds 20–55, reniform, c. 3 mm long, brown, glossy.

Christmas Is. Occurs as a common wayside herb on bush tracks and roadsides throughout the island. Probably native to tropical Africa, but a widespread, adventive species and its original distribution has become obscured.

Ch.Is.: no precise locality, *D.A.Powell 368* (K); South Point, *D.A.Powell P44* (K); Drumsite near railway sidings, *D.J. & B.P.Du Puy CI71* (CBG, K).

Although W.J. de Munk (*op. cit.*, 207) used the name *C. mucronata* Desv., it is generally accepted that the correct name for this species is *C. pallida* (R.M.Polhill, *Kew Bull.* 22: 193 (1968); B.Verdcourt, *Man. New Guinea Legumes* 582 (1979)). The smaller, obovate and emarginate leaflets are characteristic of var. *obovata*. The species is suspected of being poisonous to stock, the foliage containing a toxic alkaloid which is lost when the plant is dried. The seeds have been used as a coffee substitute, and although they contain an alkaloid, they may be eaten after careful preparation. The half-ripe seeds are boiled for 2 hours, washed, wrapped in a banana leaf and left to ferment for a couple of days, subsequently being used, either directly or fried, as a flavouring for rice. It has also been used as a green manure on tea and rubber plantations.

2. *Crotalaria retusa L., *Sp. Pl.* 2: 715 (1753)

var. **retusa**

T: Ceylon [Sri Lanka], *P.Herman* 2: 21, 84; 4: 51, 78; syn: BM, HERM, *fide* R.M.Polhill, *op. cit.* 272. Epithet from the Latin *retusus* (with a rounded shallowly-notched end), in reference to the leaf shape.

Erect annual or short-lived perennial herb to 1.5 m; stems shortly appressed-hairy. Leaves unifoliolate; lamina oblong to narrowly obovate, 15–95 mm long, rounded or emarginate, glabrous above, finely appressed-hairy beneath; petiole 1–3 mm long. Racemes terminal, to 30 cm long, many-flowered; bracts subulate, 2–6 mm long; pedicels 5–8 mm long; bracteoles on pedicel, filiform, 1–2 mm long. Calyx 11–14 mm long, appressed-hairy; lobes ±triangular. Corolla yellow; standard 13–15 mm long, purple-veined inside, diffused purple outside. Pod oblong-clavate, 2.5–5 cm long, 1–1.8 cm wide, glabrous. Seeds 12–20, c. 5 mm long, yellow-brown.

Cocos (Keeling) Is. Naturalised around the kampong in coralline sand. Pantropical, including northern Australia; probably of Asian origin.

C.K.Is.: Home Is., *I.R.Telford 10062 & C.Howard* (CBG, K).

Grown as a fibre and green manure source. Poisonous to stock, causing Kimberley horse disease.

44. HALORAGACEAE

A.E.Orchard (M.Is.)

Ephemeral, annual or perennial herbs, subshrubs, shrubs or rarely small trees, monoecious or dioecious. Leaves opposite, alternate or whorled, simple, entire to pectinate, exstipulate. Inflorescence usually spike-like, or simple or of compound dichasia, sometimes compressed into a ±globular or flat-topped corymb; each flower or dichasium subtended by a pair of bracteoles. Flowers bisexual or unisexual, actinomorphic, 4-merous, rarely 3- or 2-merous. Sepals usually 4. Petals usually 4, usually hooded or navicular. Stamens usually 8, rarely 4; anthers ovoid to linear, 4-locular, basifixed, sometimes apiculate; filaments usually elongating after anthesis. Ovary inferior, usually completely or incompletely 4-locular; ovules pendulous, 1 or 2 per locule (if 2, then 1 aborts); styles usually 4, free; stigmas usually capitate, fimbriate. Fruit an indehiscent nut or a schizocarp splitting into 4 mericarps, 1–4-locular, variously winged or ornamented. Seed 1 per locule.

An almost cosmopolitan family of 8 genera and c. 150 species with the main centre of diversity in Australia where there are 6 genera and 106 species, concentrated in temperate areas, with some species almost throughout the continent; 1 genus with 1 species on Macquarie Is. A few species are minor weeds of agriculture and waterways.

G.Bentham, Halorageae, *Fl. Austral.* 2: 470–490 (1864); A.K.Schindler, Halorrhagaceae, *Pflanzenr.* 23: 1–133 (1905); H.I.Aston, Haloragaceae, *Aquat. Pl. Australia* 76–98 (1973); A.E.Orchard, Taxonomic Revisions in the family Haloragaceae I. The genera *Haloragis*, *Haloragodendron*, *Glischrocaryon*, *Meziella* and *Gonocarpus*, *Bull. Auckland Inst. Mus.* 10: 1–299 (1975); A.E.Orchard, II. Further notes on *Haloragis*, *Haloragodendron* and *Gonocarpus*, *Nuytsia* 2: 126–144 (1977).

MYRIOPHYLLUM

Myriophyllum L., *Sp. Pl.* 2: 992 (1753); *Gen. Pl.* 5th edn, 429 (1754); from the Greek *myrios* (numberless, countless) and *phyllon* (leaf), in allusion to the finely divided pectinate submerged leaves of the European (and other) species.

Type: *M. spicatum* L.

Enydria Vell., *Fl. Flum.* 56 (1825), *non Enydra* Lour., *Fl. Cochinch.* 510 (1790). T: *Enydria aquatica* Vell. = *Myriophyllum aquaticum* (Vell.) Verdc.

Pelonastes Hook.f., *London J. Bot.* 6: 474 bis (1847). T: *P. integrifolia* Hook.f.

Vinkia Meijden, *Blumea* 22: 251 (1975). T: *V. natans* Meijden.

Annual or perennial aquatic or littoral herbs, monoecious or dioecious. Stems weak, glabrous (except *M. crispatum*). Leaves whorled, opposite or alternate, usually dimorphic; submerged leaves pectinate; emergent leaves entire or toothed. Flowers unisexual or bisexual, 2–4-merous, solitary or in small dichasia in upper axils forming a spike-like inflorescence; bracteoles 2 (absent in *M. coronatum*). Male flowers at top of spike; sepals and petals usually present, petals usually hooded; stamens 1–4 or 8; ovary and styles vestigial or absent. Female flowers (monoecious plants) below males; sepals present or absent; petals vestigial or absent; stamens absent; carpels 2–4; style clavate, rarely subulate, or stigma sessile; stigma usually fimbriate. Fruit dry, variously ornamented.

A genus of c. 60 species, almost cosmopolitan, but the major centre of diversity is Australia with 37 species (32 endemic). Other major centres are N.Z. (2 endemic species), North America (13 species, 7 endemic), and India/Indochina (10 species, 7 endemic); 1 New Zealand species extends to Macquarie Is.

A.E.Orchard, *Myriophyllum* (Haloragaceae) in Australasia. I. New Zealand: a revision of

the genus and a synopsis of the family, *Brunonia* 2: 247–287 (1980); A.E.Orchard, A revision of South American *Myriophyllum* (Haloragaceae), and its repercussions on some Australian and North American species, *Brunonia* 4: 27–65 (1981); A.E.Orchard, *Myriophyllum* (Haloragaceae) in Australasia. II. The Australian species, *Brunonia* 8: 173–291 (1986).

Myriophyllum triphyllum Orchard, *Brunonia* 2: 259 (1980)

T: Lower Selwyn Hunts, Lake Ellesmere, South Is., New Zealand, 24 Feb. 1977, *A.E.Orchard 4916*; holo: AK; iso: AD, CANB, CHR, F, HO, MEL, MO, OTA, P, WELT. Epithet from the Greek *tri-* (three) and *phyllon* (a leaf) referring to the leaves being in whorls of three.

[*M. elatinoides auct. non* Gaudich.: J.D.Hooker, *Fl. Nov.-Zel.* 1: 63 (1852) *p.p.*]

Illustrations: M.J.A.Simpson & C.J.Burrows, *New Zealand J. Bot.* 16: 164, fig. 1 (1978), as *M. elatinoides*; A.E.Orchard, *Brunonia* 2: 261–262, figs 5, 6 (1980); A.E.Orchard, *Brunonia* 8: 187, fig. 4 (1986).

Perennial monoecious aquatic herb. Stems 50–100 cm long. Leaves in whorls of 3; submerged leaves ovate, pectinate, with 12–18 filiform pinnae, the lamina 6–15 mm long; emergent leaves sometimes alternate near apex, narrowly ovate to obovate, entire, red-purple, the lamina 5–6 mm long. Bracteoles lanceolate, 1.4–2 mm long. Flowers 4-merous, sessile, solitary. Male flowers: sepals deltoid, 0.5–0.6 mm long; petals 2–2.8 mm long, caducous, yellow to reddish; stamens 8. Female flowers: sepals and petals vestigial; ovary 4-locular; styles clavate; stigmas cream. Fruit cubiform, reddish purple; mericarps cylindrical to ovoid, 1.4 mm long, rounded, smooth.

Macquarie Is. Found in lakes and streams almost throughout the island, but nowhere common. Most vigorous below 50 m altitude but occurs to 250 m. Occurs mainly in New Zealand; in Australia confined to Macquarie Is.,

M.Is.: W coast, *A.B.Costin & D.M.Moore 8* (CANB); same locality, *D.Montgomery & G.Leaman 25* (HO); lake at Green Gorge, *R.D.Seppelt 11322* (HO); 1.5 km N of Mt Waite, Nov. 1950, *B.W.Taylor* (HO); 0.1 km W of Scobles Lake, Jan. 1951, *B.W.Taylor* (HO).

Most Macquarie Is. collections are sterile or only in bud. The flower and fruit descriptions above are based on New Zealand plants.

45. LYTHRACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Herbs, shrubs or trees, sometimes spiny. Leaves mostly opposite or verticillate, simple, entire; stipules minute or absent. Inflorescence an axillary or terminal raceme, panicle or cyme, or flowers solitary. Flowers bisexual, usually actinomorphic, usually 4- or 6-merous, sometimes heterostylous; perianth and stamens perigynous. Hypanthium campanulate to tubular. Calyx lobes usually short, persistent, often alternating with appendages. Petals often clawed, inserted on hypanthium, crumpled in bud, occasionally absent. Stamens often twice as many as petals, inserted on hypanthium below petals; anthers longitudinally dehiscent. Ovary superior, 1–6-locular; ovules 2–many per locule; placentation usually axile. Fruit a 1–6-locular capsule, dehiscing by valves or by the loss of an operculum, sometimes irregularly dehiscent. Seeds often many, sometimes winged; endosperm sparse or absent.

A widespread family occurring in tropical, subtropical and temperate regions, with 22–25 genera and 500–550 species, but with greatest diversity in the tropics; 1 species native to Christmas Is. Several species are of horticultural value, including *Lythrum salicaria* L. (Purple Loosestrife), *Cuphea ignea* A.DC., with a bright reddish calyx and no

petals, and several species of *Lagerstroemia* L. The most attractive of these, *L. speciosa* (L.) Pers. (Crepe Myrtle), is cultivated on Christmas Is. The Lythraceae also includes several dye plants, the most important of which is *Lawsonia inermis* L. (Henna Bush or Mignonette Tree).

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Lythraceae, *Fl. Java* 1: 251–256 (1963); A.C.Smith, Lythraceae, *Fl. Vit. Nova* 3: 281–289 (1985); H.J.Hewson & P.L.Beesley, Lythraceae, *Fl. Australia* 18: 91–113 (1990).

PEMPHIS

Pemphis J.R.Forst. & G.Forst., *Char. Gen. Pl.* 34 (1775); the Greek word for a bubble or air-filled vesicle, in reference to the capsule which dehisces by shedding a hemispherical cap.

Type: *P. acidula* J.R.Forst. & G.Forst.

Small trees or shrubs. Leaves opposite, small, pubescent. Flowers actinomorphic, axillary, solitary or paired, 6-merous, heterostylous. Hypanthium campanulate, resembling a calyx tube. Calyx lobes 6, short, alternating with short appendages. Petals 6, subequal, shortly clawed, white, inserted towards apex of hypanthium. Stamens 12 or 18, in unequal whorls, inserted near base of hypanthium. Ovary sessile or stalked, unilocular; ovules many; style filiform; stigma capitate. Capsule almost entirely enclosed in hypanthium, with a caducous, hemispherical operculum. Seeds many, with thick wings.

A genus of only 2 species; 1 species endemic in Madagascar, the other widespread and mainly coastal in the Old World, including northern Australia, Christmas Is. and Cocos (Keeling) Is.

Pemphis acidula J.R.Forst. & G.Forst., *Char. Gen. Pl.* 34, t. 34 (1775)

T: Takaroa, Tuamotu Archipelago, *J.R.Forster & G.Forster s.n.*; lecto: BM, *fide* D.J.Du Puy (pers. comm.). Epithet the diminutive of the Latin word *acidus* (sour), from the rather bitter-tasting leaves.

P. acidula var. *crassifolia* Ridl., *J. Straits Branch Roy. Asiatic Soc.* 45: 195 (1905). T: common on sea rocks from South Point to Rocky Point, Christmas Is., *H.N.Ridley*; syn: *n.v.*

Illustrations: F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 289, fig. 19 (1980); I.R.H.Telford in *Fl. Australia* 18: xvi, fig. 13 (1990).

A much-branched shrub to c. 4 m tall; branchlets densely grey-silky. Leaves elliptic to oblong, entire, acute, thinly fleshy, finely appressed-silky; lamina 1–3 cm long; petiole c. 1 mm long. Flowers usually solitary; pedicel 5–10 mm long, pubescent. Hypanthium 5–7 mm long, campanulate, weakly 12-ridged. Calyx lobes 6, triangular, c. 1 mm long, erect, alternating with 6 short, subulate appendages. Petals 6, elliptic, 6–8 mm long, rounded, crumpled, white. Stamens 12, alternately long and short, not exserted. Ovary sessile, globose; style variable in length, persistent; stigma capitate. Capsule obovoid, c. 6–8 mm long, hardly exceeding hypanthium, red, becoming brown; operculum hemispherical. Seeds deltoid, c. 2.5 mm long. *Mentigi*, *Kayu Burong*. Figs 43G–I, 56.

Christmas Is., Cococ (Keeling) Is. On Christmas Is. frequently occurs on the sea cliffs and rocks, often in very little soil, and in stony or sandy soil behind beaches. On Cocos (Keeling) Is. grows in dense shrub communities on lagoon margins in coralline sand on both atolls. Widespread from eastern Africa and the Indian Oceanic islands, through Indo-China and Malesia, to northern Australia and the Pacific islands.

Ch.Is.: Flying Fish Cove, *H.N.Ridley 46* (K); Waterfall, *H.N.Ridley 47* (K); Lily Beach, *D.A.Powell 74* (K); sea cliff between Ethel Beach and Lily Beach, *B.A.Mitchell 205* (CBG, K). C.K.Is.: lagoon margin, North Keeling Is., *I.R.Telford 10015 & C.Howard* (CBG, K); top of lagoon beach, Direction Is., *I.R.Telford 10080 & C.Howard* (CBG); lagoon edge, West Is., *D.G.Williams 3* (BISH, CBG).

The habit is a mat-forming or erect shrub, which can become tall when among other shrubby

species. The leaves of some specimens are noticeably more succulent than others. It is an extremely tough shrub, tolerant of salt spray and trampling. The wood is very hard and on Cocos (Keeling) Is. has been used for making knife handles and pestles. The sour-tasting leaves may be eaten raw.

46. ONAGRACEAE

D.J.Du Puy (Ch.Is.)
A.E.Orchard (M.Is.)

Perennial, biennial or annual herbs or shrubs. Leaves alternate, opposite or verticillate, usually simple, entire or toothed; stipules absent or minute. Flowers usually bisexual, actinomorphic, axillary, solitary or in clusters, or combined into a terminal, leafy raceme, spike or panicle, mostly 4- or 5-merous, epigynous, with a nectariferous hypanthium which often extends beyond apex of ovary. Sepals inserted on hypanthium apex, valvate. Petals free, frequently with a basal claw. Stamens usually as many as petals, or twice as many, inserted inside hypanthium; anthers longitudinally dehiscent. Ovary inferior, usually 4-locular; ovules usually many; placentation usually axile; style simple; stigma capitate. Fruit usually a capsule with many seeds, occasionally a berry. Endosperm absent.

A cosmopolitan family of 17 or 18 genera and c. 650 species, with greatest diversity in western N America; 1 genus with 1 species naturalised on Christmas Is.; 1 genus with 2 species native on Macquarie Is. Several genera contain species of horticultural importance, including *Fuchsia* L., *Clarkia* Pursh and *Oenothera* L. (Evening Primrose).

G.Bentham, Onagrarieae, *Fl. Austral.* 3: 301–308 (1867); T.F.Cheeseman, Onagraceae, *Vasc. Fl. Macquarie Is.* 25 (1919); B.W.Taylor, Onagraceae, *Fl. Veg. Soils Macquarie Is.* 126–127 (1955); H.H.Allan, Onagraceae, *Fl. New Zealand* 1: 254–283 (1961); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Onagraceae, *Fl. Java* 1: 259–265 (1963); P.H.Raven, Onagraceae, *Fl. Males.* ser. I, 8: 98–113 (1977); A.C.Smith, Onagraceae, *Fl. Vit. Nova* 3: 378–381 (1985).

KEY TO GENERA

Leaves alternate; petals yellow; dehiscence by irregular fracturing of pericarp (Ch.Is.) **1. LUDWIGIA**

Leaves opposite; petals white; dehiscence loculicidal (M.Is.) **2. EPILOBIUM**

1. LUDWIGIA

Ludwigia L., *Sp. Pl.* 1: 118 (1753), as *Ludvigia*; corrected *Gen. Pl.* 5th edn, 55 (1754); after C.G.Ludwig (1709–1773), Professor of Medicine at Leipzig, who made botanical collections in N Africa, and wrote on botanical terminology.

Type: *L. alternifolia* L.

Herbs or shrubs, erect to creeping. Leaves alternate or opposite, sessile or shortly petiolate. Flowers axillary, solitary, in clusters or in short leafy racemes. Hypanthium not exceeding apex of ovary. Sepals 3–7, usually 4 or 5, persistent. Petals as many as sepals, yellow or white. Disc flat to conical, often with nectaries around staminal bases. Stamens mostly 4, 5, 8 or 10. Ovary usually 4- or 5-locular; ovules many; style short; stigma capitate, often lobed. Capsule terete to 4-angled, slender, with an apical pore or apical valves, or irregularly fracturing. Seeds many.

A pantropical genus of c. 75 species, with 1 centre of diversity in tropical America, and a secondary centre in Africa; 1 species has been collected on Christmas Is. They are mostly plants of damp areas, and several species are aquatic.

P.H.Raven, The Old World species of *Ludwigia* (Onagraceae), *Reinwardtia* 6: 327–427 (1963–1964).

***Ludwigia hyssopifolia** (G.Don) Exell, *Garcia de Orta* 5: 471 (1957)

Jussiaea hyssopifolia G.Don, *Gen. Syst.* 2: 693 (1832). T: Sao Tome Is., Gulf of Guinea, *G.Don 42*; holo: BM. Epithet from the resemblance of the leaves of this species to those of the culinary herb Hyssop (*Hyssopus officinalis*, Lamiaceae).

[*L. prostrata auct. non* Roxb.: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 194 (1906)]

Illustration: P.H.Raven, *Fl. Males.* ser. I, 8: 105, fig. 4 (1977).

Erect, much-branched herb to c. 1.5 m tall, sparsely puberulous. Stems narrowly winged. Leaves alternate, narrowly ovate to elliptic, cuneate at base, entire, acuminate; lamina 1–8 cm long; petiole 1–8 mm long. Flowers solitary, subsessile. Sepals 4, narrowly ovate, acute, 2–4 mm long, persistent. Petals 4, elliptic, 2–3 mm long, yellow. Disc slightly raised, with 4 nectaries. Stamens 8, 0.5–1 mm long, alternately long and short. Ovary c. 1 cm long; style 1–1.5 mm long; stigma subspherical, shallowly 4-lobed. Capsule narrowly cylindrical, slightly inflated towards apex, c. 1.5–2 cm long, dehiscing through irregular fracturing of pericarp. Seeds many. *Yellow Willow Herb*.

Christmas Is. Collected once by H.N.Ridley in 1904. A pantropical weedy species, including northern Australia (N.T., Qld), most closely related to species restricted to the Old World.

Ch.Is.: Flying Fish Cove, *H.N.Ridley 43* (K).

The specimen was found 'behind the house'. The seed was probably introduced with imported rice, and was discarded when the rice was cleaned. The specimen had produced large amounts of seed, but the species may have disappeared due to the lack of sufficiently damp habitats. The seeds are buoyant and are dispersed by water, but may also adhere to the feet and feathers of birds. Two types of seed are produced. Those near the base of the capsule are shed with a closely adhering cover of corky endocarp, while those near the apex of the capsule are free. This unusual characteristic may be linked with dispersal in water.

2. EPILOBIUM

Epilobium L., *Sp. Pl.* 1: 347 (1753); *Gen. Pl.* 5th edn, 164 (1754); from the Greek *epi* (upon) and *lobos* (pod), referring to the position of the floral parts upon the inferior ovary.

Type: *E. hirsutum* L.

Mat-forming or erect perennial herbs. Stems slender, erect, or creeping at least at base, rooting at lower or most nodes; internodes with well-defined lines of hairs below interpetiolar sinuses. Leaves opposite, ovate to rotund, entire or toothed, glabrous; petiole winged. Flowers solitary in axils of cauline leaves. Sepals 4, free. Petals 4, free, with an apical sinus, white (in sub-antarctic species). Stamens 8. Style 1. Capsule cylindrical, 4-locular, loculicidal, many-seeded. Seeds usually with a terminal tuft of hairs (coma). *Willow Herb*.

A genus of about 215 species found throughout the temperate and sub-polar regions of both Hemispheres. About 14 species in Australia, with another 2 on Macquarie Is.

P.H.Raven & T.E.Raven, The Genus *Epilobium* (Onagraceae) in Australasia: a systematic and evolutionary study, *New Zealand DSIR Tech. Bull.* 216: 1–321 (1976); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 32–33 (1984); C.J.Webb *et al.*, *Fl. New Zealand* 4: 884–903 (1988).

Leaves entire or with 1–3 very small blunt teeth on each side	**1. E. brunnescens**
Leaves distinctly serrate with 3–14 linear teeth on each side	**2. E. pedunculare**

1. Epilobium brunnescens (Cockayne) P.H.Raven & Engelhorn, *New Zealand J. Bot.* 9: 350 (1971)

subsp. **brunnescens**

E. pedunculare var. *brunnescens* Cockayne, *Trans. New Zealand Inst.* 50: 171 (1918). T: cultivated plant, collected on Mt Egmont, Taranaki, New Zealand, 2 Jan. 1918, *L.Cockayne 3729*; lecto: AK, *fide* P.H.Raven & T.G.Engelhorn, *loc. cit.* Epithet from *brunneus* (brown) with the participle *-escens* (becoming) presumably referring to the leaves.

[*E. neteroides auct. non* A.Cunn.: R.Melville, *Kew Bull.* 14: 296 (1953)]

Illustrations: P.H.Raven & T.E.Raven, The Genus *Epilobium* in Australasia figs 132–135 (1976).

Leaves ovate to rotund, leathery, rounded at tip and base, green but often flushed purple particularly on undersurface, entire or with 1–3 very small blunt teeth each side; lamina 4–5 mm long and wide, sometimes to 9 mm long and 7 mm wide; petiole 0.8 mm long. *n* = 18, P.H.Raven & T.E.Raven, *op. cit.* 263 (1976).

Macquarie Is. Widespread but rare in a range of open habitats (boggy herbfields, screes, creek banks), particularly where rabbits have eaten other vegetation. Extends from New Zealand (North, South and Stewart Is.) to Auckland, Campbell and Macquarie Is. Flowers and fruits from about Dec.–Feb.

M.Is.: N end of island, 15 Jan. 1949, *N.R.Laird* (AD, CHR, HO, MEL); Hasselborough Bay, *R.D.Seppelt 12197* (HO, MEL); Bauer Bay, *R.D.Seppelt 12547* (HO, MEL); Sandy Bay, *R.D.Seppelt 12660* (AD, AK, CHR, HO, MEL, NSW, VALD); Gadgets Gully, *R.D.Seppelt 12770* (AD, HO, MEL).

2. Epilobium pedunculare A.Cunn., *Ann. Nat. Hist.* 3: 31 (1839)

E. nummularifolium var. *pedunculare* (A.Cunn.) Hook.f., *Fl. New Zealand* 1: 58 (1853). T: E of lake between Waimate Mission Stn and great forest of Hokianga, North Is., New Zealand, 1834, *R.Cunningham*; holo: K *n.v.*, *fide* P.H.Raven & T.E.Raven, *op. cit.* 169 (1976).

E. linnaeoides Hook.f., *Fl. Antarct.* 1: 10 (1844). T: Campbell Is., Dec. 1840, *J.D.Hooker*; lecto: K; isolecto: BM, G, P, W all *n.v.*, *fide* P.H.Raven & T.E.Raven, *op. cit.* 168 (1976).

Illustrations: J.D.Hooker, *Fl. Antarct.* 1: fig. 6 (1844), as *E. linnaeoides*; P.H.Raven & T.E.Raven, *op. cit.* fig. 77 (1976).

Leaves broadly ovate to orbicular, rounded to truncate at base, rounded at apex, thinner than in *E. brunnescens*, serrate with 3–14 linear teeth each side, the edges of the teeth with recurved margins, green to coppery brown or purple; lamina 5–8 mm long, 4.5–8 mm wide, sometimes to 17 mm wide; petiole 1.7–3.0 mm long. *n* = 18, P.H.Raven & T.E.Raven, *op. cit.* 168 (1976).

Macquarie Is. Almost ubiquitous, but most common in open herbfields, bogs, feldmarks and areas heavily grazed by rabbits. Extends from New Zealand (North, South and Stewart Is.) to Chatham, Antipodes, Auckland, Campbell and Macquarie Is. Flowers Dec.–Feb.; fruits Feb.

M.Is.: above Nuggets Ck, 21 Feb. 1949, *N.R.Laird* (AD, CHR, HO); 600 m E of Handspike Corner, *R.D.Seppelt 12231* (HO, MEL); Hasselborough Bay, *R.D.Seppelt 12257* (HO, MEL); 300 m N of Brothers Lake, *R.D.Seppelt 12400* (HO, MEL); E of Boiler Rocks, *R.D.Seppelt 12517* (AD, AK, CANB, HO, MEL).

47. COMBRETACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees, shrubs or lianes, sometimes armed. Leaves alternate or opposite, simple, entire, often with petiolar or basal glands, and domatia on the lamina; stipules absent. Inflorescence a simple or branched spike or raceme, sometimes capitate. Flowers usually bisexual, actinomorphic, mostly 5-merous, sometimes 4-merous, often nectariferous; perianth and stamens epigynous, inserted on tubular to cupular hypanthium limb that extends beyond ovary apex. Calyx lobes usually valvate. Petals often small, sometimes absent (*Terminalia*). Disc usually present. Stamens usually in 2 whorls of 4 or 5; anthers longitudinally dehiscent. Ovary inferior, unilocular; ovules 1–6; style simple, sometimes adnate to hypanthium limb (*Quisqualis*). Fruit drupaceous, fleshy or dry, indehiscent, often with 2–5 longitudinal ridges, keels, or leathery to papery wings. Seed solitary; endosperm absent.

A pantropical family of c. 18 genera and c. 500 species; 3 genera (3 species) on Christmas Is., 1 of which also on Cocos (Keeling) Is. The 2 largest genera, *Combretum* and *Terminalia*, include over two-thirds of the species. *Quisqualis* and *Combretum* include several decorative climbers, and *Terminalia catappa* is often planted as a street tree. The genus *Lumnitzera* Willd. includes 2 species found in mangrove stands throughout Malesia.

A.W.Exell, Combretaceae, *Fl. Males.* ser. I, 4: 533–589 (1954); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Combretaceae, *Fl. Java* 1: 374–378 (1963); A.W.Exell & C.A.Stace, Revision of the Combretaceae, *Bol. Soc. Brot.* ser. 2, 40: 5–26 (1966); N.B.Byrnes, A revision of Combretaceae in Australia, *Contr. Queensland Herb.* 20: 1–66 (1977); M.J.E.Coode, Combretaceae, *Handb. Fl. Papua New Guinea* 1: 43–110 (1978); A.C.Smith, Combretaceae, *Fl. Vit. Nova* 3: 414–445 (1985); L.Pedley, Combretaceae, *Fl. Australia* 18: 255–293 (1990).

KEY TO GENERA

1 Trees; leaves obovate, often crowded at branchlet tips; petals absent; fruit compressed, often with 2 narrow marginal wings — **1. TERMINALIA**

1: Climbing shrubs; leaves elliptic to oblong, opposite and with distinct internodes between each pair; petals present; fruit not compressed, with 4 or 5 ridges or wings

2 Flowers small, c. 0.5 cm across; hypanthium limb c. 3 mm long, campanulate; petals c. 2 mm long, yellow, inconspicuous; fruit with 4 obtuse ridges — **2. COMBRETUM**

2: Flowers large, c. 2–4 cm across; hypanthium narrowly tubular, c. 50–80 mm long; petals 8–22 mm long, pink or red, showy; fruit with 5 broad wings — **3. QUISQUALIS**

1. TERMINALIA

Terminalia L., *Syst. Nat.* 12th edn, 2: 674 [err. 638] (1767); *Mant. Pl.* 128 (1767), *nom. cons.*; from the Latin *terminalis* (terminal), descriptive of the leaves and inflorescences which are clustered at the branchlet tips.

Type: *T. catappa* L.

Trees, often buttressed; branching often sympodial. Leaves usually alternate, crowded at branchlet tips, often with 2 basal or petiolar glands. Inflorescence usually an axillary spike. Flowers bisexual, often male towards apex of spike, many, crowded, small, mostly 5-merous. Hypanthium pedicel-like, constricted apically, expanding into a cup-shaped limb. Calyx lobes usually triangular, inserted on hypanthium apex. Petals absent. Disc usually hairy. Stamens usually 10, inserted inside hypanthium limb. Ovules usually 2. Fruit variable, drupaceous, fleshy to woody, often compressed, with 2–5 ridges or papery to leathery wings. *Pagoda Trees*.

This pantropical genus contains c. 200 species; 1 species on Christmas and Cocos (Keeling) Islands. Many are lowland forest trees, often of riverine and swampy habitats. Many attain huge proportions and frequently have strongly buttressed trunks. There are also some littoral species. The common name is derived from their unusual branching habit, where each branchlet ends in a cluster of leaves, and a new branchlet develops below the apex, producing a tiered overall effect. The fruit is important in the identification of species. Some fruits are edible, while others (the Myrobalans) are used for tanning leather. Several species have fruits that float well, allowing dispersal in water, while others have broad, papery wings for wind dispersal. Many species provide useful timber.

Terminalia catappa L., *Syst. Nat.* 12th edn, 2: 674 [err. 638] (1767); *Mant. Pl.* 128 (1767)

T: Herb. C.Linnaeus 1221.1; syn: LINN. Epithet from the Malabar name *katapang*, for this species.

Illustrations: A.W.Exell, *Fl. Males.* ser. I, 4: 566–567, figs 17, 18 (1954); A.B.Graf, *Tropica* 304 (1978); T.Low & M.Fagg in *Fl. Australia* 18: 121, figs 65, 67 (1990).

Deciduous tree to 35 m tall; trunk becoming heavily buttressed; branchlets thick, with pubescent tips. Leaves obovate, tapering and finally subcordate at base, rounded or obtusely acuminate, coriaceous, glossy, with 2 basal glands; lamina 10–30 cm long; petiole 6–20 mm long, pubescent. Spikes axillary, c. 7–18 cm long, sparsely pubescent. Flowers predominantly male, sessile, whitish. Hypanthium base 2–7 mm long; limb 1–2 mm long, shallow. Calyx lobes 5, triangular, c. 2 mm long, white, spreading. Disc densely hairy. Stamens 10, 3–4 mm long, exserted, white. Style c. 3.5 mm long, acicular; stigma minute. Fruit ellipsoidal, 4–7 cm long, laterally compressed, reddish, glossy, often with 2 longitudinal, narrow, rigid wings. *Indian Almond*, *Katapan*, *Ketapang*.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. common especially on coastal and upper terraces, often in dense, marginal forest, where it can become one of the largest trees, with massive plank buttresses. On Cocos (Keeling) Is. grows in strand forest in coralline sand, on West and Home Islands, but not common. Probably native to SE Asia, extending from India, Indo-China and Malesia to northern Australia and the Pacific islands.

Ch.Is.: no precise locality, *C.W.Andrews s.n.* (K); north-east coast, adjacent to Waterfall Rd, *B.A.Mitchell 179* (CBG, K). C.K.Is.: near settlement, West Is., *I.R.Telford 9973 & C.Howard* (CBG).

H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 190–191 (1906) noted many very large specimens on Christmas Is., often of greater size than in other localities. It is also unusual for this species to occur naturally above the littoral zone. Frequently planted as a decorative street tree. The kernel of the fruit is edible and contains oils similar to almond oil. The fruit is often eaten by fruit bats and on Christmas Is. is dispersed by land crabs which eat the outer coat. The fruit is also sea-dispersed. The bark and leaves are rich in tannin, and are used to tan leather. The timber is strong and of good quality and on Cocos (Keeling) Is. has been used for house construction. The leaves are deciduous, turning first yellow and then bright red before falling.

2. COMBRETUM

Combretum Loefl., *Iter. Hispan. App.* 308 (1758), *nom. cons.*; a classical Latin plant name.

Type: *C. fruticosum* (Loefl.) Stuntz

Trees, shrubs or woody climbers, sometimes spiny. Leaves mostly opposite or verticillate, often lepidote. Inflorescence an axillary or extra-axillary, spike or raceme, sometimes capitate, or a terminal leafy panicle. Flowers usually 4- or 5-merous, often crowded. Hypanthium constricted apically, expanding into a caducous limb. Calyx lobes deltoid to filiform, inserted on hypanthium apex, sometimes absent, sometimes enlarging and forming wings. Petals small or showy. Stamens usually 8 or 10, inserted inside hypanthium limb. Ovules usually 2. Fruit 4- or 5-winged or -ridged; pericarp papery or coriaceous. Seed elongate.

A genus of 150–200 species, occurring throughout the tropics except Australia but with greatest diversity in Africa; 1 species on Christmas Is. In Malesia they are mainly woody climbers, growing in frequently flooded habitats, especially along rivers but also in secondary forest and on the margins of primary forest. The fruit may have broad, papery wings, suited to wind dispersal, or may be leathery with ridges or thick wings which aid water dispersal. Several species are occasionally cultivated as ornamentals.

Combretum acuminatum Roxb., *Fl. Indica* 1832 edn, 2: 228 (1832)

T: illustration of *C. acuminatum*, *W.Roxburgh* Icon. n. 2225; icon: K. Epithet descriptive of the leaf, which has an acuminate apex.

Climbing shrub; young shoots ferruginous-hairy. Leaves opposite or subopposite, usually elliptic, rounded or obtuse at base, usually shortly acuminate, minutely lepidote; lamina 7–20 cm long; petiole 4–10 mm long. Spikes axillary or supra-axillary, sometimes combined into terminal panicles, c. 3–7 cm long, ferruginous-lepidote and pubescent. Flowers many, crowded, 4-merous, sessile, yellow. Hypanthium base c. 1 mm long, 4-angled, densely lepidote, pedicel-like; limb campanulate, c. 3 mm long, densely hairy within, caducous. Calyx lobes deltoid. Petals narrowly spathulate, c. 2 mm long. Disc glabrous. Stamens c. 6 mm long, exserted, yellow. Style c. 6 mm long, acicular; stigma minute. Fruit fusiform to ellipsoidal, c. 3.5–5 cm long; ridges 4, longitudinal, obtuse, coriaceous, minutely lepidote. Figs 23, 43A–C.

Christmas Is. Commonly occurs on the plateau, upper terraces and shore terrace. Distributed from India and Sri Lanka through Indo-China and Malesia and New Guinea. It usually occurs in coastal and frequently flooded habitats, secondary forests and forest margins.

Ch.Is.: east coast, *C.W.Andrews 41* (BM); high terraces and plateau, *D.A.Powell 236* (K); Sydneys Dale, *D.A.Powell 463* (K); central plateau area, adjacent to Camp 4, *B.A.Mitchell 58A* (CBG); South Point, *B.A.Mitchell 67* (CBG, K).

The tough, ridged fruits are water-dispersed. A decoction of the leaves can be used to treat tapeworm.

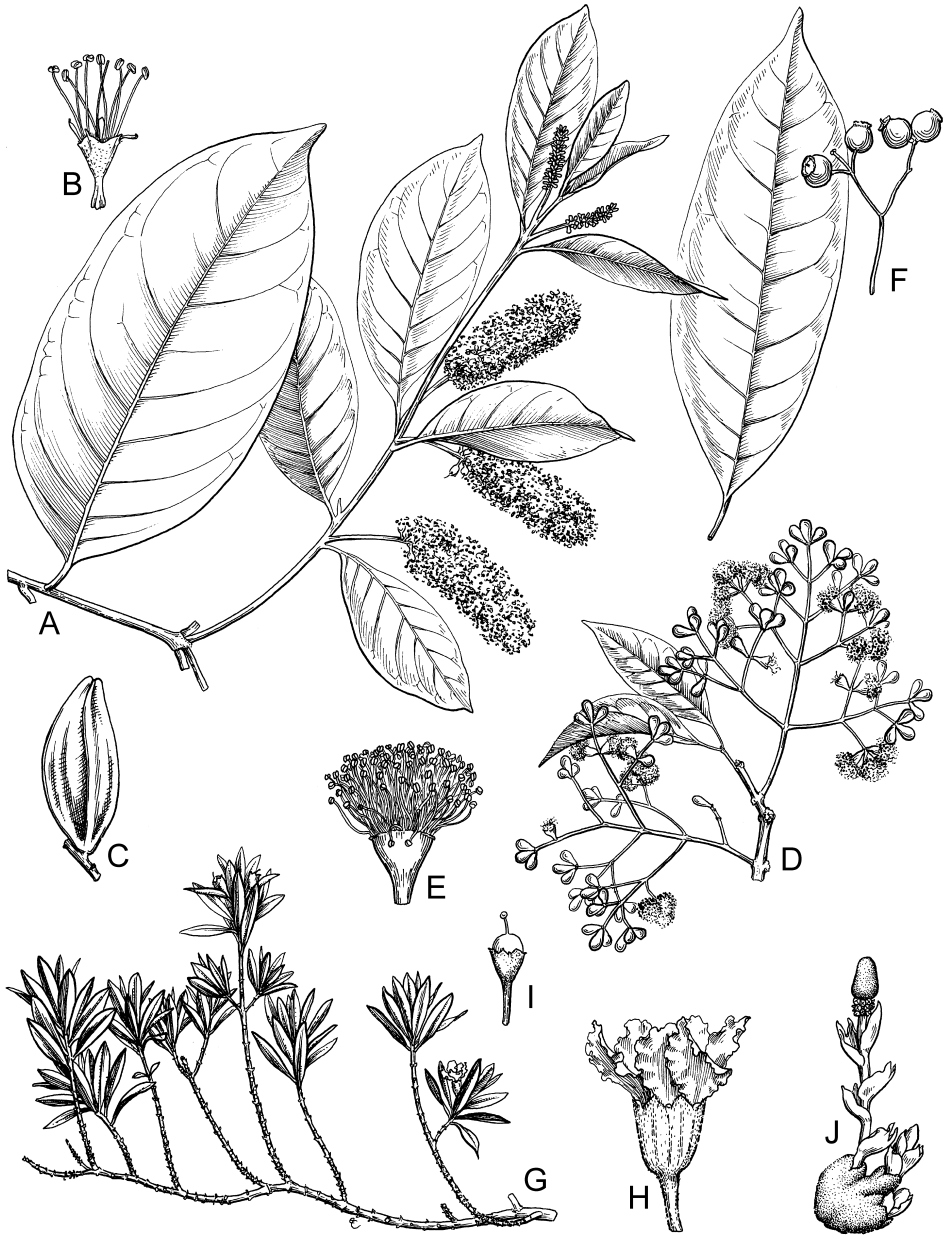

Figure 43. **A–C**, COMBRETACEAE: *Combretum acuminatum*. **A**, flowering branchlet X0.5; **B**, flower X2 (**A–B**, B.Mitchell 67, K); **C**, fruit X0.5 (J.Teijsmann 11931, K). **D–F**, MYRTACEAE: *Syzygium nervosum*. **D**, inflorescences X0.5; **E**, flower X2 (**D–E**, B.Mitchell 25, CBG); **F**, fruits and leaf X0.5 (A.Pearson & D.Powell P79, K). **G–I**, LYTHRACEAE: *Pemphis acidula*. **G**, flowering and fruiting branchlet X0.5; **H**, flower X2; **I**, fruit X1 (**G–I**, Christmas Is., C.Andrews, K). **J**, BALANOPHORACEAE: *Balanophora abbreviata*, flowering plant X0.5 (B.Mitchell 140, CBG). Drawn by E.Catherine.

3. QUISQUALIS

Quisqualis L., *Sp. Pl.* 2nd edn, 556 (1762); a pun on the similarity of the Malay name, *Udani*, for the type species, and the Dutch word *hoedanig* (who - what?), translated into the Latin *quis* (who?) and *qualis* (what?), referring to the variability of the species, and the changes in petal colour and size as the flower matures.

Type: *Q. indica* L.

Climbing shrubs; old stems with thorns formed by the persistent petiole bases. Leaves opposite or subopposite. Inflorescence a terminal or axillary spike, sometimes branched. Flowers bisexual, actinomorphic or slightly zygomorphic, sessile, 5-merous. Hypanthium slightly constricted at apex, often long and slender, caducous, resembling a pedicel; limb tubular. Calyx lobes triangular, inserted on hypanthium apex. Petals often large, inserted between calyx lobes, spreading. Stamens 10, in 2 whorls, inserted near hypanthium apex. Ovules 1–4. Style adnate to hypanthium. Fruit dry, ellipsoidal, longitudinally 5-winged.

An Old World, tropical genus of c. 17 species. They are woody climbers which occur along rivers and on forest margins. The 1 species on Christmas Is. is frequently cultivated elsewhere as an ornamental.

Quisqualis indica L. *Sp. Pl.* 2nd edn, 556 (1762)

T: India, Herb. C.Linnaeus 553.1; lecto: LINN, *fide* A.W.Exell, *J. Bot.* 69: 124 (1931). Epithet indicates that the species is Indian in origin, although the type drawing was taken from a specimen collected in Ambon, in the Moluccas.

Illustrations: A.W.Exell, *Fl. Males.* ser. I, 4: 546, fig. 8 (1954); A.B.Graf, *Tropica* 303–304 (1978).

Climbing shrub; old stems thorny; branchlets pubescent. Leaves elliptic to oblong, rounded to subcordate at base, shortly acuminate, sparsely pubescent beneath; lamina 4–18 cm long; petiole 5–15 mm long. Spikes 4–10 cm long; bracts 5–10 mm long, narrow. Flowers showy, fragrant, becoming pendulous. Hypanthium base 5–6 mm long; limb 50–80 mm long, narrowly tubular, pubescent, green, caducous. Calyx lobes 5, c. 2 mm long. Petals 5, oblong, 8–22 mm long, enlarging during anthesis, white or pink, becoming deep red. Stamens c. 5 mm long, the upper whorl exserted, greenish. Style adnate to hypanthium tube, the apex free, exserted, equalling stamens; stigma small. Fruit 2.5–4 cm long, with 5 stiff, broad wings. *Rangoon Creeper*.

Christmas Is. It grows well among the large, limestone blocks behind Flying Fish Cove, and in other sites where disturbance has exposed the limestone and large trees or shrubs cannot become established. A widespread species, probably indigenous to Africa, SE Asia, Malesia and New Guinea, now cultivated throughout the tropics and often naturalised.

Ch.Is.: no precise locality, 1898, *C.W.Andrews* (K); immediately behind Flying Fish Cove, *D.A.Powell 660* (K); Flying Fish Cove, *B.A.Mitchell 213* (CBG, K).

This striking, ornamental climber is probably native to Christmas Is. but fruit has not yet been collected. It spreads by root suckers as well as by seed. Pollination depends upon the presence of a long-tongued insect pollinator which may be absent from Christmas Is. The fruits are used as a vermifuge, by pulping 2 or 3 half-ripe fruits in water. The very young shoots may be used as a vegetable or eaten raw.

48. MYRTACEAE

D.J.Du Puy (Ch.Is.)

Trees or shrubs. Leaves opposite, sometimes alternate, simple, usually with minute pellucid oil glands, pinnately veined with an intramarginal vein; stipules absent or minute. Inflorescence cymose, often panicle-like or variously reduced, occasionally of solitary flowers. Flowers bisexual, actinomorphic, usually 4- or 5-merous; perianth and stamens epigynous, inserted on a hypanthium which sometimes extends above the ovary. Calyx large to almost absent, often persistent, or operculate and caducous before anthesis. Petals often inconspicuous, free, sometimes coherent and forming an operculum, caducous. Disc often broad, nectariferous. Stamens many, often showy, sometimes whorled or in clusters; anthers often longitudinally dehiscent, glandular. Ovary usually inferior, usually 2–10-locular; ovules 2–many per locule; placentation axile; style simple, slender. Fruit often a dry capsule or a fleshy berry, often with a conspicuous apical scar. Endosperm sparse or absent.

A pantropical to warm-temperate family of 100–144 genera, and probably well over 3000 species, mostly in the southern hemisphere, with a large centre of diversity in Australia; 2 genera (3 species) native or naturalised on Christmas Is. On Cocos (Keeling) Is. the family is represented only by cultivated plants. The Australian species include many decorative plants, especially in the genera *Callistemon* R.Br., *Leptospermum* J.R.Forst. & G.Forst., *Eucalyptus* L'Hér., and *Melaleuca* L. The stamens are often the showiest part of the flower. The characteristic oil glands produce aromatic oils which are used in perfumery and cosmetics and are also used medicinally. Cloves are the flower buds of *Syzygium aromaticum* (L.) Merr. & L.M.Perry, and allspice is the dried fruit of *Pimenta dioica* (L.) Merr. The fruits of several species are edible. The family includes several important timber trees, and *Eucalyptus* is widely planted because of its very rapid growth.

Eugenia uniflora L. (Surinam Cherry or Chermai Belanda) has a fruit with a strong spicy flavour. It is edible raw or stewed and can be made into preserves, chutneys or wine. One tree is known on Christmas Is. on the basalt slope above Flying Fish Cove.

Eucalyptus citriodora Hook. (Lemon-scented Gum), has been planted successfully on Christmas Is.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Myrtaceae, *Fl. Java* 1: 333–351 (1963); B.Molesworth Allen, *Malayan Fruits* 108–127 (1967); A.C.Smith, Myrtaceae, *Fl. Vit. Nova* 3: 289–377 (1985).

KEY TO GENERA

1 Leaves alternate, very narrowly ovate and tapering to an acute apex, often falcate, lemon-scented **+EUCALYPTUS**

1: Leaves opposite, not as above

2 Leaves 2.5–6 cm long, ovate; petiole 1–4 mm long; hypanthium (including ovary) 1–1.5 mm long; fruit conspicuously 8-ribbed **+EUGENIA**

2: Leaves and petiole not as above; hypanthium 4–12 mm long; fruit not ribbed

3 Young branchlets and leaves glabrous; inflorescence usually panicle-like, with 3–many flowers; hypanthium extending as a rim above ovary; seed usually solitary, occasionally 2 or absent **1. SYZYGIUM**

3: Young branchlets and leaves pubescent, sometimes minutely so; flowers solitary, occasionally up to 3, in leaf axils; hypanthium not exceeding ovary; seeds many **2. PSIDIUM**

Genera marked with a dagger symbol (+) are introduced but not naturalised and are not treated further in the text.

1. SYZYGIUM

Syzygium Gaertn., *Fruct.* 1: 166, t. 33 (1788), *nom. cons.*; from the Greek *syzygos* (a joining together), in reference to the perianth segments which are connate or cohere, falling as an operculum.

Type: *S. caryophyllaeum* Gaertn., *typ. cons.*

Trees or shrubs, mostly glabrous. Leaves opposite, coriaceous; pellucid glands minute. Inflorescence cymose or thyrsoid, usually panicle-like, terminal, axillary, or on old stems; flowers in terminal triads. Hypanthium often funnel-shaped, extended above ovary. Calyx lobes usually 4 or 5, sometimes minute, occasionally connate into an operculum and caducous before anthesis. Petals usually 4 or 5, spreading or coherent-operculate. Disc surrounded by hypanthium rim. Stamens free, inserted on hypanthium rim. Ovary inferior, usually 2-locular; ovules many. Style filiform, persistent; stigma small. Fruit a drupe or berry; hypanthium, disc and style forming an apical scar.

A genus of over 1000 species, distributed throughout the tropics, but with greatest diversity in SE Asia; 1 native species on Christmas Is. is an important constituent of the primary forest. Several species are cultivated for their edible fruits, especially in SE Asia and Malesia. The most widely cultivated include *S. aqueum* (Burm.f.) Alston (Water Apple) and *Syzygium jambos* (L.) Alston (Rose Apple). On Christmas and Cocos (Keeling) Islands *Syzygium grande* (Wight) Walp. (Sea Apple or Jambu Laut), *S. samarangense* (Blume) Merr. & L.M.Perry (Java Apple or Jambu Ayer Rhio) and *S. cumini* (L.) Skeels (Java Plum or Jambolan) are cultivated.

Syzygium is recognised as distinct from the mainly New World genus *Eugenia*, following R.Schmidt, *Amer. J. Bot.* 59: 423–436 (1972).

E.D.Merrill & L.M.Perry, The Myrtaceous genus *Syzygium* Gaertner in Borneo, *J. Arnold Arbor.* 18: 135–202 (1937); E.D.Merrill & L.M.Perry, Reinstatement and Revision of *Cleistocalyx* Blume, a valid genus of Myrtaceae, *op. cit.* 322–343; R.Schmidt, A resolution of the *Eugenia-Syzygium* controversy (Myrtaceae), *Amer. J. Bot.* 59: 423–436 (1972); B.P.M.Hyland, A revision of *Syzygium* and Allied Genera (Myrtaceae) in Australia, *Austral. J. Bot.* Suppl. Ser. 9: 4–5, 31–138 (1983).

Syzygium nervosum DC., *Prodr.* 3: 260 (1828)

T: India, *W.Roxburgh*, 1816, Herb. Lambert; lecto: G-DC, *fide* G.Panigrahi & S.C.Mishra, *Taxon* 34: 298–299 (1985). Epithet is the Latin for nerved, application not known.

Eugenia operculata Roxb., *Hort. Bengal.* 37 (1814), *nom. nud.*; *Fl. Indica* 2nd edn, 2: 486 (1832); *Syzygium operculatum* (Roxb.) Nied., *Nat. Pflanzenfam.* 3(7): 85 (1893); *Cleistocalyx operculatus* (Roxb.) Merr. & L.M.Perry, *J. Arnold Arbor.* 18: 337, t. 215 (1937). T: India, *W.Roxburgh*, 1816, Herb. Lambert; lecto: G-DC, *fide* G.Panigrahi & S.C.Mishra, *Taxon* 34: 298–299 (1985). Epithet from the Latin *operculum* (a lid), after the hemispherical calyx dome which falls off in one piece before the flower can open.

Eugenia gigantea Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 192 (1906). T: Waterfall and plateau, Christmas Is., 1904, *H.N.Ridley 81*; isosyn: K; Flying Fish Cove, 1904, *H.N.Ridley 81A*; isosyn: K.

Eugenia sp., *sensu* C.W.Andrews, *Monogr. Christmas Is.* 178 (1900).

Illustration: R.Wight, *Icon. Pl. Indiae Orient.* 2: t. 552 (1840–1843).

Tree to 40 m tall; trunk strongly buttressed; young branchlets 4-angled. Leaves elliptic to oblong-elliptic, obtuse to rounded and somewhat decurrent at base, entire, shortly acuminate to obtuse, glabrous, glossy above; lamina 6–17 cm long; petiole 8–15 mm long. Inflorescence paniculate, to 15 cm long, lax, many-flowered, on old stems. Flower buds obconical, 5–6 mm long, glabrous. Calyx a dome-shaped operculum c. 2 mm long, sometimes with central mucro, circumscissile, caducous before anthesis. Hypanthium rim c.

2 mm long. Petals coherent, caducous with operculum. Stamens 5–7 mm long, 2- or 3-whorled, white. Berry spherical, 8–10 mm diam., purple-red; apex surmounted by circular hypanthium rim and persistent style. *Gowok.* Figs 2, 22, 43D–F.

Christmas Is. It forms c. 18% of the primary forest canopy, and c. 30% of the emergent species, but also occurs on the lower terraces. Widely distributed from India and S China, through Indo-China, to Malesia, the Philippines and northern Australia (N.T.).

Ch.Is.: summit, *J.J.Lister s.n.* (K); northern plateau, *D.A.Powell 24 & 24A* (K); South Point, inland terrace, *A.Pearson & D.A.Powell P79* (K); Ross Hill, *B.A.Mitchell 25* (CBG); South Point, *B.A.Mitchell 65* (CBG, K).

This species may be recognised by its buttressed trunk, and by the purple colour of the inner bark when cut, this colour also marking the knife blade. It is one of the tallest species on the island and is an important species for the tree-nesting seabirds. It appears to attain a much larger size than in other areas. The size of the leaves, flowers and buds is also variable, and the specimens from Christmas Is. differ from those in Australia in their domed rather than conical operculum.

H.N.Ridley, *loc. cit.* described this as a new species of *Eugenia*, endemic to Christmas Is., but it strongly resembles the more widespread species in which it is included here. Several authorities have treated it as a member of the genus *Cleistocalyx* which is sometimes regarded as distinct from *Syzygium* due to its distinctive calycine operculum (E.D.Merrill & L.M.Perry, *J. Arnold Arbor.* 18: 337 (1937); C.A.Backer & R.C.Bakhuizen van den Brink Jr, *Fl. Java.* 1: 336–346 (1963); A.C.Smith, *Fl. Vit. Nova* 3: 313–368 (1985)). However, there are also species of *Syzygium* with calyptrate calyces, (e.g. *S. canicortex* B.Hyland), which appear to be more closely related to other species of *Syzygium* than to any species of *Cleistocalyx*. There do not appear to be any further characters which can be used to justify such a division, strongly suggesting that the 2 genera should not be separated. They are therefore considered here to be congeneric, following R.Schmidt, *Amer. J. Bot.* 59: 423–436 (1972) and B.P.M.Hyland, *Austral. J. Bot.* Suppl. Ser. 9: 1–164 (1983).

2. PSIDIUM

Psidium L., *Sp. Pl.* 1: 470 (1753); *Gen. Pl.* 5th edn, 211 (1754); from the Greek *sidion* (pomegranate), indicating a resemblance between the fruits of the 2 genera.

Type: *P. guajava* L.

Shrubs or small trees. Leaves opposite, pinnately nerved; pellucid glands minute. Inflorescence axillary, cymose, usually with 1 or 3 flowers. Flowers showy, sessile on pedicel-like peduncle; perianth and stamens epigynous. Bud splitting irregularly to near disc at anthesis, forming 2–5 calyx lobes. Petals 4 or 5, spreading, inserted on calyx lobes. Disc broad. Stamens slender, free, inserted on calyx lobes. Ovary inferior, usually 4- or 5-locular; ovules many; stigma capitate. Fruit a berry, spherical, obovoid or pyriform, with persistent, apical calyx lobes surrounding disc. Seeds many, reniform, embedded in pulp; testa bony.

A genus of 100–150 species, from tropical and subtropical America; 2 species naturalised on Christmas Is. Several species widely cultivated for their fruit.

Branches 4-angled; leaves usually elliptic, rounded at base; peduncle 20–30 mm long; petals c. 15 mm long; ovary 5–7 mm long; fruit 4–8 cm long, yellow **1. P. guajava**

Branchlets terete; leaves usually obovate, cuneate at base; peduncle 4–9 mm long; petals c. 6 mm long; ovary 3–5 mm long; fruit 2–3 cm long, deep red **2. P. cattleianum**

1. *Psidium guajava L., *Sp. Pl.* 1: 470 (1753)

T: Herb. C.Linnaeus 635.6; syn: LINN. Epithet from the Spanish name *guayaba*, used in the West Indies for the fruit of this tree.

Illustrations: B.Molesworth Allan, *Malayan Fruits* 124, fig. 45 (1967); A.B.Graf, *Tropica* 460, 686 (1978).

Shrub or small tree, c. 3–8 m tall; branchlets 4-angled, pubescent; bark smooth, pale, peeling off in thin flakes. Leaves elliptic to oblong, rounded at base, entire, obtuse, pubescent, with strongly raised veins beneath; lamina usually 7–13 cm long; petiole 3–5 mm long. Flowers usually solitary; peduncle 2–3 cm long, pubescent. Calyx lobes 2–4, ovate, 7–10 mm long, pubescent on both surfaces, persistent. Petals 5, elliptic to obovate, c. 15 mm long, white, soon falling. Stamens many, filiform, white. Ovary 5–7 mm long, pubescent; style persistent. Fruit spherical, ellipsoidal or pyriform, 4–8 cm long, aromatic, downy at first, yellow; pulp cream to pink. Seeds many, small. *Guava*, *Jambu Batu*, *Jambu Biji*.

Christmas Is. This species has spread rapidly through all disused mining areas but the fruit is rarely collected. Native to tropical America, now widely cultivated and naturalised in the tropics and subtropics including mainland Australia and Lord Howe and Norfolk Islands. Cultivated for its fruit on Cocos (Keeling) Is. but not naturalised.

Ch.Is.: no precise locality, *D.A.Powell 488* (K); Phosphate Hill, *B.A.Mitchell 173* (CBG, K).

The fruit may be eaten raw, but is usually stewed or made into preserves. Commercial cultivation is usually for juice production. The fruit is highly nutritious, containing vitamins A, B and C. Plants grown from seed will often fruit in their 2nd or 3rd year. Some cultivars have improved fruit quality, but do not usually reproduce true to type from seed. Naturalised populations usually have fruit of inferior quality, with little flesh and many seeds. A decoction of the leaves is effective against diarrhoea. The wood is hard and strong, and is often used for handles.

2. *Psidium cattleianum Sabine, *Trans. Hort. Soc. London* 4: 315–317, t. 11 (1821)

T: 'From China', Sept. 1820, cult. *W.Cattley*; holo: *n.v.* Named after William Cattley, an early 19th century horticultural enthusiast, who first cultivated this species in England.

Illustration: A.B.Graf, *Tropica* 686 (1978).

Shrub or small tree, 1–6 m tall; branchlets terete, minutely pubescent. Leaves obovate to elliptic, cuneate at base, entire, rounded to shortly acuminate, veins hardly raised, minutely pubescent beneath, glossy and dark green above; lamina 4–10 cm long; petiole 3–9 mm long. Flowers usually solitary; peduncle 4–9 mm long, minutely pubescent. Calyx lobes 3–5, oblong, 3–5 mm long, minutely pubescent, persistent. Petals 5, broadly elliptic, 6 mm long, white, soon falling. Stamens many, filiform, white. Ovary 3–5 mm long, glabrous; style base persistent. Fruit subspherical to obovoid, 2–3 cm long, dark red, aromatic, glabrous; pulp pink and cream. Seeds several, yellow. *Strawberry Guava*.

Christmas Is. Introduced, and first recorded during the early 1960s. It is now naturalised, but is much less common than *P. guajava*. A native of tropical America, now widely grown and often naturalised in the tropics and subtropics including Lord Howe and Norfolk Islands and mainland Australia.

Ch.Is.: no precise locality, *D.A.Powell 799* (K).

The fruit is edible with a tangy, sweet flavour and is far superior to that of the wild *P. guajava*. It may be eaten raw or used to make preserves and is rich in vitamins.

49. RHIZOPHORACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees or shrubs; roots sometimes aerial or with pneumatophores. Leaves opposite, simple; stipules conspicuous, in overlapping pairs, caducous. Inflorescence axillary, cymose, or flowers solitary. Flowers usually bisexual, actinomorphic, 4–15-merous; perianth and stamens hypogynous to epigynous. Hypanthium equalling or exceeding ovary, sometimes absent; calyx and corolla inserted on hypanthium apex. Sepals valvate, persistent. Petals caducous. Disc usually fleshy, annular or cup-shaped, rarely absent. Stamens usually twice as many as sepals; anthers longitudinally dehiscent. Ovary usually inferior, sometimes superior or semi-superior, usually 1–5-locular, ovules 1 or 2 per locule; style usually simple. Fruit usually a berry, rarely dry, usually indehiscent. Seeds 1–many, sometimes viviparous; endosperm well-developed or sparse.

The 16 genera contain c. 120 species, mainly occurring in the Old World tropics and warm subtropics, but extending N as far as southern Japan, and S to northern N.S.W., Australia; 2 species of the mangrove genus *Bruguiera* occur on Christmas Is.; 1 species of *Rhizophora* occurs on Cocos (Keeling) Is. Four genera include gregarious, coastal mangrove species: *Rhizophora*, *Ceriops* Arn., *Bruguiera* and *Kandelia* Wight & Arn. The remaining genera are rainforest trees.

Ding Hou, Rhizophoraceae, *Fl. Males.* ser. I, 5: 429–493 (1958); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Rhizophoraceae, *Fl. Java* 1: 378–381 (1963); A.C.Smith, Rhizophoraceae, *Fl. Vit. Nova* 2: 602–617 (1981); A.McCusker, Rhizophoraceae, *Fl. Australia* 22: 1–10 (1984).

Sepals 8–16; knee roots present (Ch.Is.) **1. BRUGUIERA**

Sepals 4; stilt roots present (C.K.Is.) **2. RHIZOPHORA**

1. BRUGUIERA

Bruguiera Lam., *Tabl. Encycl.* 1: t. 397 (1793); after the French explorer J.G.Bruguières, 1750–1799, who travelled widely in the Middle East.

Type: *B. gymnorhiza* (L.) Savigny

Evergreen trees, often buttressed, sometimes with knee roots (pneumatophores); branching sympodial. Leaves entire, glabrous, coriaceous, black-dotted beneath; stipules 2–5 cm long, slender. Flowers solitary or in branched cymes of 2–10; bracteoles absent. Sepals c. 8–15, coriaceous. Petals c. 8–15, bilobed, with 1–several apical bristles; base infolded, with hairy margins. Disc cup-shaped. Stamens in pairs enclosed by the folded petal base; anthers linear. Ovary inferior, 2–4-locular; stigma minutely 2–4-lobed. Fruit enclosed in the campanulate, coriaceous hypanthium and sepals. Seed solitary, viviparous. Hypocotyl cigar-shaped, becoming strongly exserted.

The genus contains 6 species of mangrove trees, occurring in littoral forest from tropical eastern Africa and SE Asia, through Malesia and New Guinea to northern Australia and the Pacific islands; 2 closely related species occur on Christmas Is. These species normally occur towards the landward side of mangrove communities, but on Christmas Is. they form an inland stand in an elevated area inundated by fresh water. This stand is of high scientific interest as a unique example of the species growing naturally in a non-saline habitat (C.G.G.J. van Steenis, *Blumea* 29: 395–397, 1984). It has probably adapted to fresh water from the time when land movements raised the first terrace above sea level.

Both species of *Bruguiera* are slow-growing but produce a hard, durable, reddish wood used

elsewhere in building construction, to produce charcoal or as firewood. The flower contains a nectariferous disc but the pollinator is not known. The viviparous fruits occasionally fall from the tree and stick vertically into the mud, but usually they fall flat. The hypocotyl tip soon produces roots and bends vertically, raising the seedling above sea level.

C.G.G.J. van Steenis, Three more Mangrove trees growing locally in nature in fresh water, *Blumea* 29: 395–397 (1984).

Bark fissured, dark; petal lobes 4–7 mm long, twisted, each with 1–3 conspicuous apical bristles; petiole, stipules, pedicel, hypanthium and sepals often red, sometimes bright red **1. B. gymnorhiza**

Bark smooth, pale; petal lobes 3–4 mm long, not twisted, without prominent apical bristles; petiole, stipules, pedicel, hypanthium and sepals green, yellow or brownish **2. B. sexangula**

1. Bruguiera gymnorhiza (L.) Savigny in J.P.A.P.Lamarck, *Encycl.* 4: 696 (1798)

Rhizophora gymnorhiza L., *Sp. Pl.* 1: 443 (1753). T: illustration of Kandel, in H.A. van Rheede, *Hortus Indicus Malabaricus* 6: 57–58, t. 31 (1686), from India; *fide* J.Lewis, *Fl. Trop. E. Africa*, Rhizophoraceae: 6 (1956). Epithet from the Greek *gymnos* (naked) and *rhiza* (root), descriptive of the aerial knee roots of this species.

Illustrations: V.H.Heywood, *Fl. Pl. World* 158 (1978); A.B.Graf, *Tropica* 841 (1978), as *B. conjugata*.

Tree c. 15 m tall; bark fissured, dark; buttresses and knee roots many. Leaves narrowly elliptic, usually acute, coriaceous, dark green; lamina c. 10–28 cm long; petiole 2–6 cm long, reddish, pruinose; stipules reddish. Flowers solitary, subterminal, nodding, c. 37–42 mm long; pedicel red, pruinose. Hypanthium 17–20 mm long, weakly ridged in upper half, often bright red. Sepals 10–14, acicular, 17–23 mm long, coriaceous. Petals 13–17 mm long, deeply bilobed, white; lobes 4–7 mm long, twisted, with 1–3 conspicuous apical bristles and 1 bristle between lobes. Style 20–25 mm long. Fruit enclosed in hypanthium and sepals. Hypocotyl exserted to c. 10–20 cm, cigar-shaped, slightly ridged; apex rounded. *Mangrove, Tumu Merah*.

Christmas Is. It occurs in the unusual freshwater mangrove stand at Hosnies Spring, situated on the first terrace, about 2 km SW of Steep Point, and c. 150 m inland. This area is near the base of the first inland cliff, where a junction between basalt and limestone rocks occurs at an altitude of c. 15–25 m. A common species occurring in littoral mangrove forest from eastern Africa and SE Asia through Malesia and New Guinea to northern Australia (Qld, N.T., northern N.S.W.) and the Pacific islands.

Ch.Is.: eastern coastal terrace, Hosnies Spring, *D.A.Powell 367B* (K); no precise locality, *D.A.Powell 631B* (K); no precise locality, *D.A.Powell 644* (K); Hosnies Spring, *B.A.Mitchell 89* (CBG, K); Hosnies Spring, *D.J. & B.P.Du Puy CI22* (CBG, K).

The knee roots (where the root rises out of the ground, turns sharply down and returns into the substrate) are modified as pneumatophores, or breathing roots, supplying the root system with oxygen (Ding Hou, *Fl. Males.* ser. I, 5: 458–459, 466, figs 15, 16, 22, 1958). The bark is rich in tannins, and also contains a dye.

2. Bruguiera sexangula (Lour.) Poir. in J.P.A.P.Lamarck, *Encycl.* Suppl. 4: 262 (1816)

Rhizophora sexangula Lour., *Fl. Cochinch.* 363 (1790). T: Cochinchina (Vietnam), *J. de Loureiro s.n.*; iso: BM. Epithet from the Latin *sex* (six) and *angulus* (angle), descriptive of the somewhat angular hypocotyl.

Illustration: Ding Hou, *op. cit.* 462, fig. 18.

Tree c. 15 m tall; bark smooth, pale; buttresses and knee roots present. Leaves narrowly elliptic, usually acute, coriaceous, dark green; lamina c. 8–16 cm long; petiole 1.5–5 cm long, green to brown; stipules green or yellowish. Flowers solitary, subterminal, nodding, c. 31–42 mm long; pedicel green, yellow or brownish. Hypanthium 15–20 mm long, ridged to the base, green to brown. Sepals 10–12, acicular, c. 17–20 mm long, coriaceous. Petals 13–16 mm long, bilobed, white; lobes 3–4 mm long, not twisted, without prominent apical bristles, with 1 bristle between lobes. Style 18–20 mm long. Fruit enclosed in hypanthium

and sepals. Hypocotyl exserted to c. 10 cm, cigar-shaped, somewhat angular; apex tapering. *Tumu Barau, Mangrove.*

Christmas Is. It occurs in the inland mangrove stand at Hosnies Spring. A mangrove species distributed from SE Asia through Malesia to New Guinea, New Britain and northern Australia (Qld, N.T.). It is much less common than *B. gymnorhiza*.

Ch.Is.: eastern coastal terrace, Hosnies Spring, *D.A.Powell 631A* (K, Kew spirit no. 44996 K); no precise locality, *D.A.Powell 637A* (K, Kew spirit no. 44999 K).

This species is unusual in that it sometimes has stilt roots when young. Closely related to *B. gymnorhiza*, and can be difficult to distinguish (A.McCusker, *Fl. Australia* 22: 5, 1984). On Christmas Is., the most reliable differences are those of the petals. There also appear to be colour differences, especially in sunny situations. The style length, hypocotyl length and the degree of ridging on the hypanthium and hypocotyl also show some distinction. Other characters used elsewhere to separate these species are of little value in this population.

2. RHIZOPHORA

Rhizophora L., *Sp. Pl.* 1: 443 (1753); *Gen. Pl.* 5th edn, 202 (1754); from the Greek *rhiza* (root), *phoros* (bearing), in reference to the stilt roots.

T: *R. mangle* L.

Trees with stilt roots. Leaves elliptic to obovate; midrib extended into a caducous point; stipules lanceolate. Inflorescence a 2- or 3-chasial cyme; bracteoles forming a cup below flower. Sepals 4, scarcely united at base, reflexed in fruit. Petals 4, lanceolate, glabrous (Cocos (Keeling) Is.). Disk annular. Stamens 8 or 12. Ovary 2-locular; stigma 2-lobed. Fruit ovoid or pyriform, 1-seeded. Seed viviparous. Hypocotyl cylindrical, long, protruding before propagule falls.

A pantropical genus of 8 or 9 species of tidal habitats; 4 species in Australia, 1 on Cocos (Keeling) Is.

Rhizophora apiculata Blume, *Enum. Pl. Javae* 1: 91 (1827)

T: *Pee Kandel* Rheede, *Hort. Mal.* 6: 61, t. 34 (1866), *fide* Vu Van Cuong, *Fl. Cambodge* 4: 140 (1965). Epithet from the Latin *apiculatus* (ending abruptly in a short point), in reference to the leaves.

Illustrations: P.B.Tomlinson & J.S.Womersley, *Contr. Herb. Austral.* 19: 4, 5, figs 1, 2 (1976); Vu Van Cuong, *op. cit.* 139, t. 1.

Tree to 6 m, usually many-stemmed. Bark rough. Leaves obovate, apiculate, paler beneath; lamina 8–16 cm long, 4–8 cm wide; petiole 1–4 cm long; stipules 4–8 cm long, reddish. Inflorescence 2-flowered, usually borne below leaves; peduncle 0.5–1.5 cm long; bracteoles united into a bulbous cup, with crenulate margins, brown. Flowers sessile. Calyx 10–14 mm long. Petals to 12 mm long, membranous, glabrous. Stamens usually 12. Stigma 2-lobed. Fruit 2–2.5 cm long. Hypocotyl to 35 cm long.

Cocos (Keeling) Is. Grows on the brackish lagoon shore, Horsburgh Is., in red silt over coral rubble with *Cordia subcordata*; from Sri Lanka E to islands of the western Pacific and S to northern Australia.

C.K.Is.: Horsburgh Is. (Pulu Luar), *D.G.Williams 171* (CBG, K, PERTH).

Although seedlings are common in the flotsam of the islands, survival is probably prevented by predation by crabs. Establishment on Horsburgh Is. has apparently been assisted by man (H.B.Guppy, The dispersal of plants as illustrated by the Flora of the Keeling or Cocos Islands, *J. Trans. Victoria Inst.* (*London*) 1890: 267–301, 1890).

50. OLACACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., C.S.Is.)

Shrubs or trees, sometimes thorny, frequently hemiparasitic. Leaves alternate, simple, entire, exstipulate. Inflorescence a bracteate, axillary raceme, cyme, panicle, cluster, umbel or (not in our area) flowers solitary. Flowers bisexual or (not in our area) unisexual, actinomorphic. Calyx short, 3–6-lobed or (not in our area) unlobed, sometimes enlarging. Corolla of 3–6 petals, valvate, connate or (not in our area) free. Disc sometimes present, usually of several free glands. Stamens 3–15 in 1–3 whorls, epipetalous or (not in our area) free, opposite petals when equal in number, sometimes staminodal; anthers basifixed, 2-locular, dehiscing longitudinally. Ovary superior or half-inferior, usually 3-carpellate, 2–5-locular usually opening to 1-locular above; ovules 1 per locule, pendulous; placentation usually free central or axile; style simple; stigma globular or (not in our area) shortly lobed. Fruit a drupe, 1-seeded. Seed with endosperm.

A family of 25 genera and c. 250 species, widespread in tropical and temperate regions; 3 genera and 13 species in mainland Australia, 1 of which occurs on Christmas Is., Cocos (Keeling) Is. and the Coral Sea Is.

A.Engler, Olacaceae, *Nat. Pflanzenfam.* 3(1): 231–242 (1889); A.Engler, *Nat. Pflanzenfam. Nachtr.* 1 to 3(1): 144–149 (1897); C.F.Reed, The comparative morphology of the Olacaceae, Opiliaceae and Oktonemaceae, *Mem. Soc. Brot.* 10: 29–79, t. 1–14 (1955); H.Sleumer, Olacaceae, *Nat. Pflanzenfam.* 2nd edn, 16b: 5–32 (1960); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Olacaceae, *Fl. Java* 2: 63–65 (1965); H.Sleumer, A taxonomic account of the Olacaceae of Asia, Malesia, and the adjacent areas, *Blumea* 26: 145–168 (1980); A.S.George, Olacaceae, *Fl. Australia* 22: 13–25 (1984); H.Sleumer, Olacaceae, *Fl. Males.* ser. I, 10: 1–29 (1984).

XIMENIA

Ximenia L., *Sp. Pl.* 2: 1193 (1753); *Gen. Pl.* 5th edn, 500 (1754); honouring Francisco Ximenes, 17th century Spanish naturalist who wrote on medicinal plants.

T: *X. americana* L.

Shrubs or trees; branchlets often with axillary spines. Leaves often crowded towards ends of short lateral branches, petiolate, mucronulate. Inflorescence an axillary raceme or umbel. Flowers bisexual. Calyx 4-lobed, persistent. Corolla tubular, 4-lobed, coherent, caducous; lobes thickened towards apex. Disc absent. Stamens usually 8. Ovary superior, 4-locular; style slender; stigma capitate. Drupe with a thin, pulpy pericarp and a woody endocarp.

A genus of 10–15 species in tropical regions scattered from India and Sri Lanka, through Indo-China and Malesia to the Pacific islands; 1 species on Christmas Is., Cocos (Keeling) Is. and the Coral Sea Is. and in mainland Australia.

Ximenia americana L., *Sp. Pl.* 2: 1193 (1753)

T: tropical America, *coll. unknown*; lecto: BM (Hort. Cliff. 483), *fide* G.Ll.Lucas, *Fl. Trop. E. Africa*, Olacaceae: 5 (1968).

Illustration: H.Sleumer, *Fl. Males.* ser. I, 10: fig. 4 (1984).

Scrambling shrub or small tree to 5 m; branches rigidly divaricate; branchlets sometimes spinescent. Leaves elliptic to obovate, ±succulent, shortly acuminate, obtuse or slightly emarginate, mucronate, decurrent as ridges down petiole; lamina 3–6 cm long, 1–3.5 cm wide; petiole 3–9 mm long. Inflorescence subumbellate, often near tip of short lateral

branchlets; peduncle 5–9 mm long; bracts c. 1 mm long. Flowers 3–9, fragrant; pedicels 3–5 mm long. Calyx 0.5–1.5 mm long, cupular; teeth acute. Petals linear-oblong, 7–10 mm long, white to pale yellow, bearded inside in lower 3/4; apical thickening papillose. Stamens c. 6 mm long. Style c. 5 mm long. Drupe globular, ellipsoidal or pear-shaped, 17–25 mm long, yellow, orange or red. Seed ±globular to ovoid, 15–20 mm long. *Yellow Plum*.

Christmas Is., Cocos (Keeling) Is., Coral Sea Is. On Christmas Is. grows in loam; on Cocos (Keeling) Is., recorded as rare on the main atoll with *Calophyllum inophyllum* in calcareous sand; on the Coral Sea Is. recorded only for the two cays cited below in open areas or *Pisonia* forest in calcareous sand; also pantropical and subtropical including north-eastern Australia.

Ch.Is.: North West Point, 16 Dec. 1979, *D.A.Powell* (K). C.K.Is.: lagoon shore near meteorological stn, West Is., *D.G.Williams 171* (CBG). C.S.Is.: Western Cay, Diamond Group, *K.Keith 15* (BRI, CANB); NE Cay, Herald Cays, *J.Hicks 1* (CBG).

This species is a facultative root parasite and auto-parasite. Birds eat the fruit and disperse the seed, and the stone of the fruit has a layer of air-containing tissue beneath the shell which allows the seed to float for some months, leading to sea-water dispersal. The sour pulp of the fruit is edible but the kernels are a purgative. The wood is yellow, hard and close-grained.

51. BALANOPHORACEAE

D.J.Du Puy (Ch.Is.)

Terrestrial, parasitic herbs lacking chlorophyll, monoecious or dioecious, tuberous; stems not branched. Leaves alternate, distichous, opposite or whorled, scale-like, sometimes absent. Inflorescence a terminal spadix, unisexual or with both male and female flowers. Male flowers larger than female, closely spaced, mostly 2–6-merous, pedicellate or sessile; tepals free or absent; stamens 1–6, sometimes connate into a synandrium. Female flowers minute, densely crowded; perianth usually absent; ovary superior, rarely inferior and fused to perianth (when present), usually with a solitary ovule; ovules reduced; styles 1–3. Fruit nut-like or drupaceous, minute, with a single seed. Endosperm present.

This family includes 19 genera, with c. 45 species. They are distributed throughout the tropics and subtropics, extending into warm-temperate zones. The genus *Balanophora* is represented by 1 species on Christmas Is.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Balanophoraceae, *Fl. Java* 2: 78–80 (1965); B.Hansen, Balanophoraceae, *Fl. Males.* ser. I, 7: 783–805 (1976); H.J.Hewson, Balanophoraceae, *Fl. Australia* 22: 146–147 (1984); A.C.Smith, Balanophoraceae, *Fl. Vit. Nova* 3: 747–750 (1985).

BALANOPHORA

Balanophora J.R.Forst. & G.Forst., *Char. Gen. Pl.* 99, t. 50 (1776); from the Greek *balanos* (acorn) and *phoros* (bearing), due to the appearance of the female portion of the inflorescence.

T: *B. fungosa* J.R.Forst. & G.Forst.

Short, unbranched, parasitic herbs, often brightly coloured, glabrous. Leaves sessile. Inflorescence resembling a fungus. Male flowers in unisexual, cone-like spikes or racemes, or in distinct zones of a bisexual inflorescence, actinomorphic to zygomorphic; tepals 3–6, free, ovate to oblong, spreading, valvate in bud; stamens usually 3–5, united into a

synandrium. Female flowers extremely numerous, minute, interspersed with many clavate processes, all densely packed on the fleshy rachis of the spadix; perianth absent; ovary superior; style solitary, slender; stigma minute. Fruit nut-like, indehiscent.

A genus of c. 15 tropical root parasites, distributed from Africa and SE Asia, including India, S China and Indo-China, through Malesia to Australia and the Pacific islands. The type species occurs in Australia (Qld), and a second species has been recorded from Christmas Is. They usually occur in dense rainforest. They are apparently able to parasitise a wide range of dicotyledonous trees, and even conifers and bamboos, but it is often difficult to be sure of the host species and there may be some host specificity. The tuber, which consists of tissue from both the host root and the parasite, frequently contains a wax which can be extracted and used for candles. The female inflorescence is estimated to contain 105–107 flowers.

B.Hansen, The genus *Balanophora*, in J.R. & G.Forster, A Taxonomic Monograph, *Dansk Bot. Ark.* 28: 1–188 (1972).

Balanophora abbreviata Blume, *Enum. Pl. Javae* 1: 87 (1827)

T: Java, *C.L.Blume s.n.*; not extant; *Lutjeharms 3650*; neo: L, *fide* B.Hansen, *op. cit.* 136. Epithet from the Latin *abbreviare* (to shorten), descriptive of the short inflorescence.

B. insularis Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 218–220 (1906). T: Christmas Is., 1904, H.N.Ridley; holo: SING *n.v.*

Illustrations: B.Hansen, *op. cit.* 135, fig. 35 (1972); B.Hansen, *Fl. Males.* ser. I, 7: 801, fig. 21 (1976).

Parasitic herb, monoecious, usually pale yellow; flowering stems usually 2–10 cm tall. Tuber branched; surface finely granular. Leaves c. 3–7, distichous, oblong, c. 1–1.5 cm long, usually deeply forked. Inflorescence bisexual; male flowers few, almost sessile, below female flowers, on a dense terminal fungus-like spadix 8–20 mm long. Male flowers c. 10–20; tepals usually 4, c. 1.5 mm long, the lateral pair ovate, acute, the longitudinal pair oblong, truncate; synandrium c. 1 mm diam. Female flowers surrounding base of many club-shaped processes; style c. 0.5 mm long, slightly exceeding processes. Fig. 43J.

Christmas Is. It is uncommon, usually on areas of limestone scree with a thin soil cover. The scattered distribution of this species includes tropical Africa, Madagascar and SE Asia from India through Indo-China, Malesia (except Borneo) and the Philippines to New Guinea and the Pacific islands (Tahiti, Marquesas). It usually occurs in shaded, evergreen forest, and although it may be parasitic on many species it frequently occurs on the roots of *Ficus* species.

Ch.Is.: no precise locality, *C.W.Andrews 214* (BM); on the roots of *Cryptocarya*, *D.A.Powell 220* (K); coastal terrace, between Middle and Douglas Points, *B.A.Mitchell 140* (CBG); above Hughs Dale, W coast, *B.A.Mitchell 168* (CBG).

H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: (1906) described this as a new species, endemic on Christmas Is., but it cannot be distinguished from *B. abbreviata*. He also noted that the minute fruits are wind dispersed.

52. CELASTRACEAE

D.J.Du Puy (Ch.Is.)

Trees or shrubs, sometimes scandent, bisexual or dioecious. Leaves alternate, distichous or opposite, simple, often crenate, often leathery; stipules small or absent. Inflorescence axillary or terminal, usually variously compound, often bracteate. Flowers usually small, actinomorphic. Sepals usually 4 or 5, connate at base. Petals usually 4 or 5, free, imbricate. Disc often conspicuous, annular to cupular, sometimes lobed, nectariferous. Stamens usually 4 or 5, alternating with petals, inserted on or below margin of disc; anthers dehiscing by longitudinal slits. Ovary superior, free or immersed in disc, usually 2–5-locular; ovules 2 per locule; placentation axile. Fruit a loculicidal capsule, drupe or berry. Seeds sometimes with an aril, or winged; endosperm usually present.

The c. 90 genera and over 1000 species are found from temperate to tropical regions, with most diversity in the tropics and subtropics. Of the 14 genera (34 species) in Australia, 6 are endemic; 1 genus (1 species) on Christmas Is. *Catha edulis* Forssk. contains the alkaloid cathine, a stimulant, the leaves being used to prepare a beverage in the Middle East and north-eastern Africa known as Arabian Tea. Most members of the family contain a characteristic hexitol (dulcitol) in the leaves, and gutta (chemically close to rubber) is found in many species. The seeds are often high in fatty oils which can be used to make soap. Species from several genera, including *Euonymus* L., are cultivated as ornamentals for their foliage and fruit. Some species produce a close-grained, dense wood used in turnery.

Ding Hou, A Revision of the genus *Celastrus*, *Ann. Missouri Bot. Gard.* 2: 215–302 (1955); Ding Hou, Celastraceae, *Fl. Males.* ser. I, 6(1): 227–291 (1963); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Celastraceae, *Fl. Java* 2: 53–56 (1965); L.W.Jessup, Celastraceae, *Fl. Australia* 22: 150–180 (1984).

CELASTRUS

Celastrus L., *Sp. Pl.* 1: 196 (1753); *Gen. Pl.* 5th edn, 91 (1754); from the Greek *kelastros* (an evergreen shrub), originally applied to *Ligustrum* (Privet).

Type: *C. scandens* L.

Scandent or twining shrubs, usually dioecious (in Malesia). Leaves alternate, crenate; stipules minute, caducous. Inflorescence a panicle, raceme or thyrse. Flowers bisexual or unisexual. Calyx campanulate, persistent, with 5 obtuse lobes. Petals 5, spreading. Stamens in sinuses of the disc, reduced to staminodes in female flowers. Ovary incompletely 3-locular, each locule with 2 basally attached ovules; style columnar; stigma 3- or 6-lobed; all much reduced in male flowers. Fruit a subglobose capsule, tipped by persistent style, loculicidally 3-valved. Seeds 1–6, surrounded by a fleshy, crimson aril, adherent in pairs.

The genus contains 32 species, widely distributed in the tropics and subtropics, mainly from SE Asia through Malesia to New Guinea and in tropical America, with 2 species in Australia; 1 species on Christmas Is.

Celastrus paniculatus Willd., *Sp. Pl.* 4th edn, 1(2): 1125 (1798)

T: East Indies, Herb. C.L.Willdenow 4746; holo: B, microfiche seen. Epithet refers to the inflorescence.

Illustrations: R.Wight, *Icon. Pl. Ind. Orient.* 1: t. 158 (1839); P.F.Fyson, *Fl. Nilgiri & Pulney Hill-tops* 2: 63 (1915); Ding Hou, *Ann. Missouri Bot. Gard.* 2: 230, fig. 3 (1955).

Scandent shrub, 2–10 m tall; branchlets with conspicuous, pale lenticels. Leaves elliptic to oblong-elliptic, cuneate to rounded at base, crenate, acuminate to obtuse; lamina 5–9 cm long; petiole 0.5–1.5 cm long. Panicles 5–15 cm long, terminal, often on short, lateral shoots, pendulous; pedicels 2 mm long. Calyx lobes c. 1 mm long. Petals oblong, 2.5–3 mm

Figure 44. **A–C,** CELASTRACEAE: *Celastrus paniculatus*. **A**, fruiting shoot X0.3; **B**, female flowers X2; **C**, fruits X1 (**A–C**, D.Powell 283, K). **D–J**, EUPHORBIACEAE. **D–E**, *Phyllanthus amarus*. **D**, flowering shoot X0.3; **E**, portion of fruiting branchlet X3 (**D–E**, B.Mitchell 143, K). **F–G**, *Claoxylon indicum*. **F**, flowering male branchlet X0.3 (R.Shivas 805, PERTH); **G**, infructescence X1 (B.Mitchell 170, K). **H–J**, *Acalypha lanceolata*. **H**, flowering shoot X0.3; **I**, leaf X0.5; **J**, portion of infructescence X4 (**H–J**, D.Powell 423, K). Drawn by E.Catherine.

long, obtuse, yellowish green. Disc cupular. Stamens c. 3 mm long in male flowers. Style columnar; stigma 3- or 6-lobed in female flowers. Capsule depressed-globose, 7–8 mm long, 3-angled, with 3 broadly elliptic valves which spread open exposing 3–6 yellowish brown seeds with bright red arils. Figs 44A–C, 50.

Christmas Is. Occurs on all terraces to c. 200 m alt., probably native. Distributed from India and S China through Indo-China and Malesia (except Borneo) to New Caledonia and the Philippines.

Ch.Is.: Rocky Point, *C.W.Andrews s.n.* (K); terraces, *D.A.Powell 283* (K); Smith Point, *B.A.Mitchell 130* (CBG, K); cliff edge overlooking golf course, *D.J. & B.P.Du Puy CI24* (CBG, K).

The seed is dispersed by birds which are attracted by the red aril.

53. EUPHORBIACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., C.S.Is.)

Trees, shrubs or herbs, sometimes scandent, sometimes succulent, monoecious or dioecious, sometimes with milky or coloured sap. Leaves usually alternate, simple, or occasionally palmately lobed, or reduced; stipules usually present, occasionally connate. Inflorescence cymose, often resembling a raceme, spike, panicle or thyrse, or flowers reduced and clustered within an involucre, forming cyathia (*Euphorbia*). Flowers unisexual, commonly actinomorphic. Perianth and stamens hypogynous. Sepals usually 2–6, free or connate, sometimes absent. Petals present or absent. Stamens 3–many, free or variously connate, sometimes solitary (*Euphorbia*); anthers usually longitudinally dehiscent. Disc often present and nectariferous. Ovary superior, usually 3-locular; ovules 1 or 2 per locule, apical; styles usually 3, sometimes connate, often bilobed. Fruit frequently a capsular schizocarp splitting into 3 caducous mericarps, leaving a persistent columella, sometimes drupaceous (*Aleurites*, *Drypetes*), rarely a capsule (*Macaranga*). Seeds commonly with an oil-containing caruncle.

A large and very diverse family of c. 300 genera and c. 7500 species, with a wide, cosmopolitan distribution absent only from the arctic regions, and with greatest diversity in the tropics and subtropics; 11 genera (19 species) occur on Christmas Is., 5 of which (9 species) occur on Cocos (Keeling) Is. and 1 species on the Coral Sea Is. The African species include many spiny, often arborescent succulents with extreme xerophytic adaptions, often resembling cacti. Many species produce poisonous alkaloids, tannins and latex, probably to deter predators. The endosperm of the seed usually has a high oil content and often also contains poisonous proteins. The oil-containing caruncle on the seed encourages dispersal by ants.

Many species are cultivated as ornamentals, both in temperate gardens and greenhouses, and in the tropics. Among the tropical ornamental species are *Euphorbia pulcherrima* Willd. (Poinsettia) with scarlet bracts and *Codiaeum variegatum* (L.) A.Juss. (Croton) with multicoloured and bizarrely shaped leaves in an array of different forms. Other species, such as *Ricinus communis* L., *Aleurites fordii* Hemsl. and *Croton tiglium* L. are cultivated for the oils contained in their seeds. *Manihot esculenta* Crantz, Cassava, is a vital source of carbohydrates in the tropics. *Hevea brasiliensis* (Willd. ex Juss.) Müll.Arg. is the major source of natural rubber, derived from its copious white latex. *Manihot glaziovii* Müll.Arg. also has some historical importance as a source of rubber.

Cultivated species on Christmas Is. are: *Breynia disticha* f. *nivosa* (Bull) Croizat ex Radcl.-Sm. (Snow Bush), in hedges around cultivated land and in gardens; *Antidesma bunius* (L.) Spreng. (Buni), represented by one male and one female plant at Drumsite; *Hevea brasiliensis* (Willd. ex Juss.) Müll.Arg. (Para Rubber Tree), in an old experimental

rubber plantation above Ross Hill Gardens.

Jatropha curcas L. (Physic Nut or Jarak Pagar) was recorded by C.W.Andrews, *Monogr Christmas Is.* 315 (1900) but is now known from only one plant that was planted beside Drumsite road by the Chinese in c. 1960. *Codiaeum variegatum* (L.) A.Juss. (Croton) is cultivated on Christmas Is. where it marks many of the graves in the Chinese and Singapore Muslim Cemeteries. An isolated plant in the Plateau forest indicates the site of a pre-war Chinese shrine. It is also cultivated in gardens.

Cultivated species on Cocos (Keeling) Is. include *Manihot esculenta* Crantz (local Malay name, Dandar) grown for its edible roots, *Phyllanthus acidus* (L.) Skeels (Cheremai) for its fruit, *Sauropus androgynus* (L.) Merr. (Keretu) for its edible leaves and *Breynia disticha* J.R.Forst. & G.Forst. as an ornamental.

F.Pax & K.Hoffman, Euphorbiaceae, *Pflanzenr.* IV. 147 (1910–1924); F.Pax & H.Hoffman, *Nat. Pflanzenfam.* 2nd edn, 19c: 11–233 (1931); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Euphorbiaceae, *Fl. Java* 1: 441–505 (1963); G.L.Webster, The genera of Euphorbiaceae in the southeastern United States, *J. Arnold. Arbor.* 48: 303–430 (1967); G.L.Webster, Conspectus of a new classification of the Euphorbiaceae, *Taxon* 24: 593–601 (1975); H.K.Airy Shaw, The Euphorbiaceae of Borneo, *Kew Bull.* Add. Ser. 4 (1975); H.K.Airy Shaw, The Euphorbiaceae of New Guinea, *Kew Bull.* Add. Ser. 8 (1980); H.K.Airy Shaw, The Euphorbiaceae - Platylobeae of Australia, *Kew Bull.* 35: 577–700 (1980); H.K.Airy Shaw, The Euphorbiaceae of Sumatra, *Kew Bull.* 36: 239–374 (1981); A.C.Smith, Euphorbiaceae, *Fl. Vit. Nova* 2: 439–575 (1981).

KEY TO GENERA

1 Leaves mottled, blotched, veined or otherwise variegated with white, cream, yellow or red

2 Herbs; cream or red colouring confined to leaves subtending the terminal, corymbose inflorescence — **11. EUPHORBIA** (*p.p.*)

2: Shrubs or small trees; most leaves variegated

3 Leaves distichous, c. 2.5–4.5 cm long, broadly elliptic with a rounded apex, the younger leaves boldly mottled with white and pink — **†BREYNIA**

3: Leaves spirally arranged, c. 10–25 cm long, usually obovate-elliptic with an acute apex, strongly veined and spotted with various shades of gold and red — **†CODIAEUM**

1: Leaves not variegated, occasionally entirely purple-green

4 Leaves trifoliolate, the leaflets each with a short petiolule — **†HEVEA**

4: Leaves entire to deeply lobed

5 Leaves deeply palmately lobed, the divisions between the lobes extending at least half way to base of leaf

6 Leaves irregularly but coarsely serrate; male flowers with many stamens in complex branched clusters; fruit with many long, fleshy prickles — **10. RICINUS**

6: Leaves entire; male flowers with 10 stamens in 2 whorls; fruit warty, sometimes narrowly winged — **5. MANIHOT**

5: Leaves entire or shallowly lobed

7 Leaves conspicuously peltate, 8–80 cm long, usually broadly ovate, occasionally weakly lobed — **9. MACARANGA**

7: Leaves not peltate, not as above

8 Prostrate herbs — **11. EUPHORBIA** (*p.p.*)

8: Erect herbs, shrubs or trees

9 Leaves opposite — **11. EUPHORBIA** (*p.p.*)

9: Leaves alternate or clustered near branchlet tips (sometimes subopposite in *Alchornea*)

10 Leaves palmately veined, or with 7 or 8 palmate veins from base

11 Climbing or sprawling shrubs; leaves, stems and inflorescences stellate hairy; leaves with 3–5 inconspicuous veins from base; petioles with 2 apical, stalked glands; stipules deeply divided, with filiform segments — **4. CROTON**

11: Not the above combination of characters

12 Herbs; leaves serrate; each female flower enclosed in a funnel-shaped foliaceous bract — **7. ACALYPHA**

12: Trees or shrubs; leaves entire, or the leaf shallowly palmately 3- or 5-lobed; bracts subtending female flowers small, not as above

13 Leaves mostly triangular-ovate, sometimes palmately 3- or 5-lobed on juvenile shoots and suckers; young shoots and leaves densely stellate pubescent, glabrescent; flowers in terminal thyrses c. 9–17 cm long — **3. ALEURITES**

13: Leaves mostly shallowly, palmately 5-lobed: leaves and shoots ±glabrous; flowers in subapical paniculate inflorescences c. 5–10 cm long — **+JATROPHA**

10: Leaves pinnately veined

14 Herbs with flowers in terminal corymbs subtended by leaves with red or whitish bases; flowers enclosed in a 2–5 mm long involucre with a marginal cup- or trumpet-shaped gland — **11. EUPHORBIA** (*p.p.*)

14: Plants not as above

15 Leaves mostly 8–30 cm long, spirally arranged or subopposite

16 Leaves softly hairy beneath, especially on veins; petiole 2–7 cm long, with 2 apical glands — **6. CLAOXYLON**

16: Leaves glabrous, or pubescent only in axils of veins beneath; petiole 0.5–8 cm long, without apical glands

17 Leaves papery, cuneate at base, serrate — **8. ALCHORNEA**

17: Leaves coriaceous, glossy, obtuse to rounded at base, entire — **+ANTIDESMA**

15: Leaves 0.2–8 cm long, mostly distichous on short, lateral branchlets which sometimes resemble pinnate leaves

18 Flowers in clusters along raceme-like, leafless shoots on older, leafless branches — **2. PHYLLANTHUS** (*p.p.*)

18: Flowers solitary or in clusters in axils of leaves on young shoots

19 Herbs; leaves 0.2–1.1 cm long; flowers c. 1–2 mm diam.; male and female flowers with 5 sepals, green; fruit a capsule, c. 1.5–2 mm diam. — **2. PHYLLANTHUS** (*p.p.*)

19: Trailing shrubs; leaves 2–8 cm long; flowers c. 4–8 mm diam.; male flowers discoid, flat; female flowers with 5 sepals, dark red; fruit fleshy and berry-like, c. 1.5 mm diam. — **1. SAUROPUS**

Genera marked with a dagger symbol (†) are introduced but not naturalised and are not treated further in the text.

1. SAUROPUS

Sauropus Blume, *Bijdr.* 595 (1826); from the Greek *sauros* (a lizard) and *pous* (a foot, leg), from the fancied resemblance of the male flower and especially of the 3-lobed column formed by the stamens, to a reptilian foot.

Type: not designated.

Herbs or shrubs, sometimes scandent, monoecious, glabrous, without milky sap. Leaves alternate, often distichous, entire, pinnately veined; petiole short; stipules small, persistent. Flowers in axillary clusters sometimes combined into a racemose or paniculate inflorescence, sometimes cauliflorous; sepals 6, 2-whorled; petals absent; disc absent. Male flowers: sepals free or variously connate, frequently flattened into a discoid, shallowly lobed calyx; stamens 3, usually connate. Female flowers: sepals shortly connate, spreading, persistent; ovary 3-locular; ovules 2 per locule; styles free or connate; stigmas usually bifid. Fruit subspherical, weakly lobed, occasionally fleshy and berry-like, subtended by enlarging sepals. Seeds up to 6, trigonous.

A genus of c. 50 species, distributed from SE Asia to Australia; 1 species on Christmas and Cocos (Keeling) Islands. The Australian genus *Synostemon* F.Muell. has recently been combined with *Sauropus* (H.K.Airy Shaw, *Kew Bull.* 35: 870, 1980). This extended genus has a highly unusual distribution pattern, with distinct centres of diversity in SE Asia and Australia.

*Sauropus androgynus (L.) Merr., *Bull. Bur. Forest. Philipp. Islands* 1: 30 (1903)

Clutia androgyna L., *Mant. Pl.* 1: 128 (1767). T: India, Herb. C.Linnaeus 1206.14; syn: LINN. Epithet from the Greek *andros* (man) and *gynos* (woman), signifying that the inflorescence contains both male and female flowers.

Trailing shrub, 1–3 m tall, monoecious, glabrous. Leaves narrowly ovate, obtuse to rounded at base, subacute, pale green beneath; lamina 2–8 cm long; petiole 2–8 mm long; stipules triangular, 1–3 mm long, with scarious margins. Flowers in axillary clusters. Male flowers: calyx c. 4–7 mm diam., discoid, flat, weakly and irregularly lobed, fleshy, green; stamens 3, connate, immersed in calyx; anthers small, hardly exserted. Female flowers c. 6–8 mm diam.; sepals 6, in 2 whorls, connate at base, obovate, spreading, obtuse or rounded, persistent, enlarging, dark red; styles 3, free, short; stigmas broad, cordate, horizontal, bifid, red. Fruit subspherical, c. 1.5 cm diam., impressed at apex and base, 3-lobed, fleshy and berry-like, whitish. *Chekop manis*, *Chermela hutan*, *Keretu*, *Tarok manis*.

Christmas Is., Cocos (Keeling) Is. Uncommon on Christmas Is., having escaped from cultivation and become naturalised in a few areas. On Cocos (Keeling) Is. recorded as naturalised on Home Is. in disturbed strand forest. Distributed from India and S China, through Indo-China and Malesia, to the Philippines and New Guinea.

Ch.Is.: Grants Well, *D.A.Powell 41* (K); above Ross Hill Gardens, in old Castilla plantation, *B.A.Mitchell 87* (CBG, K); secondary growth at Grants Well, *R.Shivas 808* (PERTH); Grants Well, *D.J. & B.P.Du Puy CI66* (CBG, K). C.K.Is.: Home Is., *I.R.Telford 10072 & C.Howard* (CBG, K).

The discoid male flowers are highly distinctive. The plants may appear to be dioecious, as the different sexes open sequentially and the branchlets are often found with open flowers of 1 sex only. In the Philippines and New Guinea, this species becomes a climbing shrub, rather than scrambling or trailing. The leaves taste sweet and are used as spinach by both the Chinese and Malay communities on Christmas Is. and the Cocos Malay community. The fruits are used to prepare a sweetmeat on Java. A decoction of the roots may be used medicinally against fever and the roots and leaves are sometimes pounded for use as a poultice.

2. PHYLLANTHUS

Phyllanthus L., *Sp. Pl.* 2: 981 (1753); *Gen. Pl.* 5th edn, 422 (1754); from the Greek *phyllon* (a leaf) and *anthos* (a flower), the flowers often being produced along leafy, lateral branches that appear like compound leaves, or are occasionally reduced to phylloclades.

Type: *P. niruri* L.

Trees, shrubs or herbs, mostly monoecious, usually glabrous, without milky sap. Branches sometimes reduced to phylloclades. Leaves alternate, frequently distichous along short, deciduous branchlets resembling pinnate leaves, simple, pinnately veined; petiole short; stipules various. Flowers usually in axillary clusters, sometimes combined into raceme-like or panicle-like inflorescences, sometimes cauliflorous; sepals usually 4–6, connate at base, often 2 whorled, imbricate; petals absent; disc usually glandular. Male flowers: stamens usually 3–5, free or connate. Female flowers: ovary usually 3-locular; ovules 2 per locule; styles free or shortly connate; stigmas bifid, spreading. Fruit usually a 3-locular capsule or schizocarp, rarely drupaceous. Seeds up to 6, trigonous.

A pantropical and subtropical genus of more than 750 species, occasionally extending into temperate regions. The genus has its greatest diversity in SE Asia, and there are c. 50 species in Australia including several endemic species; 2 naturalised species occur on Christmas Is., 1 of which also occurs on Cocos (Keeling) Is. A few species are cultivated as ornamentals, especially those with phylloclades such as *P. angustifolius* (Sw.) Sw. and *P. arbuscula* (Sw.) J.G.Gmel. Others, such as *P. urinaria* L. and *P. amarus*, are troublesome weeds. *Phyllanthus acidus* is cultivated on Cocos (Keeling) Is. for its edible acidic fruit but is not naturalised.

G.L.Webster, A monographic study of the West Indian species of *Phyllanthus*, *J. Arnold Arbor.* 37: 91–122, 217–268, 340–359 (1956); 38: 51–80, 170–198, 296–373 (1957); 39: 49–100, 111–205 (1958).

Herb; leaves 2–11 mm long; flowers mostly in pairs from axils of leaves on deciduous branchlets that resemble compound leaves; sepals usually 5; stamens connate into a column; fruit a 3-locular capsule **1. P. amarus**

Shrub or small tree; leaves c. 5–8 cm long; flowers in clusters combined into raceme-like inflorescences, from older, leafless branches; sepals usually 4; stamens free; fruit drupaceous, fleshy, with a bony, 3- or 4-lobed endocarp **2. P. acidus**

1. *Phyllanthus amarus Schumach. & Thonn., *Beskr. Guin. Pl.* 421 (1827); *Kongl. Danske Vidensk. Selsk. Skr.* 4: 195–196 (1829)

T: Guinea [Ghana], West Africa, *H.Thonning 4*; holo: C *n.v.*, iso: C *n.v.*, K, *fide* A.Radcliffe-Smith, *Fl. Trop. E.Africa*, Euphorbiaceae 1: 58 (1987). Epithet from the Latin *amarus* (bitter), descriptive of the flavour of the leaves.

[*P. niruri auct. non* L.: C.W.Andrews, *Monogr. Christmas Is.* 187 (1900)]

Illustrations: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr Atlas.* t. 880 (1938); F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 265, fig. 42 (1980).

Herb 10–80 cm tall, monoecious, glabrous. Deciduous branchlets 4–12 cm long, with c. 15–40 distichous leaves, resembling a pinnate leaf. Leaves oblong, obtuse and slightly oblique at base, rounded, glaucous beneath; lamina 2–11 mm long; petiole c. 0.5 mm long. Flowers minute, mostly in pairs of 1 female and 1 male, in leaf axils on deciduous branchlets. Sepals usually 5, elliptic, acute; margin conspicuous, white, scarious. Male flowers: sepals c. 0.5 mm long; disc 5-glandular; stamens usually 3, connate into a column. Female flowers: sepals c. 1 mm long; ovary 3-locular; styles 3, short, free, spreading; stigmas shallowly bilobed. Capsule c. 1.5–2 mm diam., obtusely 3-lobed, decurved, in a single file beneath the deciduous branchlets. *Dukong Anak.* Fig. 44D–E.

Christmas Is., Cocos (Keeling) Is. Common on Christmas Is. in the area of Settlement and Phosphate Hill, especially in gardens, on roadsides and in disturbed soil, preferring a somewhat shaded situation. On Cocos (Keeling) Is. a weed of disturbed places around the

settlement. A pantropical weed of cultivation, probably native to the Caribbean. The most abundant species of the genus in Malesia.

Ch.Is.: towards South Point, *H.N.Ridley 127* (K); Flying Fish Cove, *H.N.Ridley 128* (K); Settlement, *D.A.Powell 8* (K); Phosphate Hill area, *B.A.Mitchell 143* (CBG, K); track entering Natl Park E of Stewart Hill, *D.J. & B.P.Du Puy CI33* (CBG, K). C.K.Is.: near settlement, West Is., *I.R.Telford 9963 & C.Howard* (CBG).

Said to contain high amounts of potash and a bitter-tasting compound, phyllanthin. It is used medicinally as a diuretic, in the treatment of diarrhoea, mild fever, children's coughs, gonorrhoea and syphilis. It is used on Christmas Is. to treat kidney complaints.

Somewhat resembles the compound-leaved *Sesbania bispinosa* (Fabaceae) in its vegetative habit.

2. *Phyllanthus acidus (L.) Skeels, *U.S. Dept. Agric. Bur. Pl. Ind. Bull.* 148: 17 (1909)

Averrhoa acida L., *Sp. Pl.* 1: 428 (1753); *Cicca acida* (L.) Merr., *Inter Rumph. Herb. Amboin* 314 (1917). T: Sri Lanka, Herb. P.Hermann, illustr. no. 179 in vol. 5: 306; syn: BM; H.A.Rheede, *Hort. Malab.* 3: 57, t. 47, 48 (1682); syn. Epithet from the Latin *acidus* (acid or sour), reflecting the taste of the fruit.

Illustration: A.B.Graf, *Tropica* 429 (1978).

Shrub or small tree, c. 2–8 m tall, monoecious, glabrous; branchlets thick. Deciduous branchlets 20–40 mm long, with c. 10–40 distichous leaves, resembling a pinnate leaf. Leaves ovate, obtuse to rounded at base, acute, glaucous beneath; lamina c. 3–8 cm long; petiole 2–4 mm long. Flowers minute, in clusters along leafless shoots on older branches. Sepals usually 4, elliptic, c. 1–1.5 mm long, rounded to obtuse, light green or reddish. Male flowers: disc 4-glandular; stamens 4, free. Female flowers often with staminodes; ovary 3- or 4-locular; styles 3 or 4, shortly connate; stigmas deeply bifid. Drupe 1.7–2.3 cm diam., 6- or 8-ridged, fleshy, pale yellow; endocarp bony, 3- or 4-lobed. *Otaheite Gooseberry, Chermai*.

Christmas Is. Originally introduced as a garden plant but has spread rapidly in recent years. Cultivated on Cocos (Keeling) Is. for its fruit, but not naturalised. A widely cultivated, tropical species, probably native to the coastal region of north-eastern Brazil. It occurs throughout Malesia.

Ch.Is.: Drumsite, *D.A.Powell 93* (K); central area work quarry, *R.Shivas 892A* (PERTH).

The fruit is edible, with a sour, apple-like flavour, and is either eaten raw, sometimes with salt, or unripe as a flavouring in cooked dishes. It can also be used with other fruit to make sweet preserves. The root has medicinal value in Malaysia where it is boiled and the vapour inhaled to treat colds or headaches. There is a strong superficial resemblance between this species and the compound leaved *Averrhoa bilimbi* L. (Oxalidaceae), which probably grows sympatrically in the coastal forests in north-eastern Brazil.

3. ALEURITES

Aleurites J.R.Forst. & G.Forst., *Char. Gen. Pl.* 111, t. 56 (1776); from the Greek *aleurites* (floury), descriptive of the pale, mealy indumentum on the young shoots of the type species.

Type: *A. triloba* J.R.Forst. & G.Forst. = *A. moluccana* (L.) Willd.

Tall trees, monoecious, often with milky sap; indumentum of simple to stellate hairs. Leaves alternate, simple or sometimes palmately lobed, with 3–7 basal, palmate veins; petiole long, with 2 apical glands; stipules minute. Inflorescence terminal or axillary, much-branched, thyrsoid, with many flowers, mostly male. Calyx irregularly or valvately splitting into 2–5 lobes. Petals 5, free. Disc glandular. Male flowers: stamens 7–20 in 2–4 whorls, the outer free, the inner connate into a column. Female flowers terminal, larger than male flowers; ovary 2–5-locular; ovules 2–5 per locule; styles 2–5, free, bilobed. Fruit large, drupaceous, indehiscent. Seeds 1–5, large, oily, with thick testa.

A genus of c. 5 species, distributed from SE Asia to the Pacific islands; 1 species in

Australia and on Christmas Is. *Aleurites fordii* Hemsl., from southern China, yields Tung Oil, a drying oil used commercially in the manufacture of high quality, waterproof varnishes, and of paints and linoleum.

***Aleurites moluccana** (L.) Willd., *Sp. Pl.* 4: 590 (1805)

var. **moluccana**

Jatropha moluccana L., *Sp. Pl.* 2: 1006 (1753). T: Sri Lanka, Herb. P.Hermann 348, vol. 2. fol. 45; vol. 3, fol. 27; vol. 4. fol. 8; illustr. in vol. 5. fol. 232; syn: BM. Epithet in reference to the Moluccas where the type was collected.

Illustrations: E.J.H.Corner, *Wayside Trees of Malaya* 2: pl. 55 (1940); A.B.Graf, *Tropica* 407 (1978).

Tree to 15 m tall; branchlets thick; young shoots and inflorescences pale brown tomentose. Leaves triangular to ovate, cordate to truncate at base, entire, sometimes palmately 3- or 5-lobed, acute, stellate-pubescent, glabrescent; lamina 7–24 cm long; petiole 5–17 cm long. Thyrses c. 9–17 cm long, terminal. Flowers scented. Calyx irregularly 2- or 3-lobed. Petals 5. Male flowers: pedicels c. 1 cm long; petals narrowly oblong, c. 6 mm long, cream; stamens c. 20 in 4 whorls, forming a column. Female flowers: petals c. 10 mm long; ovary bilocular, tomentose; styles 2. Fruit c. 4–5 cm long, subspherical with 1 seed, or broader, bilobed, with 2 seeds. Seed nut-like; testa bony. *Candlenut Tree*, *Buah Keras*.

Christmas Is. Introduced, occurring along the South Point to Drumsite railway and in the Settlement area. The natural distribution is difficult to determine, as it is widely cultivated and semi-naturalised throughout the tropics and subtropics, including the New World. In SE Asia it occurs from India and southern China, through Indo-China, Malesia, the Philippines and New Guinea to northern Australia (Qld), the Pacific islands and New Zealand.

Ch.Is.: South Point to Drumsite railway, at the 5 mile [8 km] peg, *D.A.Powell 17* (K); Drumsite Rd., c. 1 km from Settlement, *A.Pearson P64*, *P89* (K); Drumsite School precinct, *B.A.Mitchell 190* (CBG, K).

The tomentose young leaves of this species give the crown of the tree a characteristic silver-white appearance. The male flowers mature later than the females in the same inflorescence. The seed kernels contain c. 60% of an oil, mainly used in the manufacture of soap and paint, but also used medicinally as a purgative and as a tonic hair oil. In Java the kernels are pounded together with cotton and copra and then formed into candles around a bamboo splint. The soot produced from these candles is sometimes used as an eye cosmetic. The fermented kernels are used in small amounts in Javanese sauces. In Malesia, the nuts are used by children in games of 'conquerors' or 'conkers'. The var. *floccosa* Airy Shaw (*Kew Bull.* 20: 28, 393, 1966), with a 3- or 4-locular ovary and fruit, occurs in New Guinea and Australia (Qld).

4. CROTON

Croton L., *Sp. Pl.* 2: 1004 (1753); *Gen. Pl.* 5th edn, 436 (1754); from the Greek *kroton* (a tick), also used as a name for *Ricinus communis* L. from the resemblance of the seed to this arachnid. The name was arbitrarily applied by Linnaeus to the present genus.

Type: *C. tiglium* L.

Trees, shrubs or herbs, occasionally scandent, mostly monoecious, usually stellate-hairy or lepidote; sap often coloured. Leaves alternate, usually simple, toothed, often glandular; venation entirely pinnate, or palmate at base; petiole with 2 apical glands; stipules small. Inflorescences terminal, racemose, or clustered, usually male distally and female basally, sometimes unisexual; flowers usually 5–many, with a glandular disc. Male flowers mostly in small clusters; sepals imbricate to valvate; petals free, often lanate at apex; stamens few to many, free, inserted on a hairy receptacle. Female flowers: sepals persistent; petals often reduced; ovary usually 3-locular; ovules usually 1 per locule; styles 3, free or connate at base, 2- or 4-lobed. Schizocarp 3-locular, smooth or muricate.

A large, pantropical and subtropical genus of c. 800 species, with greatest diversity in S

America; 1 species on Christmas Is. The seeds of *Croton tiglium* L., from tropical Asia, yield Croton oil, an extremely potent purgative. This plant is also useful in its ability to grow strongly enough in poor soil to suppress the coarse, weedy grass *Imperata cylindrica* (L.) P.Beauv. (Lalang). The bark of *Croton eluteria* (L.) Sw., from the West Indies, yields cascarilla, an aromatic laxative, also used to prepare liqueurs, tobacco and perfume. The cultivated 'Croton' is *Codiaeum variegatum* (L.) A.Juss. (Euphorbiaceae).

The lectotypification of the genus was disputed by G.L.Webster, *J. Arnold Arbor.* 48: 354 (1967), on the grounds that *C. tiglium* does not belong to the type section. As this does not preclude its selection as a lectotype species, the earlier lectotypification is maintained following J.K.Small, *Ill. Fl. N. U.S.* 2nd edn, 2: 454 (1913).

Croton caudatus Geiseler, *Croton Monogr.* 73 (1807)

T: E India, *J.P.Rottler*; *n.v.* Epithet from the Latin *cauda* (a tail), in reference to the long, unbranched inflorescences.

Climbing or sprawling shrub 4–25 m tall, stellate hairy. Leaves ovate to oblong, irregularly dentate, cordate at base, shortly acuminate, with 3–5 basal, palmate veins, glandular; lamina c. 4–17 cm long; petiole 1–4 cm long; stipules deeply divided into filiform segments. Inflorescence usually slender, long, entirely male or with female flowers towards base. Male flowers: sepals 5, oblong, c. 2 mm long, valvate; petals narrowly obovate, c. 3 mm long, with woolly margins; stamens 18–30, exceeding numerous short hairs. Female flowers: sepals 5, oblong, 3–4 mm long; petals minute; ovary densely hairy; styles 3, bifid. Fruit subglobose, c. 20–22 mm diam., woody, muricate. Seeds c. 1 cm long, sparsely hairy.

Christmas Is. Common on all terraces, preferring exposed positions in open forest, especially on limestone cliffs and associated scree slopes. A widely distributed species in SE Asia from India and S China through Indo-China and Malesia to the Philippines and northern Australia (Qld).

Ch.Is.: cliffs overlooking Flying Fish Cove, *D.A.Powell 435* (K); high limestone cliffs overlooking the golf course, *D.A.Powell 436* (K); shore terrace, North West Point, *D.A.Powell 444* (K); Poon Saan Rd, bordering Settlement, *B.A.Mitchell 167* (CBG, K).

The old leaves become bright orange-red, making this a conspicuous climber. A decoction of the root causes purging and can be used to treat constipation. The twigs may be used in basket work, but the wood itself splits on drying.

5. MANIHOT

Manihot Mill., *Gard. Dict. Abr.* 4th edn, 2 (1754); the native Brazilian name for cassava.

Type: not designated.

Herbs, shrubs or trees, monoecious, with milky sap; roots often tuberous. Leaves spirally arranged, palmately lobed; upper leaves sometimes entire, usually glabrous, paler beneath; petiole long; stipules caducous. Inflorescence terminal or pseudoaxillary through the dominant growth of a subtending axillary bud, paniculate or racemose, sometimes unisexual. Flowers unisexual, campanulate. Sepals 5, connate, petaloid, fleshy, imbricate. Petals absent. Disc 5-lobed; lobes bifid. Male flowers usually many; sepals partially connate; stamens 10, free, alternating with disc lobes, in 2 whorls; pistillode small or absent. Female flowers few, towards base of inflorescence; sepals ±free; ovary 3-locular; ovule 1 per locule; style short, 3-branched; stigmas broad. Schizocarp subspherical, sometimes winged.

A genus of 100–150 species distributed in the New World from the SW United States to Argentina, with greatest diversity in Brazil; 2 species on Christmas Is. Several species have been widely cultivated in the tropics for food, including on Christmas and Cocos (Keeling) Islands (*M. esculenta*) and for rubber made from the latex (*M. glaziovii*), although the latter is now infrequently cultivated. Both these species have become naturalised on Christmas Is.

Leaves not peltate, with narrow, obovate to elliptic, acuminate lobes; stipules bifid; sepals in male flowers 8–10 mm long; schizocarp with 6 narrow, undulating wings; seeds c. 10 mm long **1. M. esculenta**

Leaves narrowly peltate at base, with broad, obovate, rounded to apiculate lobes; stipules entire; sepals in male flowers 12–15 mm long; schizocarp not winged; seeds c. 13–14 mm long **2. M. glaziovii**

1. *Manihot esculenta Crantz, *Inst. Rei Herb.* 1: 167 (1766)

Jatropha manihot L., *Sp. Pl.* 2: 1007 (1753). T: South America, Herb. C.Linnaeus 1141.11; syn: LINN. Epithet from the Latin *esca* (food), as the tuberous root is edible.

Illustration: A.B.Graf, *Tropica* 428 (1978).

Shrub c. 2–4 m tall, glabrous, with milky sap; root large, tuberous; bark pale. Leaves usually palmately 3–7-lobed to near base, not peltate, glaucous beneath; lobes narrowly elliptic to obovate, 5–20 cm long, acuminate; petiole c. 5–20 cm long; stipules bifid. Inflorescence 2.5–21 cm long, racemose or paniculate, lax, in apical clusters of c. 3–5. Flowers campanulate. Sepals 5, elliptic, hairy within, yellowish, often streaked or stained red. Disc 10-lobed. Male flowers: sepals 8–10 mm long, connate in basal half; stamens 10. Female flowers: sepals 10–12 mm long, ±free; stigmas fleshy, crisped. Fruit subspherical, c. 14–17 cm long, warty; wings six, narrow, undulating; seeds 3, c. 10 mm long, mottled brown and grey, glossy. *Cassava*, *Manioc*, *Ubi Kayu*.

Christmas Is. Cultivated and now a common wayside plant in any area cleared of natural vegetation; also cultivated on Cocos (Keeling) Is. Probably native to tropical Brazil, but cultivation in S America is so widespread that the wild distribution has become obscured. Now widely cultivated throughout the tropics.

Ch.Is.: no precise locality, *D.A.Powell 697* (K).

The edible, tuberous root is an extremely important carbohydrate source throughout the tropics; however, it is low in protein and is therefore inferior to yams or taro. The tuber is poisonous when raw, containing prussic (hydrocyanic) acid which is highly water-soluble and the bitter glycoside phaseolutin. These 2 chemicals are freed by an enzyme which is denatured after boiling or roasting, rendering the tuber safe to eat. Other methods of preparation include grinding into meal, pressing to extract the bitter juice, and finally cooking and drying to produce an edible flour. The starch can also be extracted and eaten as tapioca, used as arrowroot or fermented for alcohol. Sweet cultivars have also been selected, with low amounts of the bitter chemicals in the cortex of the tuber. The young leaves may be eaten boiled. The species is easily propagated by cuttings or seed.

2. *Manihot glaziovii Müll.Arg. in C.P.Martius, *Fl. Bras.* 11: 446–447 (1874)

T: Brazil, *A.F.M.Glaziou 1022*; *n.v.* Epithet after A.F.M.Glaziou (1828–1906), a French engineer and botanical collector in Brazil.

Shrub or tree c. 4–10 m tall, glabrous, with abundant milky sap; root not tuberous; bark glossy brown, often peeling. Leaves usually deeply palmately 3–5-lobed, narrowly peltate, glaucous beneath; lobes obovate, 5–20 cm long, rounded to apiculate; petiole c. 5–20 cm long; stipules slender, entire. Inflorescence 2–15 cm long, racemose or paniculate, in pseudoaxillary clusters of 1–5. Flowers campanulate. Sepals 5, elliptic, pubescent within, greenish outside, purple at base inside. Disc 10-lobed. Male flowers: sepals 12–15 mm long, connate in basal half; stamens 10. Female flowers: sepals c. 13–16 mm long, ±free; stigmas fleshy, crisped. Fruit subspherical, c. 15–20 mm long, warty, not winged; seeds 3, c. 13–14 mm long, compressed, dark mottled brown, glossy. *Ceara Rubber Tree*, *Manicoba*.

Christmas Is. Very common in secondary growth on Ross Hill Gardens and along some of the drill lines. It was probably introduced c. 1910 to an experimental plantation for rubber above Ross Hill Gardens. Its seeds are spread by machinery during the clearing of vegetation. A native of northern Brazil, formerly widely cultivated in the tropics, but now mainly abandoned. Its native habitat is subject to extremely dry periods, and it can tolerate

much drier conditions than the rubber tree (*Hevea brasiliensis*).

Ch.Is.: Ross Hill Gardens, *D.A.Powell 401* (K); near Drumsite to Airport road, *D.J. & B.P.Du Puy CI27* (CBG, K).

This species produces large amounts of latex which yields a rather resinous rubber. It was widely cultivated prior to the First World War, especially in eastern Africa, but is now rarely planted. Its seeds contain c. 10–15% (by weight) of a slow-drying oil.

6. CLAOXYLON

Claoxylon A.Juss., *Euphorb. Gen.* 43, t. 14, fig. 43 (1824); from the Greek *klao* (to break) and *xylon* (wood), as the wood is brittle and breaks easily.

Type: *C. parviflorum* A.Juss.

Shrubs or small trees, usually dioecious, without milky sap. Leaves alternate, simple, usually toothed, becoming purplish when withering, pinnately veined; petiole often long; stipules small. Inflorescence axillary, usually simple, raceme-like, slender; flowers small. Male flowers in small clusters; sepals usually 3 or 4, valvate; petals absent; stamens 10–200, free, interspersed with many erect glands; anthers of 2 almost free cells. Female flowers not clustered; sepals usually 3 or 4, valvate; petals absent; disc lobed, with inconspicuous nectaries; ovary 2–4-locular; ovules 1 per locule; styles 3, spreading. Schizocarp 2–4-lobed; lobes often deeply separated. Seeds with a fleshy outer layer.

A tropical and subtropical genus of c. 70–80 species, distributed throughout the Old World and extending into Australia and the Pacific islands; 3 endemic species in Australia; 1 species native on Christmas Is.

Claoxylon indicum (Reinw. ex Blume) Hassk., *Cat. Hort. Bot. Bogor.* 235 (1844)

Erythrochilus indicus Reinw. ex Blume, *Bijdr.* 615 (1825). T: Java, Herb. C.G.C.Reinwardt; *n.v.* Epithet from the Latin *Indicus* (Indian), although the type specimen was probably collected in Java, at that time part of the Dutch East Indies.

C. caerulescens Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 223 (1906). T: Phosphate Hill & near Rocky Point, Christmas Is., 1904, *H.N.Ridley 182 & 132A*; syn: K.

[*C. rubescens auct. non* Miq.: C.W.Andrews, *Monogr. Christmas Is.* 188 (1900)]

[*C. polot sensu* Merr., *Interpr. Rumph. Herb. Amboin.* 200 (1917), *non Croton polot* Burm.f.]

Illustration: E.J.H.Corner, *Wayside Trees of Malaya* 1: 245, fig. 74 (1940).

Pyramidal shrub or small tree c. 2–10 m tall, dioecious; branchlets thick, hairy, whitish, with large leaf scars. Leaves ovate to elliptic, cordate to cuneate at base, serrate to sinuate, acuminate, softly hairy beneath; lamina c. 8–30 cm long; petiole 2–7 cm long, tomentose, with 2 apical glands. Male inflorescence c. 3–15 cm long, slender; flowers many; sepals ovate, c. 2 mm long, tomentose; stamens 15–25, exceeding the many hairy glands. Female inflorescence c. 1.5–8 cm long; flowers small, few to many; sepals 3 or 4, triangular, c. 2 mm long, pubescent; ovary densely pubescent. Fruit 7–10 mm diam., 3- or 4-lobed, with raised sutures, tomentose, hairy inside. Seeds subspherical, wrinkled, black. Fig. 44F–G.

Christmas Is. Common on roadsides, railways and clearings in the primary and marginal forests. Also found in secondary vegetation where it has a more shrubby habit, with longer, pendulous branches and larger leaves. Widely distributed in SE Asia from India and S China through Indo-China and Malesia east to Sulawesi.

Ch.Is.: Rocky Point, *C.W.Andrews 112* (BM, K); South Point to Drumsite railway, *D.A.Powell 113* (K); railway line between camp 5 and South Point, *B.A.Mitchell 57* (CBG, K); adjacent to access track entering Dales, *B.A.Mitchell 170* (CBG, K); central plateau region, *R.Shivas 805* (PERTH).

A conspicuous characteristic of this species is that cut or damaged tissue, especially the

underbark, assumes an indigo-blue colour. The withering leaves also become purplish. The leaves may be used medicinally as a purgative. The specimens from Christmas Is. appear to be unusually hairy, especially on their fruit, but there is a complete range of variation with specimens from other regions and there is no evidence to support the separation of a distinct taxon.

Claoxylon indicum is frequently referred to as *C. polot* (Burm.f.) Merr., but E.J.H.Corner (*Gard. Bull. Straits Settlem.* 10: 292–294, 1939) argued that the basionym, *Croton polot* Burm.f. cannot be considered conspecific with *C. indicum*. This view was followed by H.K.Airy Shaw (*Kew Bull.* Add. Ser. 4 (1975); *op. cit.* 8 (1980)), and is accepted here.

7. ACALYPHA

Acalypha L., *Sp. Pl.* 2: 1003 (1753); *Gen. Pl.* 5th edn, 436 (1754); from the Greek name *acalyphe* (nettle) from the resemblance of the leaves to those of the stinging nettle (*Urtica dioica* L., Urticaceae).

Type: *A. virginica* L.

Herbs, shrubs or small trees, usually monoecious, without milky sap. Leaves alternate, often toothed, sometimes with 3 or 5 main veins from base, often dotted with minute, pellucid glands; stipules slender. Inflorescence bracteate, axillary or terminal, spike-like, rarely branched, bisexual (on Christmas Is.) or unisexual. Male flowers usually minute, clustered; sepals 4, valvate; stamens usually 3, free; anthers narrow, twisted. Female flowers in clusters of c. 1–4 in axils of often-leafy bracts; sepals usually 3, imbricate; ovary usually 3-locular; ovule 1 per locule; styles laciniate. Schizocarp usually 3-lobed, sometimes enclosed in the enlarging bract.

A pantropical and subtropical genus of 400–450 species, occasionally extending into temperate regions; 2 Old World species occur on Christmas Is. and Cocos (Keeling) Is. A third species, *A. arvensis* Poepp. & Endl., from central America and the West Indies, has been recorded as a weed in the Malay kampong, Flying Fish Cove, although no specimen has been available for confirmation. It closely resembles the other 2 species on Christmas Is. in its habit and rhomboidal to ovate, serrate leaves. It can easily be distinguished by the long, spreading hairs on the stems, its very condensed, hairy inflorescence and the filiform teeth c. 5 mm long on the bracts subtending the female flowers.

Two species of *Acalypha* are of horticultural value; *A. hispida* Burm.f. has very showy, long, red, female inflorescences and *A. wilkesiana* Müll.Arg. has multicoloured and variegated leaves in a wide variety of shapes and colour combinations.

F.Pax & K.Hoffmann, Acalyphinae, *Pflanzenr.* IV, 147, XVI: 12–178 (1924).

Hairs on stems upcurved; leaves pubescent only on veins beneath; inflorescence 1 per axil; bracts subtending female flowers not closely parallel-veined, very sparsely appressed-pubescent with few, broad, shallow teeth; schizocarp minutely glandular pubescent **1. A. indica**

Hairs on stems decurved; leaves with scattered hairs and densely hairy veins beneath; inflorescences often more than 1 per axil; bracts subtending female flowers closely parallel-veined, densely hairy with some glandular hairs and with many, narrow, acute teeth; schizocarp pubescent **2. A. lanceolata**

1. *Acalypha indica L., *Sp. Pl.* 2: 1003 (1753)

T: Ceylon [Sri Lanka], Herb. P.Hermann 841, vol. 8, fol. 2; syn: BM. Epithet from the Latin *Indicus* (Indian), indicating the provenance of the type specimen.

Illustrations: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 386 (1939); F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 255, fig. 40 (1980).

Erect, annual herb 10–100 cm tall; hairs on stems upcurved. Leaves rhomboidal to ovate, cuneate at base, serrate in apical half, acute, 3- or 5-veined from base, with minutely

pubescent veins beneath; lamina c. 1–7 cm long; petiole c. 0.5–7 cm long, slender, pubescent. Inflorescences usually axillary, solitary, bisexual, with a short, apical male portion, often terminated by an abnormal T-shaped flower. Male flowers c. 0.5 mm long. Bracts subtending female flowers 3–4 mm long, funnel-shaped, enlarging to 4–6 mm long in fruit, broadly and shallowly dentate, very sparsely appressed-pubescent on the veins, not closely parallel veined. Fruit c. 2.5 mm diam., 3-lobed, minutely glandular-pubescent.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. it commonly occurs in Settlement and Drumsite and is spreading along roadsides and railway lines. On Cocos (Keeling) Is. recorded from *Cocos* plantations and disturbed *Calophyllum* forest in coralline sand. A widespread species in the Old World tropics, from western Africa, the Mascarenes and India, through Indo-China and Malesia (except Borneo) to the Philippines, New Guinea and Timor; naturalised in Mexico, Central America and the West Indies.

Ch.Is.: no precise locality, common wayside herb, *D.A.Powell 424* (K); alongside railway line near Camp 4, central plateau, *B.A.Mitchell 119* (CBG, K); road to Waterfall, *R.Shivas 898B* (PERTH). C.K.Is.: Direction Is., *D.G.Williams 122* (AD, CBG); N of copra drying sheds, Home Is., *D.G.Williams 177* (CBG, K, PERTH).

A decoction of the leaves may be used as a laxative or a purgative.

2. ***Acalypha lanceolata** Willd., *Sp. Pl.* 4: 524 (1805)

T: J.Burman, *Thes. Zeylan.* 205, t. 93, fig. 2 (1737), fide A.Radcliffe-Smith, *Kew Bull.* 45: 677 (1990). Epithet from the Latin *lanceolatus* (spear-shaped), in reference to the leaf shape.

A. fallax Müll.Arg., *Linnaea* 34: 48 (1865). T: Peninsular India, *G.S.Perrottet 462, 463*; syn: *n.v.*; Peninsular India, *G.Thomson s.n.*; syn: *n.v.*

A. wightiana Müll.Arg., *Linnaea* 34: 43 (1865). T: India, *R.Wight*, N.Wallich Cat. no. 7780C; holo: K.

Illustration: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 385 (1939), as *A. boehmerioides* Miq.

Erect, annual herb 20–100 cm tall; hairs on stems decurved. Leaves ovate, obtuse to rounded at base, coarsely serrate to near base, shortly acuminate, 8- or 5-veined from base, with scattered hairs and densely hairy veins beneath; lamina c. 2.5–9 cm long; petiole c. 1.5–7 cm long, slender, pubescent. Inflorescences 1–4 per axil, bisexual, with a short, apical male portion, often with 1–3 abnormal T-shaped flowers in the transition zone. Male flowers c. 0.5 mm long. Bracts subtending female flowers 1–2 mm long, funnel-shaped, enlarging to 3–4 mm in fruit, with many, narrow, acute teeth, densely hairy with some glandular hairs, closely parallel-veined. Fruit c. 2.5–3 mm diam., 3-lobed, pubescent. Fig. 44H–J.

Christmas Is., Cocos (Keeling) Is. Common on Christmas Is. in Drumsite and Settlement and along roadsides. On Cocos (Keeling) Is. recorded as common on North Keeling Is. in *Pisonia grandis* forest in calcareous sand, with one record from disturbed strand forest of the main atoll. A locally common weedy species distributed from India and Indo-China through Malesia to New Guinea and the Pacific islands, including north-western Australia.

Ch.Is.: North East Point, *C.W.Andrews 157* (BM, K); common wayside herb, *D.A.Powell 423* (K). C.K.Is.: North Keeling Is., *I.R.Telford 10023 & C.Howard* (AD, CBG, K, MEL); 200 m E of landing place, North Keeling Is., *D.G.Williams 152* (CBG, PERTH); Home Is., *I.R.Telford 10049 & C.Howard* (CBG, K).

Acalypha indica and *A. lanceolata* both frequently have abnormal female flowers in the inflorescence. These flowers have only 1 fertile locule, and are roughly T-shaped. Their position in the inflorescence is characteristic for these species. They have been described and illustrated by A.Radcliffe-Smith, *Kew Bull.* 28: 525–529 (1973).

8. ALCHORNEA

Alchornea Sw., *Prodr.* 6: 98 (1788); after S.Alchorn (1727–1800), a British botanist.

Type: *A. latifolia* Sw.

Trees or shrubs, monoecious or dioecious, without milky sap. Leaves alternate, simple, usually crenate to serrate, pinnately or palmately veined; stipules small. Inflorescence axillary or terminal, racemose or spicate, sometimes branched, slender; flowers small. Male flowers in small clusters; sepals 2–5, valvate; petals absent; stamens 3–8, concave at base. Female flowers not clustered; sepals 4–8, sometimes glandular, imbricate, persistent; petals absent; disc lobed; ovary usually 3-locular; ovules 1 per locule; styles usually 3, spreading, sometimes shortly connate, often elongate. Schizocarp usually 3-locular, lobed or not, smooth or muricate.

A pantropical genus of c. 50 species; 3 species occur in Australia (Qld, N.S.W.), 2 of which are endemic, and *A. rugosa* which also occurs on Christmas Is.

Alchornea rugosa (Lour.) Müll.Arg., *Linnaea* 34: 170 (1865)

Cladodes rugosa Lour., *Fl. Cochinch.* 704 (1790). T: Vietnam (Cochinchina), *J. de Loureiro*; holo: BM. Epithet from the Latin *rugosus* (wrinkled), in reference to the leaves which Loureiro described as rugose.

[*Cleidion javanicum auct. non* Blume: C.W.Andrews, *Monogr. Christmas Is.* 188 (1900)]

Illustration: H.K.Airy Shaw, The Euphorbiaceae of Sumatra, *Kew Bull.* 36: 250, fig. B (1981).

Erect shrub or small tree, c. 2–5 m tall, dioecious; branchlets soon glabrescent. Leaves sometimes subopposite, elliptic to obovate, cuneate to narrowly obtuse at base, serrate, sometimes obscurely so, acuminate, pinnately veined, hairs confined to vein axils beneath; lamina 6–23 cm long; petiole c. 0.5–3 cm long, glabrous. Inflorescences unisexual, usually several in terminal cluster, usually branched, c. 3–20 cm long; rachis angular. Male flowers small, many, yellowish, in well-spaced clusters; sepals 2 or 3, ovate, concave, c. 1 mm long; stamens 4; filaments subulate. Female flowers subtended by glands; sepals c. 5–7, narrowly triangular; ovary pubescent; styles 3, free, long, recurved. Fruit c. 6–8 mm diam., 3-lobed, smooth, sparsely appressed-pubescent. Seed oblong-ellipsoidal, brown.

Christmas Is. Common on all terraces and occasionally on the plateau, where it occurs in clearings or in areas of shallow, limestone soil. Distributed from India and the Nicobar islands, throughout Malesia, to New Guinea and northern Australia (Qld).

Ch.Is.: Phosphate Hill, *H.N.Ridley 100 & 107* (K); Rocky Point, *H.N.Ridley 106* (K); Murray Hill, *H.N.Ridley 109A* (K); summit of Murray Hill, *D.A.Powell 780* (K); mining field 6, east of Hanitch Hill, *B.A.Mitchell 196* (CBG, K).

H.N.Ridley (*J. Straits Branch Roy. Asiat. Soc.* 45: 225, 1906) recorded that although the leaves are usually toothed, a distinct form with entire leaf margins occurred along Cemetery Rd. This species and *Aidia* aff. *racemosa* often form the dominant understorey on the upper terraces.

9. MACARANGA

Macaranga Thouars, *Gen. Nova Madagasc.* 26 (1806); probably from a Madagascan vernacular name.

T: *M. mauritiana* Bojer ex Müll.Arg.

Trees or shrubs, often exuding reddish gum, dioecious or occasionally monoecious; hairs simple. Leaves alternate, entire or palmately lobed, often peltate, often glandular, palmately to pinnately veined; petiole sometimes with apical glands; stipules often conspicuous, free or connate. Inflorescence axillary, spicate, racemose or paniculate. Flowers unisexual. Sepals 3 or 4, ±free to variously connate, valvate. Petals absent. Disc absent. Male flowers minute, in clusters; stamens 1–20, usually few; anthers 4-locular. Female flowers: sepals

persistent; ovary 1–6-locular; ovules 1 per locule; styles or stigmas 1–6, linear-subulate. Fruit a schizocarp or loculicidal capsule, smooth, angular, tuberculate, bristly or spiny. Seeds with fleshy testa. *Mahang*.

The c. 300 species in this genus are distributed in tropical Africa and Madagascar, and in SE Asia from India and S China through Indo-China and Malesia to Australia and the Pacific islands, with a centre of diversity in Malesia; 1 widespread species occurs on Christmas Is. They are often important in the development of secondary forest. Some species have hollow twigs inhabited by an ant that farms scale insects inside them, and in turn protect the tree from other insect predators.

Macaranga tanarius (L.) Müll.Arg. in A.de Candolle, *Prodr.* 15(2): 997 (1866)

Ricinus tanarius L., *Herb. Amboin.* 14 (1754); *Amoen. Acad.* 4: 125 (1759). T: illustration of *Tanarius minor* in G.E.Rumphius, *Herb. Amboin.* 3: t. 121 (1743). Epithet in reference to the species being a tanniniferous species.

Tree 5–20 m tall, producing sticky gum, dioecious; branchlets thick, finely pubescent. Leaves broadly ovate, rounded at base, occasionally weakly lobed, entire to weakly dentate, acuminate, conspicuously peltate, glandular-punctate, palmately veined, hairy on veins beneath; lamina 8–30 cm long; petiole 5–80 cm long, minutely velvet-hairy, glaucous; stipules free, triangular, c. 10–25 mm long, acuminate, subpersistent. Male inflorescence 3–15 cm long, paniculate, hairy; bracteoles conspicuous, entire to weakly toothed; flowers pale green; sepals 3, free, c. 1 mm long; stamens c. 9–16. Female inflorescence c. 3–5 cm long, racemose; ovary 3-locular, subovoid, glandular; stigmas 3, pubescent. Fruit turbinate, 7–9 mm long, 3-locular, bristly; bristles soft, 10–30 mm long, yellow-powdery. *Hairy Mahang, Kayu Merah*.

Christmas Is. Common principally in secondary forest on all terraces and in cleared areas of the primary forest on the plateau. Distributed throughout S China, Indo-China and Malesia to Australia (N.T., Qld, N.S.W.) and Melanesia.

Ch.Is.: Flying Fish Cove, *C.W.Andrews 64* (K); western side, northern plateau, *D.A.Powell 49* (K); central plateau, *B.A.Mitchell 59* (CBG, K); coastal terrace, near Dolly Beach, *B.A.Mitchell 138* (CBG, K); first terrace, NE of island, near Grotto, *R.Shivas 873* (PERTH).

Usually recognised by the conspicuously toothed bracts on the male inflorescences. On Christmas Is. the bracts are much more weakly toothed, and many are entire. Often gregarious, and important in the succession of vegetation that develops on disused quarries and other cleared areas. It grows rapidly, and can become quite a tall tree but never has a large girth and is eventually displaced by taller species, as it is intolerant of shade. The timber is tough, very lightweight and burns readily. The bark may be used for cordage and also has a high tannic acid content. A mixture of this acid and a gum is exuded from wounds as a sticky substance known as kino. This may be used in tanning, as an astringent, and also medicinally. H.N.Ridley (*J. Straits Branch Roy. Asiat. Soc.* 45: 224, 1906) noted that the seeds have a fleshy testa and are distributed by birds.

10. RICINUS

Ricinus L., *Sp. Pl.* 2: 1007 (1753); *Gen. Pl.* 5th edn, 487 (1754); the Latin word for a tick, which the seed is fancied to resemble.

Type: *R. communis* L.

Trees or shrubs, monoecious, glabrous, without milky sap. Leaves alternate, palmatifid, toothed, peltate; petiole long, glandular; stipules connate, leaving an annular scar. Inflorescence terminal, often appearing leaf-opposed through the growth of the subtending axillary bud, paniculate; upper flowers female; lower flowers male; bracts glandular. Flowers in cymose clusters. Sepals usually 5, valvate, often coherent. Petals absent. Disc absent. Male flowers: stamens very numerous, variously connate into branched clusters; anthers bilocular. Female flowers: ovary spherical, often echinate, 3-locular; ovule 1 per

locule; styles 3, short; stigmas bifid, papillose. Schizocarp subspherical, weakly 3-lobed, usually prickly.

A genus of 1 highly variable species that has been variously divided into several varieties and cultivars. It probably originated in tropical Africa, but is now very widely cultivated for its oil-bearing seed and has become common as a naturalised species throughout the tropics. Introduced on Christmas and Cocos (Keeling) Islands.

***Ricinus communis** L., *Sp. Pl.* 2: l007 (1753)

T: Herb. Hort. Cliff. 450, *Ricinus* 1; lecto: BM, *fide* A.Radcliffe-Smith, *Kew Bull.* 39: 794 (1984). Epithet is the Latin word for common.

Illustrations: G.L.Webster, *J. Arnold Arbor.* 48: 380, fig. 4 (1967); A.B.Graf, *Tropica* 428 (1978).

Shrub or small tree, 1–5 m tall. Leaves subcircular, palmately 7–11-lobed, green or reddish, often glaucous beneath; lobes elliptic, 5–50 cm long, irregularly serrate, acuminate; petiole 5–40 cm long, with several raised glands, glaucous; stipules 1–3.5 cm long, caducous. Inflorescence c. 5–15 cm long. Flowers unisexual. Sepals 5, elliptic, c. 7 mm long, acute, green, often not all separating at anthesis. Male flowers in complex branched clusters, yellow. Female flowers: ovary echinate; stigmas conspicuously papillose, red. Fruit 1.5–2.5 cm diam., with many fleshy prickles. Seeds ellipsoidal, 8–12 mm long, compressed, carunculate, brown streaked with grey. *Castor Oil Plant, Jarak.*

Christmas Is., Cocos (Keeling) Is. Common on Christmas Is. along many roads and among more open secondary vegetation. On Cocos (Keeling) Is. recorded only from Home Is. in calcareous sand in disturbed sites. Probably native to Africa, now naturalised throughout the tropics, including Malesia and Australia (W.A., S.A., Qld, N.S.W.).

Ch.Is.: no precise locality, *D.A.Powell 391* (K); no precise locality, *D.A.Powell 664* (K); roadside on central plateau, *R.Shivas 929* (PERTH). C.K.Is.: kampong, Home Is., *D.G.Williams 30* (CBG); kampong, Home Is., *I.R.Telford 10055 & C.Howard* (CBG, K).

The seeds contain c. 35–50% of castor oil which is well-known as a mild purgative, the active constituent being ricinoleic acid. It is a non-drying, viscous oil used as a fine lubricant. It is especially useful in aeroplane engines as it is insoluble in benzene. Also used in cloth printing, to carry aniline dyes. Other uses include the manufacture of inks, paints, plastics, soap and linoleum. The seed coat is extremely poisonous, containing the phytotoxin ricin (a toxalbumen), which is lethal in doses of 0.001 mg per kilo, making 4 seeds potentially deadly. This toxin causes blood coagulation, but its activity is destroyed at 100°C.

Two variants occur on Christmas Is., one with green leaves, the other with coppery red leaves. The latter is more frequently cultivated as an ornamental and is used extensively for medicines by the Chinese community.

11. EUPHORBIA

Euphorbia L., *Sp. Pl.* 1: 450 (1753); *Gen. Pl.* 5th edn, 208 (1754); after Euphorbius (court physician of Juba, King of Mauritania), who is reputed to have been the first to discover the medicinal properties of euphorbium, a resin from *E. resinifera* Bergius.

Type: *E. antiquorum* L.

Herbs, shrubs or small trees, monoecious, with milky sap, sometimes cactus-like. Leaves alternate or opposite, simple, sometimes greatly reduced; stipules small, absent or glandular. Flowers grouped in cyathia; cyathia usually in terminal or axillary clusters. Involucre of the cyathium 4- or 5-lobed, with 1, 4 or 5 apical, nectariferous glands. Male flowers represented by several articulated stamens in each cyathium. Female flowers solitary in each cyathium, consisting of a prominent ovary, sometimes subtended by a minutely 3-lobed perianth; ovary 3-locular, usually becoming exserted from involucre on an enlarging pedicel; ovule 1 per locule; styles 3, free to partially connate, bifid to simple.

Schizocarp 3-lobed, splitting into 3 mericarps. Seeds 3, carunculate. *Spurges*.

A cosmopolitan genus of c. 2000 species, with greatest diversity in subtropical and warm-temperate regions; 6 species occur on Christmas Is., 4 of which occur on Cocos (Keeling) Is. and 1 on the Coral Sea Is. The characteristic inflorescence structure, of several unisexual flowers combined into a cyathium, is a highly advanced modification. The individual cyathia function as whole flowers. All species produce a white latex that is often caustic and poisonous. Several species are important ornamentals, including *E. pulcherrima* Willd. (Poinsettia) with bright scarlet leaves below the inflorescence. The genus also includes several important weeds of cultivation.

S.Carter, *Fl. Trop. E. Africa*, Euphorbiaceae II, Euphorbieae: 409–533 (1988).

1 Leaves alternate; petiole 5–45 mm long; inflorescence terminal, corymbose; gland on involucre solitary, large

2 Leaves entire or serrulate; petiole to 4.5 cm long; leaves subtending inflorescence green, often with a pale or whitish base; seeds broadly ovoid **1. E. heterophylla**

2: Leaves pinnately 5 lobed, with a single, broad, rounded sinus on each side; petiole to 2 cm long; leaves subtending inflorescence bright red, at least in basal portion; seeds broadly ellipsoidal **2. E. cyathophora**

1: Leaves opposite; petiole 0.5–4 mm long; inflorescence axillary, not corymbose; glands on involucre 4, sometimes minute

3 Plant erect or ascending; leaves up to 85 mm long

4 Stem glabrous; leaves entire; inflorescence panicle-like; involucre c. 1.5–2 mm long, glabrous **3. E. atoto**

4: Stem conspicuously hairy; leaves serrulate; inflorescence capitate, subspherical; involucre c. 0.5 mm long, appressed-hairy **4. E. hirta**

3: Plant prostrate; leaves 2–6 mm long

5 Leaves with hairs confined to the apices beneath; stipules connate on underside of stem, forming a bifid scale; involucre hairy at apex; schizocarp stalked and exserted from involucre, hairy only on outer angles of lobes **5. E. prostrata**

5: Leaves evenly hairy beneath; stipules all free; involucre hairy all over; schizocarp short-stalked, its base enclosed by the involucre, uniformly hairy **6. E. thymifolia**

1. *Euphorbia heterophylla L., *Sp. Pl.* 1: 453 (1753)

T: illustration in L.Plukenet, *Phytographia* t. 112, fig. 6 (1691), from tropical America. Epithet from the Greek *heteros* (different, various) and *phyllon* (leaf), because of the different leaf shapes that can occur on individual plants.

Erect herb c. 20–50 cm tall, usually sparsely branched, often tinged reddish; petioles and young stems sparsely hairy; stems hollow. Leaves alternate, the upper ones opposite, broadly to narrowly elliptic, obtuse to cuneate at base, entire to serrulate, acute, sparsely hairy beneath and along margin above, glaucous beneath, the apical leaves pale basally; lamina c. 1.5–9 cm long; petiole 0.5–4.5 cm long; stipules modified as purplish glands. Inflorescence terminal, corymbose. Involucre campanulate, 2–3 mm long, glabrous; upper margin laciniate, with 5 main teeth. Gland solitary, trumpet-shaped. Styles c. 1.5 mm long, bilobed. Fruit c. 5–6 mm diam., glabrous. Seeds broadly ovoid, c. 3 mm long, warty.

Christmas Is. Common throughout Settlement, and an early coloniser of areas disturbed by mining. Native to Central America, but has become a pantropical weed of roadsides, open grassland, waste ground and rocky soil.

Ch.Is.: no precise locality, *D.A.Powell 171* (K); road to Murray Hill, *B.A.Mitchell 107* (CBG); entrance to golf course, *R.Shivas 820* (PERTH).

Some variants have lobed leaves, as in *E. cyathophora*, but these do not appear to occur in

Malesia. This species tends to develop into a single-stemmed plant.

2. *Euphorbia cyathophora Murray, *Commentat. Soc. Reg. Sci. Gott.* 7: 81–83, t. 1 (1786)

T: illustration in J.A.Murray, *loc. cit.* 7: t. 1. Epithet from the Greek *kuathos* (a cup) and *pherein* (to bear, to carry), in reference to the gland on the involucre.

Illustrations: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* 396 (1939); A.B.Graf, *Tropica* 426 (1978), as *E. heterophylla*.

Erect herb c. 15–70 cm tall, often branched; petioles and young stems sometimes with scattered hairs; stems hollow, ribbed. Leaves alternate, the upper ones opposite, cuneate at base, usually pinnately 5-lobed, triangular at apex, with a single, broad, rounded sinus on each side, usually sparsely hairy beneath; lamina c. 2–9 cm long; apical leaves nearly entire and bright scarlet at least in basal portion; petiole 0.5–2 cm long; stipules modified brownish glands. Inflorescence terminal, corymbose. Involucre cup-shaped, c. 4–5 mm long, glabrous; upper margin laciniate, with 5 main teeth. Gland solitary, cup-shaped. Styles c. 1.5 mm long, deeply bifid. Fruit c. 5 mm diam., glabrous. Seeds broadly ellipsoidal, c. 3 mm long, warty. *Mexican Fire Plant*.

Christmas Is., Cocos (Keeling) Is., Coral Sea Is. On Christmas Is. occurs in old mine sites. On Cocos (Keeling) Is. a common weed of disturbed sites on West Is. in coralline sand. On the Coral Sea Is. recorded only from Willis Is. where it grows in herbfield dominated by grasses in coralline sand. Native of Mexico and the West Indies, occasionally cultivated as an ornamental, and has become naturalised as a pantropical weed.

Ch.Is.: no precise locality, *D.A.Powell 106* (K); old mine site, 0.5 km N of airport, *R.Shivas 933* (PERTH); road to Waterfall at end of North Settlement, 3 June 1965, *P. van Tets* (CBG, GAUBA). C.K.Is.: near settlement, West Is., *I.R.Telford 9962 & C.Howard* (CBG, K); outside W boundary fence of Quarantine Stn, West Is., *D.G.Williams 117* (CBG, PERTH). C.S.Is.: Willis Is., 21 Dec. 1981, *A.Skeat & J.Henry* (CBG).

Closely related to *E. heterophylla*, differing in its bright scarlet leaves subtending the inflorescences, its strongly lobed leaves, its shorter petiole, its larger involucre, more deeply divided styles and ellipsoidal seeds. Juvenile leaves are often entire or slightly toothed, closely resembling those of *E. heterophylla*. Six plants were introduced to Christmas Is. in June, 1958. Escaped plants were able to compete well against the native weeds and in secondary vegetation. The population increased during the 1980s and by 1986 it was a common plant on waste ground in Settlement and at Drumsite and as a roadside weed. However, the population has since declined, although it is still frequently found in areas disturbed by mining.

3. Euphorbia atoto G.Forst., *Prodr.* 36 (1786)

Chamaesyce atoto (G.Forst.) Croizat in O.Degener, *Fl. Hawaiiensis Fam.* 190 (1936). T: Society Islands, *J.R. & G.Forster*; *n.v.* Epithet of unknown origin, possibly a vernacular name from the Society Islands.

[*E. hypericifolia auct. non* L.: C.W.Andrews, *Monogr. Christmas Is.* 187 (1900)]

Erect subshrub c. 25–50 cm tall, glabrous, usually widely branched; stems terete, with swollen nodes. Leaves opposite, elliptic to oblong, somewhat fleshy, entire, mostly rounded to obtuse, mucronate, glabrous, glaucous; base obtuse, often strongly oblique with one side forming a lobe; lamina c. 0.5–3.5 cm long; petiole 1–4 mm long; stipules short, triangular, laciniate. Inflorescence from one axil of each leaf pair, panicle-like. Involucre campanulate, c. 1.5–2 mm long, glabrous; upper margins laciniate, with 5 mucronate teeth. Glands 4, small, broadly elliptic, flat, with very narrow petaloid margin, pale yellow. Styles c. 0.5 mm long, bilobed. Fruit c. 2.5 mm diam., glabrous. Seeds broadly ovoid, c. 2 mm long.

Christmas Is., Cocos (Keeling) Is. Probably native to Christmas Is., and along with the grasses in the genus *Ischaemum* forms the first plant community behind the seashore. Also common on the low cliffs along the western coast, in protected pockets formed by the weathering of the limestone. On Cocos (Keeling) Is. grows at the top of beaches, in coralline sand. Native of the Old World tropics, from southern India and S China through

Indo-China and Malesia to northern Australia (Qld) and the Pacific islands.

Ch.Is.: Flying Fish Cove, *H.N.Ridley 122* (K); Smiths Point, *D.A.Powell 879* (K). C.K.Is.: beside loading jetty, West Is., *A.S.George 16256* (CBG, K); Home Is., *I.R.Telford 10063 & C.Howard* (AD, CBG, K); Scout Park, West Is., *D.G.Williams 18* (CBG).

Easily recognised by its opposite, entire leaves and strikingly glaucous appearance. The name is often applied in a very broad sense. The Indian Ocean form treated here is possibly *E. chamissonis* Boiss. (or *E. maritima* Boiss.).

4. *Euphorbia hirta L., *Sp. Pl.* 1: 454 (1753)

Chamaesyce hirta (L.) Millsp., *Field Columb. Mus. Publ.* 136, Bot. 2: 303 (1904). T: India, Herb. C.Linnaeus 630.7; syn: LINN. Epithet from the Latin *hirtus* (hairy, shaggy), in reference to the indumentum.

E. pilulifera L., *Sp. Pl.* 1: 454 (1753). T: India, Herb. C.Linnaeus 630.8; syn: LINN.

Illustrations: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 392 (1939); F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 259, fig. 41 (1980).

Erect or ascending herb or subshrub, to c. 50 cm tall; stems terete, hairy, with long, spreading, yellow hairs and short appressed hairs, somewhat glabrescent, reddish. Leaves opposite, elliptic, obtuse and often strongly oblique at base, serrulate, subacute, with short hairs especially beneath; lamina c. 1.5–3.5 cm long; petiole 1–3 mm long; stipules small, subulate, hairy. Inflorescence from one angle of each leaf pair, capitate, subspherical. Involucre campanulate, c. 0.5 mm long, 5-toothed, appressed-hairy. Glands 4, minute and hardly discernable. Styles c. 0.5 mm long, bifid. Fruit c. 1.2 mm diam., minutely hairy. Seeds oblong, angled, c. 0.75 mm long, red-brown. *Ara tanan*. Fig. 45D.

Christmas Is., Cocos (Keeling) Is. Recorded as 'abundant' on Christmas Is. by H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 222 (1906), and still common on any cleared ground, roadsides and gardens, frequently as a small herb. On Cocos (Keeling) Is. common in coralline sand in disturbed sites around the settlements on West Is. This Central American native is now a common, pantropical weed, widespread in the Old World tropics.

Ch.Is.: Phosphate Hill, *H.N.Ridley 124* (K); at entrance to golf course, *R.Shivas 837* (PERTH); Phosphate Hill area, *B.A.Mitchell 145* (CBG, K). C.K.Is.: settlement, West Is., *I.R.Telford 9951 & C.Howard* (CBG, K); settlement, West Is., *D.G.Williams 198* (CBG, PERTH).

The hairs on the stems are conspicuously multicellular. The latex is used to treat eye complaints in Malaya, and the plant is sometimes used as a poultice to treat leg sores and ringworm.

5. *Euphorbia prostrata Aiton, *Hort. Kew.* 2: 139 (1789)

Chamaesyce prostrata (Aiton) Small, *Fl. SE United States* 713 (1903). T: West Indies, 1758, cult. *P.Miller*; not located. Epithet from the Latin *prostratus* (prostrate), in reference to the growth habit.

[*E. thymifolia auct. non* L.: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 222 (1906)]

Illustrations: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 395 (1939); F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 259, fig. 41 (1980).

Prostrate herb 0.5–10 cm tall, much-branched, purplish; stems hairy above. Leaves opposite, oblong-obovate, obtuse and oblique at base, shallowly serrate, obtuse to rounded, hairy beneath at apex; lamina c. 2–6 mm long; petiole 0.5–1 mm long; stipules connate on underside of stem, bifid. Cyathia 1–several from one axil of each leaf pair, dark green or purple. Involucre funnel-shaped, 0.5–1 mm long, shortly 5-toothed, hairy at apex. Glands 4, subcircular, minute, flat, purple, each with a narrow, pale purple, marginal appendage. Styles c. 0.25 mm long, deeply bifid. Fruit long-stalked, exserted from involucre, c. 1.5 mm diam., with hairs confined to outer angles of lobes. Seeds ovoid, c. 1 mm long, 4-angled. Fig. 45E–F.

Christmas Is., Cocos (Keeling) Is. Common on Christmas Is. by 1906, and now a common garden weed capable of competing successfully in lawns. On Cocos (Keeling) Is., recorded from disturbed sites around the settlement on West Is. in coralline sand. A common weed

throughout the tropics and subtropics, native to the West Indies.

Ch.Is.: Flying Fish Cove, *H.N.Ridley 123, 125* (K); Waterfall, *H.N.Ridley 126* (K); no precise locality, *D.A.Powell 4B* (K); Smith Point, *D.J. & B.P.Du Puy CI42* (CBG, K). C.K.Is.: settlement, West Is., *I.R.Telford 9988 & C.Howard* (AD, CBG, K); settlement, West Is., *D.G.Williams 195* (CBG, PERTH).

Very similar in appearance to *E. thymifolia* with which it often grows, but can be distinguished by the characters given in the key, the most easily observed being those of the fruit.

6. *Euphorbia thymifolia L., *Sp. Pl.* 1: 454 (1753)

T: India, Herb. C.Linnaeus 630.10; syn: LINN. Epithet from *Thymus*, a genus of plants in the Lamiaceae, and the Latin *folius* (a leaf), as the leaves resemble those of the culinary herb thyme.

Illustration: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 394 (1939).

Prostrate herb to 10 cm tall, much-branched, purplish; stems hairy above. Leaves opposite, oblong-elliptic, obtuse to subcordate and oblique at base, shallowly serrate, acute to obtuse, sparsely hairy beneath; lamina c. 2–6 mm long; petiole 0.5–1 mm long; stipules minute, subulate, free. Cyathia 1–several from one axil of each leaf pair, dark green or purple. Involucre campanulate, 0.5–1 mm long, shortly 5-toothed, uniformly hairy. Glands 4, minute, subcircular, flat, purple, with a narrow, pale purple, marginal appendage. Styles c. 0.5 mm long, bifid. Fruit short-stalked, enclosed by involucre at base, c. 1 mm diam., uniformly sparsely hairy. Seeds ellipsoidal, c. 1 mm long, 4 angled. *Rumput Barah*.

Christmas Is. Occurs around Flying Fish Cove, Drumsite, Settlement, Waterfall and South Point, especially in gardens, lawns and paths. An early coloniser of bare ground, but intolerant of shade and displaced by taller species. Widespread in the Old World tropics.

Ch.Is.: no precise locality, *D.A.Powell 4A* (K).

Often found with *E. prostrata*, with which it is commonly confused. The dried leaves and seeds are astringent, and are used against diarrhoea and dysentry in children. The leaves are sometimes applied to wounds. *Euphorbia rubicunda* Steud. is a synonym, but is not applied to Christmas Is. *E. thymifolia*.

54. RHAMNACEAE

D.J.Du Puy (Ch.Is.)

Tree, shrubs, sometimes scandent or lianas, sometimes thorny. Leaves alternate or opposite, simple; stipules usually present. Inflorescence usually cymose. Flowers small, usually bisexual. Receptacle broad, concave; perianth and stamens perigynous. Sepals 4 or 5, valvate, keeled within. Petals 4 or 5, free, often clawed at base, hooded, frequently reduced. Stamens 4 or 5, opposite petals and often enclosed by them at first; anthers dehiscing by longitudinal slits. Disc well-developed. Ovary superior, often immersed in disc, usually 2- or 3-locular, each locule with 1 ovule; placentation basal. Style simple, lobed or divided. Fruit often drupaceous, fleshy, with 1–several pyrenes, or dry and septicidally splitting into 3 segments each with 1 seed. Seed with endosperm.

A family which occurs throughout the tropical and temperate zones, and includes about 58 genera and c. 900 species; 17 genera and c. 160 species occur in Australia; 1 genus on Christmas Is. Many have fruit adapted for wind dispersal. Some species of *Zizyphus* produce edible fruits, *Z. jujuba* (Chinese Date) and *Z. lotus* Lam. (Lote Fruit), probably being the lotus fruits of Greek legend.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Rhamnaceae, *Fl. Java* 2: 80–85 (1965).

COLUBRINA

Colubrina Rich. ex Brongn., *Mem. Fam. Rhamn.* 61 (1826), *nom. cons.*; from the Latin *colubra* (snake), descriptive of the twining stems.

Type: *C. ferruginosa* Brongn.

Trees or shrubs, sometimes scandent. Leaves entire or crenate, often with marginal glands in the sinuses. Inflorescence axillary, thyrsoid, often condensed. Flowers small, 5-merous. Calyx, corolla and anthers on the rim of a receptacular cup, deciduous. Disc broad, nectariferous, enclosing ovary. Fruit subglobose, covered towards base by the enlarging receptacle and disc and apically by a papery exocarp which fragments irregularly at dehiscence; endocarp crustaceous, splitting into 3 segments. Seeds 3, convex behind, angled in front, glossy.

A genus of 31 species, 21 in warmer parts of America, 4 in SE Asia, including 1 widespread tropical species which also occurs in Australia; 1 endemic species occurs on Christmas Is.

M.C.Johnson, Revision of *Colubrina* (Rhamnaceae), *Brittonia* 23: 2–53 (1971).

Colubrina pedunculata Baker f. in C.W.Andrews, *Monogr. Christmas Is.* 175 (1900)

T: North Coast, near Settlement, Christmas Is., Feb. 1898, *C.W.Andrews*; holo: BM. Epithet from the Latin *pedunculatus* after the long, conspicuous peduncle of the inflorescence.

Small tree or shrub, sometimes straggling, thorny; thorns 0.5–2 cm long. Leaves alternate, deciduous after fruiting, narrowly elliptic, oblong-elliptic or ovate, cuneate, rounded or cordate at base, weakly crenate to almost entire with small marginal mucronate glands, acuminate, with short appressed hairs on veins below; lamina 4–14 cm long; petiole 6–20 mm long; stipules 3 mm long. Flowers many, yellow-green, 5–6 mm across, clustered; peduncle 10–40 mm long in flower, 20–50 mm long in fruit; pedicels 3–5 mm long, to 12 mm long in fruit, hairy. Sepals triangular, 2 mm long, hairy. Petals spathulate, 1.5 mm long. Disc 1.5–2 mm across, lobed. Style 3-lobed towards apex. Fruit c. 7 mm long. Fig. 45A–C.

Christmas Is. Endemic. Common on the north and north-eastern terraces, often in areas of poor, dry soil and among limestone pinnacles and scree and in thickets on cliff edges.

Ch.Is.: above Toms Ladder, *H.N.Ridley 58A* [?*501A*] (K); cliff overlooking Flying Fish Cove, *D.A.Powell 55* (K); first terrace, overlooking the east coast, *D.A.Powell 282* (K); North West Point, Feb. 1980, *D.A.Powell* (K); Egeria Point, S of Winifreds Beach, *B.A.Mitchell 69* (CBG, K).

Differs substantially from the closely related and widespread *C. asiatica* (L.) Brongn. The fruit of *C. asiatica* are used as a fish poison, and a decoction of the leaves is used medicinally for some skin diseases. Similar properties may be expected in *C. pedunculata*.

55. LEEACEAE

D.J.Du Puy (Ch.Is.)

Trees or shrubs, sometimes scandent, without tendrils. Leaves alternate, usually 1–3-pinnate; leaflets opposite, crenate to serrate, glandular; petiole and stipules fused, expanded, sheathing around stem apex. Inflorescence cymose, leaf-opposed, bracteate, often condensed. Flowers actinomorphic, bisexual. Calyx campanulate, 4- or 5-lobed. Corolla hypogynous, 4- or 5-lobed, valvate, tubular at base. Disc absent. Epipetalous tube present, consisting of a lower ring extending down towards ovary, and an upper corona which is 4- or 5-lobed. Stamens epipetalous, from base of corona; filaments flattened, passing over sinuses between lobes; anthers coherent in a ring inside corona, dehiscing by longitudinal

Figure 45. **A–C**, RHAMNACEAE: *Colubrina pedunculata*. **A**, flowering branchlet X0.5; **B**, flower X4 (**A–B**, D.Powell 282, K); **C**, infructescence X1 (D.Powell 55, K). **D–F**, EUPHORBIACEAE. **D**, *Euphorbia hirta*, flowering shoot X0.5 (B.Mitchell 145, K). **E–F**, *Euphorbia prostrata*. **E**, flowering plant X0.5 (D.Powell 4B, K); **F**, portion of fruiting stem X8 (I.Telford 9988 & C.Howard, K). **G–I**, LEEACEAE: *Leea angulata*. **G**, flowering shoot X0.5 (D.Powell 81, K); **H**, flower X4 (D. & B.Du Puy CI1, K); **I**, fruits X1 (D.Powell 81, K). Drawn by E.Catherine.

slits. Ovary superior, discoid, usually 4–6-locular, each with 1 ovule. Style short, entire. Fruit a depressed-globose berry with up to 6 seeds. Seeds without a distinct beak; endosperm present.

A pantropical family containing 1 genus, *Leea*, with 34 species, 32 of which occur in SE Asia, from India and S China, through Malesia to the Pacific islands, with 2 species in Australia (N.T., Qld), and 2 in Africa; 1 species of *Leea* native on Christmas Is. The family is sometimes included in the Vitaceae. C.W.Andrews, *Monogr. Christmas Is.* 176 (1900) and H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 185 (1906) both included *Leea* in the family Ampelidaceae (*nom. nud.*) along with the genera now placed in the Vitaceae.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Leeaceae, *Fl. Java* 2: 93–94 (1965); C.E.Ridsdale, A Revision of the family Leeaceae, *Blumea* 22: 57–100 (1974); C.E.Ridsdale, Leeaceae, *Fl. Males.* ser. I, 7: 755–782 (1976).

LEEA

Leea D.Royen ex L., *Syst. Nat.* 12th edn, 2: 627 (1767) & *Mant. Pl.* 1: 17, 124 (1767), *nom. cons.*; after James Lee, an 18th century horticulturist in London who was among the first in Europe to cultivate this genus.

Type: *L. aequata* L.

Leea angulata Korth. ex Miq., *Ann. Mus. Bot. Lugd. Bat.* 1: 97 (1863)

T: Krawang, Java, *P.W.Korthals s.n.*; lecto: L *n.v.*, *fide* C.E.Ridsdale, *Blumea* 22: 84 (1974). Epithet from the Latin *angulatus* (angular), in reference to the stems.

L. sambucina var. *intermedia* Ridl., *J. Straits Branch. Roy. Asiat. Soc.* 45: 185 (1906). T: Phosphate Hill, Christmas Is., 1904, *H.N.Ridley 86*; iso: BM, K.

[*L. sambucina auct. non* Willd.: E.G.Baker in C.W.Andrews, *Monogr. Christmas Is.* 176 (1900)]

Shrub or small tree to 7 m tall, often suckering. Leaves usually imperfectly 2- or 3-pinnate; rachis 4–20 cm long; leaflets narrowly elliptic, 3–15 cm long, obtuse and unequal at base, serrate, acuminate, angles of veins below with tufts of hair; petiolules 3–7 mm long; petiolar wings to 5 mm wide. Cymes 4–7 cm or more long, sometimes paired; peduncle 3–4 cm long. Flowers many, small, greenish. Calyx 1.5 mm long, 5-lobed. Petals 5, c. 3 mm long, connate in basal third, spreading above, with a hooded, mucronate apex. Corona 1.5 mm long, 5-lobed; lobes emarginate. Style 0.8 mm long; stigma not swollen. Anthers 5, relatively large. Berry 4–9 mm diam., 1–6-lobed, almost black. Seeds 1–6. Fig. 45G–I.

Christmas Is. Found all over the island, but most common on the terraces where it can be part of the lower canopy. Distributed from the Nicobar Islands and peninsular Thailand, throughout Malesia but not yet found in New Guinea.

Ch.Is.: no precise locality, 1886–1887, *J.P.Maclear* (K); no precise locality, 3 Oct. 1887, *J.J.Lister* (K); South Point, W of Field 17D, *B.A.Mitchell 5* (CBG, K); on first terrace near Grotto, *R.Shivas 867A, B* (PERTH); beside pool at Ross Hill Gardens, *D.J. & B.P.Du Puy CI1* (CBG, K).

In Malaya this tree is reputed to have magical properties effective in warding off tigers.

56. VITACEAE

D.J.Du Puy (Ch.Is.)

Mostly climbing shrubs with leaf-opposed tendrils. Stems commonly jointed or swollen at nodes, sometimes succulent (not on Christmas Is.). Leaves alternate, usually distichous, simple or palmately to pinnately compound; stipules usually present. Inflorescence often cymose or paniculate, leaf-opposed or axillary, bracteate, with many small flowers. Flowers actinomorphic, bisexual or unisexual. Calyx truncate. Petals 4 or 5, valvate, free or connate, caducous. Disc usually conspicuous, sometimes lobed, adnate to base of ovary. Stamens 4 or 5, opposite petals, inserted outside disc; anthers dehiscing by longitudinal slits. Ovary superior, generally immersed in disc, usually 2-locular, each usually with 2 ovules; placentation axile. Style 1. Fruit a berry with 1–4 seeds. Seeds with endosperm.

A family of about 12 genera with c. 700 species, mostly tropical and subtropical, with some temperate representatives; 5 genera with c. 34 species in Australia; 3 genera on Christmas Is. The most economically important species is *Vitis vinifera* L. (Grape Vine). Two species of *Parthenocissus* Planch. are commonly planted in temperate gardens, and several species of *Cissus* and *Rhoicissus* Planch. are popular house plants. The family is synonymous with the Ampelidaceae, an illegitimate name used both by C.W.Andrews, *Monogr. Christmas Is.* 176 (1900) and H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 184–185 (1906).

J.E.Planchon, in A.de Candolle, *Monogr. Phan.* (Ampelideae) 5(2): 305–654 (1887); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Vitaceae, *Fl. Java* 2: 86–93 (1965).

KEY TO GENERA

1 Leaves simple, often lobed; flowers 5-merous; petals connate at apex, forming a cap which is caducous as flower expands; seeds with a rounded beak at base **1. VITIS**

1: Leaves compound or simple and not lobed; flowers 4-merous; petals free, not caducous at anthesis; seeds not beaked at base

2 Leaves simple; inflorescence usually leaf-opposed; berry with a single seed **2. CISSUS**

2: Leaves pedately to palmately 3–7-foliolate; inflorescence axillary or apparently terminal; berry with 2–4 seeds **3. CAYRATIA**

1. VITIS

Vitis L., *Sp. Pl.* 1: 202 (1753); *Gen. Pl.* 5th edn, 95 (1754); from the Latin word *vitis*, for the Grape Vine.

Type: *V. vinifera* L.

Deciduous climbers with forked, leaf-opposed tendrils; dioecious or bisexual. Stems commonly swollen at nodes or jointed, sometimes succulent. Leaves simple or rarely palmate, usually lobed. Inflorescence a leaf-opposed panicle. Flowers minute, greenish. Calyx minute or obsolete, cupular, weakly 5-lobed. Petals 5, connate at apex, caducous as flower expands. Disc strongly 5-lobed. Ovary not usually immersed in disc. Style short, conical; stigma discoid. Fruit a fleshy berry with 2–4 seeds. Seeds pyriform, with 2 furrows on the front, and a rounded basal beak.

A genus of about 60 species, mostly from the temperate regions of the northern hemisphere; 1 species on Christmas Is.

R.D.Meikle, *Fl. Cyprus* 1: 360–361 (1977).

Vitis flexuosa Thunb., *Trans. Linn. Soc., London* 2: 332 (1794)

T: Japan, Herb. C.P.Thunberg 5844; holo: UPS, microfiche seen. Epithet from the Latin *flexuosus* (zigzag, crooked), descriptive of the somewhat flexuose stems.

Climbing shrub; young shoots tomentose. Stems swollen at nodes. Leaves ovate to triangular, cordate to truncate at base, entire or sometimes 3-lobed, coarsely dentate, acuminate, villous beneath, glabrescent; lamina 4–15 cm long; petiole 3–8 cm long. Flowers many, in pyramidal, tomentellous panicles 5–15 cm long. Calyx saucer-shaped, c. 1 mm diam., slightly lobed. Petals oblong, 1–2 mm long, connate at apex, free at base, greenish white, caducous. Disc yellow-brown, glandular. Stamens 1.5–3 mm long, with whitish filaments. Ovary ovoid-conical, 1–1.5 mm long; style less than 0.5 mm long. Berry 6–7 mm diam., globose or slightly elongated, glabrous, dark blue-black. Seed c. 4 mm long.

Christmas Is. Occasional in scrubby or disturbed vegetation, both on the plateau and on the terraces. Probably native. A widely distributed and variable vine, occurring from Japan, Korea, China and India through the Philippines and Indo-China to Malesia (Java).

Ch.Is.: south-western terrace, Winifred Beach, *D.A.Powell 394* (K); Ross Hill Gardens, *D.A.Powell 520* (K).

2. CISSUS

Cissus L., *Sp. Pl.* 1: 117 (1753); Gen. Pl. 5th edn, 53 (1754); from the Greek kissos (the name given to Ivy – *Hedera* sp.) in allusion to the climbing habit.

Type: *C. vitiginea* L.

Climbing shrubs or occasionally creeping herbs, rarely with succulent stems (not on Christmas Is.), tendrils simple or bifid. Leaves simple, dentate, the teeth often reduced. Inflorescence usually a leaf-opposed, corymbiform, bracteate cyme. Flowers small, bisexual, yellow-green. Calyx cupular, slightly 4-lobed. Petals usually 4, free, hooded. Disc cupular, usually 4-lobed, usually with a thickened margin. Stamens 4. Ovary adnate to, and immersed in, the disc. Style slender. Fruit a globose or obovoid berry with a single seed.

A large genus of about 350 species, mainly tropical but with some temperate species; 1 species occurs on Christmas Is. and about 15 species occur in Australia, several of which are endemic. Several species are cultivated as ornamentals, including the Indo-Chinese and Malesian *C. discolor* Blume, which has dark green leaves, red below with silver markings above, and *C. antarctica* Vent. from Australia (N.S.W.).

A.Latiff, Studies in Malesian Vitaceae 6. The Malay Peninsula species of *Cissus* L., *Malayan Nat. J.* 35: 197–207 (1982).

Cissus repens Lam., *Encycl.* 1: 31 (1783)

T: illustration in H.A.Rheede, *Hort. Ind. Malabar.* 7: t. 48 (1688). Epithet is Latin for creeping, in reference to the habit of some specimens.

Illustration: F.Gagnepain in P.H.Lecompte, *Fl. Indo-Chine* 1(2): 968, fig. 120 (1911).

Climbing or creeping shrub; stems somewhat quadrangular, often whitish encrusted around the nodes. Tendrils entire. Leaves ovate, cordate at base, serrate with teeth much reduced and mucronate, shortly acuminate, glabrous; lamina 3–14 cm long; petiole slender, 2–8 cm long. Cymes umbel-like with c. 12–20 flowers; peduncle 2–5 mm long; pedicels 2–5 mm long, extending to 10 mm in fruit. Calyx cupular, 1 mm long, weakly lobed. Petals c. 2 mm long, thickened at apex, light green becoming reddish at apex. Disc lobes erect, surrounding ovary, violet-red. Style c. 1 mm long; stigma not swollen. Berry ellipsoidal, c. 6 mm long, glabrous, with the disc adnate to base. Fig. 46D–F.

Christmas Is. It occurs in patches of forest where damage has caused the canopy to be more open. This variable species is widely distributed throughout SE Asia, from India and S

China through Indo-China to Malesia and the Philippines.

Ch.Is.: no precise locality, *C.W.Andrews s.n.* (K); Flying Fish Cove, *H.N.Ridley 84A* (K); North West Point, Feb. 1980, *D.A.Powell* (K).

The leaves are used as a poultice for swellings and fevers in Malaya and are reported to be edible. The fruits, however, are very acid and leave a stinging sensation in the mouth which lasts for about 24 hours. The stems may be used as rough ropes.

3. CAYRATIA

Cayratia Juss., *Dict. Sci. Nat.* 10: 103 (1818), *nom. cons.*; from the local name in Cochin China, now Vietnam (*cay-rat-loung*).

Type: *Columella pedata* Lour. = *Cayratia pedata* (Lam.) Gagnep.

Climbing or creeping shrubs; tendrils 1–3-forked. Leaves palmately or pedately 3–12 foliolate; leaflets serrate to crenate. Inflorescence an axillary, corymb-like cyme. Flowers small, bisexual, yellow-green. Calyx minute, truncate or slightly 4-lobed, persistent. Petals 4, free, thickened and hooded at apex. Disc cupular, with a thin margin. Stamens 4; filaments flat. Ovary immersed in disc. Style short; stigma not inflated. Fruit a globose or depressed-globose berry with 1–4 seeds. Seeds with 1 or 2 deep cavities in ventral surface.

This genus contains c. 56 species, distributed in tropical Africa and SE Asia from India and Japan through Malesia to the Pacific islands and Australia, the last with c. 8 species; 3 species occur on Christmas Is. The genus contains several widely distributed species and the taxonomy of these especially is incompletely understood.

A.Latiff, Studies in Malesian Vitaceae 5, The genus *Cayratia* in the Malay Peninsula, *Sains Malaysiana* 10(2): 129–139 (1981); B.R.Jackes, Revision of the Australian Vitaceae, 2. *Cayratia* Juss., *Austrobaileya* 2(4): 365–379 (1987).

1 Young branchlets, inflorescence, petiole and main leaf veins below minutely pubescent; leaflets with a strongly oblique base, one side cordate, the other cuneate; leaflet margin crenate; seed with a single large cavity, the endosperm being C-shaped in T.S. **1. C. pedata**

1: Branchlets, leaves and inflorescence glabrous; leaflet base not oblique; leaflet margins serrate; seed with 2 cavities, the endosperm being T-shaped in T.S.

2 Leaves small, trifoliolate; leaflets usually less than 4 cm long, on petiolules 30–15 mm long; leaflet base obtuse **2. C. trifolia**

2: Leaves large, usually 5-foliolate; leaflets mostly longer than 6 cm, almost sessile (on Christmas Is.); leaflet base cuneate, tapering **3. C. japonica**

1. Cayratia pedata (Lam.) Gagnep. in P.H.Lecompte, *Not. Syst.* 1: 346 (1911)

Cissus pedata Lam., *Encycl.* 1: 31 (1783). T: India, *P.Sonnerat*; holo: P-LA, microfiche seen. Epithet descriptive of the leaf shape where the lateral leaflets of a palmate leaf are further divided, i.e. pedate.

Cissus pedata var. *glabrescens* Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 184–185 (1906). T: Smith Point, Christmas Is., *H.N.Ridley*; holo: SING *n.v.*

Climbing shrub; young branchlets and inflorescences minutely pubescent. Leaves usually pedately 5-foliolate (on Christmas Is.); petiole 4–12 cm long; terminal leaflet and lateral leaflet groups with petiolules 2–5 cm long; leaflets elliptic, crenate, acute or slightly acuminate, minutely pubescent below, especially on veins; base obtuse, often unequal, cordate on one side, cuneate on the other; lamina 4–16 cm long. Inflorescence usually with 2 main branches, often apparently terminal on a short lateral shoot and subtended by 1 or 2 reduced leaves; peduncle 1.5–3.5 cm long. Petals ovate, c. 2 mm long, acute, shortly pubescent. Disc 4-lobed. Berry depressed-globose, 6–10 mm diam., pink. Seed with 1 large ventral cavity; endosperm C-shaped in T.S. Fig. 46A–C.

Christmas Is. Occurs mainly on the Plateau and on land above 150 m (c. 500ft.), but also on the shore cliffs. It is common in open areas and in secondary vegetation. Distributed from India and Sri Lanka through Indo-China and Malesia to the Philippines.

Ch.Is.: no precise locality, (1886–87), *J.P.Maclear* (K); no precise locality, 4 Oct. 1887, *J.J.Lister* (K); shore cliff, *C.W.Andrews 59* [*159*] (BM, K); Phosphate Hill, *H.N.Ridley 85* (K); secondary growth on high ground, *D.A.Powell 331* (K).

There is variation in the density of the indumentum, especially on the leaves, of different specimens from Christmas Is. H.N.Ridley, *loc. cit.* apparently described var. *glabrescens* from an almost glabrous specimen. Variation in this character is continuous, and a distinct taxon cannot be recognised. The specimens from Christmas Is. also vary from other populations in the number of leaflets. Christmas Is. specimens consistently have 5 or occasionally 7 leaflets, whereas other specimens usually have more than 7 and up to 13 leaflets.

2. **Cayratia trifolia** (L.) Domin, *Biblioth. Bot.* 22(89): 370 (1927)

Vitis trifolia L., *Sp. Pl.* 1: 203 (1753). T: no extant syntype material available; neotypification necessary. Epithet from the Latin prefix *tri-* (three) and *folium* (a leaf) in reference to the number of leaflets in the leaf.

Illustrations: B.R.Jackes, *Austrobaileya* 2(4): figs 1G–J, 2B (1987).

Climbing shrub, glabrous. Leaves trifoliolate; leaflets ovate to elliptic, obtuse at base, serrulate, acute to rounded, mucronate, rather fleshy, glabrous; lamina 1.5–4.5 cm long; petiole 2.5–4.5 cm long; petiolules 3–15 mm long. Inflorescence with 3 branches, often apparently terminal; peduncle slender, 6–10 mm long. Petals ovate, c. 2 mm long, acute, slightly pubescent outside towards apex. Disc not lobed. Berry depressed-globose, 1.5–2 cm diam., black. Seed with 2 ventral cavities; endosperm T-shaped in T.S.

Christmas Is. Common along the northern coastline to about 30 m a.s.l. in secondary vegetation or open areas, commonly scrambling over low shrubs. Occurs from N India through Malesia to the Philippines, New Guinea, Melanesia, Micronesia and Australia (W.A., N.T., Qld).

Ch.Is.: NE coast, *D.A.Powell 300* (K).

The leaf extract is reputed to be effective against Yaws (frambesia) in Malaya and Indonesia, and against other fevers.

3. **Cayratia japonica** (Thunb.) Gagnep. in P.H.Lecompte, *Not. Syst.* 1: 349 (1911)

Vitis japonica Thunb., *Fl. Japan* 104 (1784). T: Japan, Nagasaki, *Papenberg*; *n.v.* Originally described from Japan, hence the epithet.

Illustration: T.Makino, *Ill. Fl. Japan* 341, fig. 1022 (1948), as *Cissus japonica*; B.R.Jackes, *Austrobaileya* 2(4): fig. 4E–H (1987).

Climbing shrub, glabrous. Leaves pedately 5-foliolate; leaflets elliptic, cuneate at base, acute to acuminate, mucronate, somewhat decurrent along petiolule; lamina 4–15 cm long; petiole 7–12 cm long; petiolules to 5 mm long, but leaflets often sessile. Inflorescence with 2 or 3 main branches; peduncle 5–13 cm long, often apparently terminal on a short, lateral shoot and subtended by a reduced leaf. Petals narrowly ovate, c. 2 mm long, subglabrous. Disc 4-lobed, cupular. Berry globose, 6–9 mm diam., blue-black. Seed with 2 ventral cavities; endosperm T-shaped in T.S.

Christmas Is. Said to be common along tracks through the primary rainforest where it covers fallen trees and low shrubs, but has been collected only twice. A widespread species found from India, China and Japan through Indo-China, Malesia and New Guinea to Melanesia, Polynesia and N Australia (Qld).

Ch.Is.: south coast, Taits Vale, *D.A.Powell 114* (K); S of Hanitch Hill and N of South Point Rd, *B.A.Mitchell 180* (AD, CBG, K).

The Christmas Is. collections are at present included in *C. japonica* pending a revision of

the genus. The species is variable with regard to leaf size and shape and it is not certain that only this species is involved in the complex. The Christmas Is. population represents an extreme of the variation with large leaflet size, and reduced petiolules, the leaflets being almost sessile. Some specimens from Java and Sumatra resemble this variant.

In Borneo and Sumatra the leaves are boiled and the water used for bathing as a treatment for fevers.

57. SAPINDACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees or shrubs, sometimes climbing. Leaves alternate, usually compound, often paripinnate with alternate leaflets; stipules absent. Inflorescence cymose, axillary or terminal. Flowers actinomorphic or zygomorphic, often unisexual. Sepals 4 or 5, free or fused, usually imbricate. Petals 4 or 5, free, sometimes absent, often with hairy scales. Disc conspicuous, nectariferous, extrastaminal (except *Dodonaea*). Stamens usually in 2 whorls of 5, often with 2 missing, so appearing as 8; filaments free and often hairy; anthers 2-locular, dehiscing by longitudinal slits. Ovary superior, entire to deeply divided; carpels usually 3, fused, often only one developing into a fruit, each with 1 or 2 ovules; placentation usually axile. Style terminal, simple or divided. Fruits various. Seeds often arillate, without endosperm.

A mainly tropical and subtropical family of 1500–2000 species in over 140 genera, with greatest diversity in SE Asia. Of these about 150 species in 27 genera occur in Australia; 4 genera (4 species) on Christmas Is., 2 of which (2 species) are on Cocos (Keeling) Is. The genera are often most easily distinguished by their fruit structures.

Koelreuteria paniculata Laxm. is a handsome, commonly cultivated, small tree from temperate E Asia. Quarana, a stimulating Brazilian beverage containing caffeine, is obtained from the seed of *Paullinia cupana* Humb., Bonpl. & Kunth. The family is most renowned, however, for its fruit trees, the edible part of the fruit comprising the fleshy aril which surrounds the seed. The fruit of *Litchi sinensis* Sonn. (Lychee) has a large, white aril. *Dimocarpus longan* Lour. (Longan, Mata Kuching) is a commonly grown fruit tree in China and Malaya and is occasionally cultivated on Christmas Is. as small stands in the forest, from seeds of imported fruit, although usually with poor results. This is a variable species, the specimen from Christmas Is. (*D.A.Powell 867*, K) corresponding with var. *obtusus* (Pierre) Leenh. (in *Blumea* 19: 122–128, 1971), and somewhat similar to the variant cultivated in Penang (B.Molesworth Allen, *Malayan Fruits* 179–182, fig. 65 (1967), as *Nephelium malaiense*). It is characterised by its paripinnate leaves with 8–10 subopposite leaflets which are 3–6 cm long, elliptic and obtuse to emarginate, by its thyrsoid inflorescence, and by its small, 5-merous flowers with hairy petals and disc. Its fruit is c. 2 cm diam., spherical and warty, brownish, with a thin white flesh inside around a single, glossy, dark-brown seed. A somewhat similar fruit is *Nephelium lappaceum* L. (Rambutan). Its leaves differ in that it has only 4–6 leaflets which are 7–18 cm long, and the 4–6-merous flowers have no petals and a glabrous disc. The fruits are c. 5 cm diam., ellipsoidal, and covered in soft, curved, reddish spines. The skin is easily removed, revealing the sweet, white fleshy aril enclosing a single brown seed. It is native to Malaya and is commonly cultivated there but grows poorly on Christmas Is., producing low-quality fruit (*D.A.Powell 679*, K).

L.A.T.Radlkofer, Sapindaceae, *Pflanzenr.* 4, 165, Heft 98: 1–1539 (1931–1934); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Sapindaceae, *Fl. Java* 2: 130–143 (1965); S.T.Reynolds & J.G.West, Sapindaceae, *Fl. Australia* 25: 4–164 (1985).

KEY TO GENERA

1 Leaves simple, trifoliolate, biternate or bipinnate; fruit dry or thinly fleshy, without a fleshy aril; not cultivated fruit trees

2 Climbing herb with tendrils on the peduncle; leaves biternate with pinnatifid leaflets; fruit an inflated, papery capsule with 3 black seeds, each with a heart-shaped hilum **1. CARDIOSPERMUM**

2: Trees or shrubs without tendrils; leaves, fruit and seeds not as above

3 Leaves simple; petals absent; disc reduced to a short stalk; fruit a flattened, papery capsule with 2 or 3 broad, longitudinal wings **2. DODONAEA**

3: Leaves compound; petals present; disc conspicuous; fruit not as above

4 Leaves twice paripinnate; flowers actinomorphic, 5-merous; petals with incurved basal auricles; fruit fibrous and woody with up to 4 seeds **3. TRISTIROPSIS**

4: Leaves trifoliolate; flowers zygomorphic, 4-merous; petals with a hairy scale inside; drupe thinly fleshy around a single, large seed **4. ALLOPHYLUS**

1: Leaves paripinnate; fruit with a large, fleshy, white aril surrounding the seed; cultivated fruit trees

5 Leaflets 8–10, 3–6 cm long; petals 5; disc hairy; fruit 2 cm diam., warty **†DIMOCARPUS**

5: Leaflets 4–6, 7–18 cm long; petals absent; disc glabrous; fruit up to 5 cm diam., with many soft, curved spines **†NEPHELIUM**

Genera marked with a dagger symbol (†) are introduced but not naturalised and are not treated further in the text.

1. CARDIOSPERMUM

Cardiospermum L., *Sp. Pl.* 1: 366 (1753); *Gen. Pl.* edn. 5, 171 (1754); from the Greek *kardia* (heart) and *sperma* (seed), descriptive of the whitish, heart-shaped hilum on the dark seed.

Type: *C. halicacabum* L.

Climbing herbs with tendrils, monoecious. Leaves biternate, distichous; leaflets pinnatifid. Inflorescence axillary, pedunculate, branched, bracteate, with 2 tendrils below apex of peduncle. Flowers small, zygomorphic, in short raceme-like clusters. Sepals 4, free, hooded, in 2 unequal pairs. Petals 4, 2 with large, petaloid scales, 2 with hooded scales. Disc of 2 nectariferous glands on one side of flower. Stamens 8, clustered opposite disc, sterile in female flowers; filaments hairy. Ovary of 3 uniovulate lobes. Style deeply trifid. Pistil rudimentary in male flowers. Fruit an inflated, membranous, 3-angled capsule with 3 dark seeds.

A genus of c. 14 species, with pantropical distribution and greatest diversity in the New World; 2 species occur in Australia (W.A., N.T., Qld, N.S.W.), 1 of which is introduced; 1 weedy species occurs on Christmas Is.

***Cardiospermum halicacabum** L., *Sp. Pl.* 1: 366 (1753)

T: Herb. Hort. Cliff.; syn: BM. Epithet from the Greek *halos* (salt) and *kakabos* (crucible), because of the resemblance of the inflated fruits to a salt-cellar.

Illustrations: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 397 (1939); J.G.West in B.D.Morley & H.R.Toelken, (eds), *Fl. Pl. Australia* 203, fig. 117i–q (1983).

Climbing herb, finely pubescent; stems ridged. Leaflets ovate, decurrent at base, acute, irregularly pinnatifid, slightly pubescent; lamina 1.5–4 cm long; petiole 2–4 cm long. Inflorescence 3-branched at apex; peduncle slender, 5–7 cm long, with 2 subapical tendrils

1.5–2 cm long. Flowers in 3, few-flowered clusters. Sepals circular, the inner pair largest, 2.5. mm long, strongly hooded, pinkish. Petals obovate, 2.5 mm long, white, crumpled, 2 with large, obovate, petaloid scales attached near base, and 2 with hairy, hooded, yellow-crested scales. Capsule inflated, turbinate, 1.5–2 cm long, pubescent, pale green with reddish veins. Seeds spherical, 3.5 mm across, black; hilum cream-coloured, heart-shaped. *Heart Pea*, *Balloon Vine*.

Christmas Is. It was collected in 1904 by H.N.Ridley, *J. Straits Branch. Roy. Asiat. Soc.* 45: 186 (1906) on the coral beach in Flying Fish Cove. Recently it has been noted among the limestone pinnacles and poor soil of abandoned phosphate quarries. A pantropical weedy species that also occurs in N Australia.

Ch.Is.: South Point, *D.Pearson & D.A.Powell P29* (K); Waterfall, east coast, *B.A.Mitchell 84* (CBG, K).

Common as a weed of cultivation, sometimes grown as a pot-herb or coarse leaf vegetable. The leaves contain a saponin, making them slimy and perhaps leading to their medicinal usage as a poultice for arthritis and for sore eyes. In Europe the heart-shaped hilum and somewhat heart-shaped capsule led to the deduction, through the doctrine of signatures, that the plant should be used for heart-disease.

2. DODONAEA

Dodonaea Mill., *Gard. Dict. Abr.* 4th edn, (1754); after the 16th century Flemish botanist, herbalist and professor of medicine at Leiden, Rembert Dodoens (1518–1585).

Type: *D. viscosa* Jacq.

Erect shrubs or small trees, often glandular and viscid, bisexual, dioecious or monoecious. Leaves simple, spirally arranged. Inflorescence terminal and sometimes in upper leaf axils, panicle-like. Flowers small, actinomorphic. Calyx deeply 3–5-lobed. Petals absent. Disc much reduced, stalk-like. Stamens 4–12, absent in female flowers; anthers large. Ovary bilaterally compressed or trigonous, 2- or 3-locular, each with 2 ovules, rudimentary in male flowers. Fruit a membranous capsule, bilaterally compressed or sharply trigonous, emarginate at base and apex, with 2 or 3 longitudinal wings. *Hop Bushes*.

A genus of c. 68 species, mainly Australian; 9 species occur outside Australia; 1 species on Christmas Is. and Cocos (Keeling) Is. Two highly variable species, *D. viscosa* and *D. angustifolia* L.f., have pantropical and subtropical distributions.

L.A.T.Radlkofer, *Pflanzenr.*, Heft 98G: 1350–1404 (1933); P.W.Leenhouts, Notes on the extra-Australian species of *Dodonaea* (Sapindaceae), *Blumea* 28: 271–289 (1983); J.G.West, A revision of *Dodonaea* Miller (Sapindaceae) in Australia, *Brunonia* 7: 1–194 (1984).

Dodonaea viscosa Jacq., *Enum. Syst. Pl.* 19 (1760)

subsp. **viscosa**

T: Jamaica, Herb. H.Sloane, v. 97; lecto: BM, *fide* P.W.Leenhouts, *Blumea* 28: 285 (1983). Epithet in reference to the viscid young leaves, branchlet tips, inflorescence and young fruit.

Illustration: A.B.Graf, *Tropica* 876 (1978).

A short tree or shrub, 1–2 m tall, glabrous, glandular. Leaves elliptic to obovate, cuneate at base, entire, obtuse or rounded and apiculate to emarginate, glabrous, with many lateral veins, viscid when young; lamina 8–16 cm long, 2.5–5 cm wide; petiole 2–4 mm long. Inflorescence c. 3 cm long, glabrous and somewhat viscid; pedicels 3–6 mm long, elongating up to 15 mm in fruit. Flowers c. 5 mm diam. Sepals 4, ovate, 2.5 mm long, obtuse, minutely hairy at apex, green. Anthers 5–9, c. 1.5 mm long, red. Style c. 2 mm long, simple. Fruit spherical, 1.5–2 cm diam., with 2 or rarely 3 longitudinal wings, deeply notched at apex and base, gland-dotted, papery. Seeds 4, black.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. 3 small trees have been recorded in the

Settlement. They may be introduced, but this shrub also occurs among the limestone pinnacles on the terraces. On Cocos (Keeling) Is. recorded only from Horsburgh Is. where it is dominant in an open shrub community in coralline sand. A pantropical species (including Australia).

Ch.Is.: Settlement, *D.A.Powell 563* (K); Settlement, *D.A.Powell 573* (K). C.K.Is.: 0.5 km NW of Possession Point, Horsburgh Is., *D.G.Williams 27* (CBG).

The *D. viscosa* complex has been divided by P.W.Leenhouts, *loc. cit.*, into 3 species, the coastal *D. viscosa*, the inland *D. angustifolia* L.f. and *D. eleagnoides* Rudolph from tropical America. J.G.West, *loc. cit.* and *pers. comm.*, regards *D. viscosa s. lat.* as a polymorphic complex involving several entities. The specimens from Christmas Is. have wide leaves (up to 5 cm wide, and only about 3 times as long as wide) and a 2- or 3-winged fruit and bisexual flowers, and are therefore included in *D. viscosa s. str.*

The wood is exceptionally hard and is useful for tool handles, walking sticks, and for turning and engraving. It is a good firewood, easily ignited.

3. TRISTIROPSIS

Tristiropsis Radlk. in T.Durand, *Index Gen. Phan.* 76 (1887) ['1888']; after the genus *Tristira* (Sapindaceae) which it resembles and the Greek *-opsis* (appearance); *Tristira* is derived from the Greek *tri* (three) and *steira* (a keel), in reference to the fruit with three longitudinal keels.

T: not designated.

Trees. Leaves twice paripinnate, spirally arranged; pinnae and leaflets distichous; leaflets of mature foliage entire, coriaceous. Inflorescence axillary, panicle-like, bracteate. Flowers small, actinomorphic, bisexual. Sepals 5, subequal, concave, shortly connate at base. Petals 5, broadly ovate, with two incurved auricles towards base, shortly hairy outside, white. Disc annular. Stamens usually 10, sometimes 9 or 11; filaments densely hairy. Ovary of 3 or 4 uniovulate locules, pubescent. Style short; stigma usually 3-lobed, the lobes decurrent. Fruit indehiscent, ellipsoidal, 3- or 4-angled, with a fibrous exocarp and a woody endocarp, 3- or 4-locular with up to 4 seeds.

A genus of 2 species, occurring in Malesia from Java east to New Guinea and Melanesia, and through Borneo to the Philippines and Micronesia; 1 species on Christmas Is.

P.W.Leenhouts, Florae Malesianae Precursores XLII, Notes on Sapindaceae II. *Tristiropsis*, *Blumea* 13: 395 (1966).

Tristiropsis acutangula Radlk. in T.Durand, *Index Gen. Phan.* 76 (1887)

T: Solomon Islands, *H.B.Guppy 272*; holo: K. Epithet from the Latin *acutangulus* (sharp-angled) in reference to the keeled fruit.

T. nativitatis Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 182–183 (1906), as *Tristiriopsis*. T: Phosphate Hill, Christmas Is., 1904, *H.N.Ridley*; iso: K.

T. ridleyi Hemsl., *Hook. Icon. Pl.* 29: t. 2812 (1906). T: Phosphate Hill, Christmas Is., 1904, *H.N.Ridley 67*; syn: K.

[*Burseraceae*? *sensu* W.B.Hemsl., *J. Linn. Soc., Bot.* 25: 353–354 (1895)]

Illustration: W.B.Hemsley, *Hook. Icon. Pl.* 29: t. 2812 (1906).

Trees 15–30 m tall; bole unbranched, with irregular, knotty buttresses; bark red-brown; branchlet tips and inflorescences finely pubescent, yellow-brown. Adult leaves usually with 2–4 pinnae, each with 5–9 leaflets; primary rachis 2–6 cm long; secondary rachises 6–17 cm long; leaflets narrowly elliptic, oblong or ovate, unequal-sided, cuneate to rounded at base, entire, obtuse, retuse or acuminate; lamina 3–15 cm long, glabrous, lustrous. Inflorescence 12–30 cm long, branched towards apex, in upper axils. Flowers many, white. Sepals

Figure 46. **A–F**, VITACEAE. **A–C**, *Cayratia pedata*. **A**, flowering shoot X0.5 (D.Powell 331, K); **B**, flower X4 (T.Horsfield Ampel. 13, K); **C**, fruit X1 (C.Andrews 59, K). **D–F**, *Cissus repens*. **D**, flowering shoot X0.5 (D.Powell, Feb. 1980, K); **E**, flower X4 (W.de Wilde 12258, K); **F**, fruit X1 (H.Ridley 84A, K). **G–I**, SAPINDACEAE: *Tristiropsis acutangula*. **G**, flowering branchlet X0.5; **H**, flower X2 (**G–H**, D.Powell 137, K); **I**, fruit X0.5 (J.Lister, Oct. 1887, K). Drawn by E.Catherine.

orbicular, c. 4 mm long, finely pubescent, persistent. Petals c. 2–3 mm long, finely pubescent outside. Fruit ellipsoidal, 2.5–3.3 cm long, obscurely 3- or 4-ridged, tapering at base and apex, reddish. Fig. 46G–I.

Christmas Is. Occurs on the plateau in primary forest where it forms about 6% of the canopy. Less frequent on the terraces, but is a major emergent species in the marginal forest. Tolerant of limestone soils. Also on W Java, along the Sunda Islands to New Guinea and Melanesia and in the Philippines and Micronesia.

Ch.Is.: Flying Fish Cove, 2 Oct. 1887, *J.J.Lister* (K); northern plateau, *D.A.Powell 39* (K); first terrace, immediately below Drumsite (seedlings), *D.A.Powell 51* (K); terrace between North East Point and Waterfall, *D.A.Powell 137* (K); South Point, *B.A.Mitchell 66* (CBG, K).

The woody, indehiscent fruit with a fibrous exocarp is probably suited to sea dispersal.

4. ALLOPHYLUS

Allophylus L., *Sp. Pl.* 1: 348 (1753); *Gen. Pl.* 5th edn, 164 (1754); from the Greek *allos* (other) and *phylon* (nation), an obscure reference perhaps indicating the Sri Lankan origin of the type species, or a corruption of the Greek *phyllon* (a leaf).

Type: *A. zeylanicus* L.

Scrambling shrubs to small trees, monoecious or dioecious. Leaves mostly trifoliolate, spirally arranged. Inflorescence axillary, raceme-like, long, slender, sometimes sparsely branched. Flowers many, minute, zygomorphic, faintly fragrant, in closely spaced, few-flowered clusters. Sepals 4 in 2 unequal pairs, free, hooded. Petals 4, towards one side of flower, with a hairy scale inside. Disc 4-lobed, nectariferous, unilateral. Stamens 8, with hairy filaments, sterile in female flowers. Ovary of 2, spherical, hairy, uniovulate lobes. Style bifid. Pistil rudimentary in male flowers. Fruit a drupe, thinly fleshy, glabrous, rarely 2-lobed. Seed 1, large.

A pantropical and taxonomically complex genus; 1 species on Christmas Is. and Cocos (Keeling) Is.

P.W.Leenhouts, *Blumea* 15: 301–358 (1967) listed about 225 accepted species, but also described a very complex pattern of variation linking them. He considered that it is possible to recognise only 1 species on the basis of morphological characters, and suggested that locally distinct variants should be designated as races.

L.A.T.Radlkofer, Sapindaceae, *Pflanzenr.* 98B: 455–604 (1932); E.J.H.Corner, Notes on the systematics and distribution of Malayan Phanerogams, *Gard. Bull. Straits Settlem.* 10: 38–43 (1939); P.W.Leenhouts, A conspectus of the genus *Allophylus* (Sapindaceae), *Blumea* 15: 301–358 (1967).

Allophylus cobbe (L.) Blume, *Rumphius* 3: 131 (1847)

Rhus cobbe L., *Sp. Pl.* 1: 267 (1753). T: Sri Lanka, Herb. P.Hermann, vol. 2, fol. 46, n. 441; syn: BM. Epithet a Latin transcription of the Sri Lankan name, *kobbae*, for this species.

Illustration: E.J.H.Corner, *Wayside Trees of Malaya* 1: 584, fig. 213 (1940).

A small tree, monoecious; branchlets and petiolules sparsely pubescent. Leaves trifoliolate; leaflets ovate to elliptic, cuneate to obtuse at base, weakly serrate or entire, acuminate, glabrous, with 8–12 lateral veins each side; lamina 8–15 cm long; petiole 2–8 cm long; petiolules 3–12 mm long. Inflorescence 8–15 cm long, c. 5 mm diam., usually simple; rachis pubescent; pedicels c. 1 mm long. Flowers c. 1.5 mm diam. Sepals orbicular, the outer pair smaller and more strongly hooded. Petals spathulate, c. 1 mm long, with a hairy scale inside. Fruit a single drupe, obovoid, 6–7 mm long, 4–5 mm diam., orange-red, several on each inflorescence.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. represented by small trees on forest

margins, but not as a part of the lower canopy; common on all terraces up to 220 m. On Cocos (Keeling) Is., recorded only for North Keeling Is. in strand forest with *Pisonia grandis* and *Cordia subcordata* in coralline sand. A widespread and variable species distributed throughout the tropics, including Australia (N.T., Qld).

Ch.Is.: no precise locality, *D.A.Powell 324* (K); terrace W of Lily Beach, east coast, *B.A.Mitchell 81* (CBG, K); near Lily Beach Rd, *B.A.Mitchell 183* (CBG, K). C.K.Is.: North Keeling Is., *D.G.Williams 48* (BRI, CBG); North Keeling Is., *D.G.Williams 44A* (CBG, PERTH).

This variant is larger than the common seashore shrub found throughout Malesia. A very variable species, especially in size and habit, leaf morphology and branching of the inflorescence, but the flowers and fruit are uniform throughout. In the past it has been split into many species (L.A.T.Radlkofer, *loc. cit.*), but a broader species concept has been applied more recently (E.J.H.Corner, *loc. cit.*, 1939; P.W.Leenhouts, *loc. cit.*) Corner recognised 5 varieties in the Malay Peninsula, the variant on Christmas Is. corresponding to his var. *glaber*. This variety is characterised by its glabrous or sparsely pubescent twigs and petioles, its large leaflets with many veins, and the lack of hairs in the angles of its leaf veins. It is a small tree rather than a shrub, usually found inland, in secondary forests rather than on the coast.

The fruit are reported to be edible, and the wood is widely used as fuel.

58. ANACARDIACEAE

D.J.Du Puy (Ch.Is.)

Trees, shrubs or climbers, often with acrid sap which blackens on exposure. Leaves imparipinnate or simple, with a swollen petiole base, often crowded near branchlet tips; stipules absent. Inflorescence axillary or terminal, usually a thyrse or panicle. Flowers small, actinomorphic, 5- or sometimes 4-merous, bisexual or unisexual. Calyx usually 4- or 5-lobed. Petals 4 or 5 (absent in *Pistacia*), free, imbricate or valvate. Stamens usually 4, 5, 8 or 10, usually free, sometimes reduced to staminodes; anthers longitudinally dehiscent. Disc intrastaminal or with stamens on outer margin, often nectariferous. Ovary superior; carpels usually 1, up to 5, free or connate, often only 1 fertile, uniovular. Fruit drupaceous, usually 1-locular, often fleshy; endocarp fibrous or woody. Endosperm sparse or absent.

There are about 75 genera and 600 species in this family, distributed throughout the tropics and subtropics with some temperate species, but with greatest diversity in Malesia; 2 genera native or naturalised on Christmas Is. They occur mainly as small trees in primary rainforest, some species being tall enough to form part of the main canopy, although they are rarely gregarious.

Many species in the Anacardiaceae can be recognised by the dried, black sap exuded from damaged parts of the plant. This sap is a skin irritant in many species, causing dermatitis, inflamation or blistering. Direct contact with the sap or with the wood or sawdust, inhaling smoke from the burning wood or even contact with water dripping from the foliage may be enough to cause serious irritation. *Rhus radicans* L., the Poison Ivy of North America, is a well-known example. In Malaya, such trees are known collectively as Rengas. The sap of *Rhus verniciflua* Stokes dries very hard and black, and is the basis of Japanese Lacquer.

Several species are commercially important for their fruits. *Pistacia vera* L. produces Pistachio nuts. *Anacardium occidentale* L. (Cashew) and *Mangifera* spp. (Mango) are widely cultivated in the tropics and occur on Christmas Is.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Anacardiaceae, *Fl. Java* 2: 146–154 (1965); Ding Hou, Anacardiaceae, *Fl. Males.* ser. I, 8: 395–549 (1978).

KEY TO GENERA

1 Leaves compound, imparipinnate, with 9–17 subopposite leaflets; fertile stamens 8 or 10; styles 5 **2. SPONDIAS**

1: Leaves simple; fertile stamen 1; style 1

2 Leaves narrowly elliptic, shortly acuminate; flowers in small clusters along panicle branches; petals 4-6 mm long; fruit c. 10–15 cm long **1. MANGIFERA**

2: Leaves obovate, rounded to emarginate; flowers grouped towards ends of panicle branches; petals 7–15 mm long; fruit a reniform nut c. 3 cm long, at the tip of a highly swollen, obovoid pedicel which is much larger than the nut itself **†ANACARDIUM**

Genera marked with a dagger symbol (†) are introduced but not naturalised and are not treated further in the text.

1. MANGIFERA

Mangifera L., *Sp. Pl.* 1: 200 (1753); *Gen. Pl.* 5th edn, 93 (1754); from the name *mango*, for the fruit of this tree, and the Latin *ferre* (to bear).

Type: *M. indica* L.

Evergreen trees. Leaves spirally arranged, clustered at branchlet tips, simple, entire; petiole thickened at base. Inflorescences mainly terminal panicles, sometimes apparently clustered. Flowers many, small, actinomorphic, 5- or 4-merous, bisexual or male. Calyx usually deeply 5-lobed. Petals usually 5, free, distally reflexed, with 3–5 raised veins, imbricate. Stamens usually 5, 4 staminodal, 1 fertile and much longer than staminodes, projecting from flower, often inserted inside disc. Disc cupular or pulvinate, often lobed or furrowed, papillose or not, sometimes reduced. Ovary unilocular; ovule 1; style solitary, somewhat lateral, slender, projecting. Endocarp 1-locular, laterally compressed, woody or fibrous. Seed 1.

A genus of c. 35 species native to SE Asia from India and Indo-China through Malesia to the Philippines, New Guinea and the Solomon Is. *Mangifera indica* L. is cultivated throughout the tropics for its edible fruit, the mango, and several others are cultivated more locally, including *M. odorata* Griff.. Both of these species are cultivated on Christmas Is., and *M. odorata* is partially naturalised.

***Mangifera odorata** Griff., *Notul.* 4: 417 (1854)

T: Malacca, Malay Peninsula, Oct. 1842, *W.Griffith s.n.*; holo: K. Epithet from the Latin *odoratus* (scented), in reference to the fragrant flowers.

Illustration: Ding Hou, Anacardiaceae, *Fl. Males.* ser. I, 8: 438, fig. 12 (1978).

Tree to 35 m tall. Leaves narrowly elliptic, cuneate at base, entire, shortly acuminate, glabrous, purplish when young; lamina 10–30 cm long; petiole 2–5 cm long. Panicles terminal, 12–30 cm long, pyramidal, glabrous, yellowish. Flowers many, fragrant, yellowish-white becoming red. Calyx deeply 5-lobed; lobes ovate to elliptic, 2–3 mm long, sparsely hairy or glabrous. Petals 5, narrowly elliptic, 4–6 mm long, acute, with 3–5 raised veins. Fertile stamen 3–4 mm long. Disc pulvinate, about as broad as ovary, 5-lobed, glabrous. Ovary subglobose; style c. 3 mm long, somewhat lateral. Drupe obliquely ovoid or ellipsoidal, 10–13 cm long, dark- to yellow-green, finely yellow-spotted; flesh sweet, yellow; endocarp fibrous. *Mango*, *Kuini*.

Christmas Is. Introduced as a fruit tree, and old trees often mark areas previously cultivated. It is now quite common on the island, and many specimens are self-sown. The natural distribution of *M. odorata* has been obscured through its widespread cultivation throughout Malesia, but it occurs in lowland forest in Sumatra, Java and Borneo.

Ch.Is.: no precise locality, *D.A.Powell 658* (K).

The fruit is sweet and pleasant to eat, with a slightly pungent scent, and slightly fibrous flesh. Mangoes may be eaten raw, or preserved as sun-dried slices, pickled in salt, or made into a delicious chutney or jam. The unripe fruit contains a strongly irritant sap, and care must be taken to use fully ripe fruits.

A second species of mango, *Mangifera indica* L., is also cultivated on Christmas Is. This species is probably native to India and Burma, but is widely cultivated throughout the tropics, and is commercially the most important mango. The seed produced on Christmas Is. is viable and seedlings will grow freely if the fruit is not collected, suggesting that this species may become naturalised in the future. The fruit is delicious eaten raw or dried, and may be used to make pickles, chutney or jam. It is most easily distinguished from *M. odorata* by its more slender, glossy leaves with an undulating margin, its shortly hairy inflorescence, its broader, papillose disc and its more brightly coloured fruit; *D.A.Powell 659* (K).

2. SPONDIAS

Spondias L., *Sp. Pl.* 1: 371 (1753); *Gen. Pl.* 5th edn, 174 (1754); the ancient Greek name for the wild plum, which the fruit of *Spondias* resembles.

Type: *S. mombin* L.

Trees, usually deciduous. Leaves spirally arranged, clustered at branchlet tips, large, imparipinnate, with subopposite leaflets, rarely bipinnate or simple (not on Christmas Is.); leaflets usually with a distinct intra-marginal vein; petiole much thickened at base. Inflorescence axillary or terminal, often forming a large panicle. Flowers small, actinomorphic, 5- or occasionally 4-merous, bisexual or unisexual. Calyx usually 5-lobed or divided. Petals usually 5, free, reflexed, valvate. Stamens 8 or 10, sometimes staminodal, inserted below disc. Disc annular, deeply 10-lobed, glabrous. Ovary 5-locular, each with 1 ovule. Styles 3–5. Endocarp 1–5-locular, woody, ridged, sometimes with many slender processes. Seeds usually 1–3.

The 10–15 species in this genus are distributed in the Indo-Malesian and American tropics; 1 species on Christmas Is. Some species are widely cultivated for their fruit, which is often sour and eaten mainly as a pickle or a flavouring.

H.K.Airy Shaw & L.L.Forman, The genus *Spondias* L. (Anacardiaceae) in tropical Asia, *Kew Bull.* 21: 1–19 (1967).

Spondias cytherea Sonn., *Voy. Indes Orient.* 3: 242, t. 123 (1782)

T: Mauritius, *P.Sonnerat*; holo: P *n.v.* Epithet from the French name 'Ile de Cyther', for Tahiti, where the specimens seen by Sonnerat on Mauritius originated.

S. dulcis Sol. ex G.Forst., *Pl. Escul.* 33 (1786) & *Prodr.* 34 (1786). T: Tahiti, Society Islands, 1769, *J.Banks & D.C.Solander*; holo: BM.

Illustration: B.Molesworth Allen, *Malayan Fruits* 21, fig. 10 (1967).

Deciduous tree to 30 m or more tall. Leaflets 9–17, oblong or oblong-ovate, rounded or cuneate at base, shallowly crenate or serrate, abruptly acuminate, somewhat leathery, foetid when crushed; intra-marginal vein distinct; lamina 8–13 cm long; rachis and petiole 18–35 cm long; petiolules 4–6 mm long, narrowly winged. Panicle terminal, 20–30 cm long, glabrous, produced with or before new leaves. Flowers many, bisexual; pedicels 1–3 mm long. Calyx c. 2 mm across, deeply 5-lobed. Petals narrowly ovate, c. 4 mm long, acute, hooded, strongly reflexed, white. Disc thick, lobed, yellow. Ovary deeply 5-lobed. Styles 5. Drupe ellipsoidal, 2.5–4.5 cm long; skin thin, fibrous, yellow-orange; pulp orange; endocarp with many arching processes. *Great Hog Plum, Kedondong*.

Christmas Is. Confined to two natural stands at about 250 m altitude, one on the northern slopes of Murray Hill, and one on the eastern side of Phosphate Hill. Distributed throughout SE Asia, and widely cultivated in other tropical regions.

Ch.Is.: towards Andrews Lookout, Phosphate Hill, *H.N.Ridley 92* (K); small terrace on the eastern side of Phosphate Hill, *D.A.Powell 58* (K); Camp 4, Drumsite to South Point railway, *D.A.Powell 555 & 672* (K); Phosphate Hill, *D.A.Powell 773* (K); north coastal terrace, north of Murray Hill and southeast of West White Beach, *B.A.Mitchell 97* (CBG, K).

The branchlets are stout but brittle, with the leaves crowded towards the tips, causing tall specimens to suffer severely from wind damage. The stand on Phosphate Hill was recorded by H.N.Ridley (1906) as gigantic trees 100 ft (30 m) tall with 2 ft (61 cm) diam. trunks. These specimens are strong emergents from the surrounding canopy. This species is also cultivated on Christmas Is. for its edible fruit. The cultivated trees are smaller, somewhat different in appearance, and have better quality fruit than native specimens. The quality of fruit varies greatly, some cultivars being sweet, others acrid, and some having a smaller endocarp. There is therefore the possibility of improvement of the fruit quality by selection of good cultivars. The fruit is usually stewed before being eaten.

59. MELIACEAE

D.J.Du Puy (Ch.Is.)

Trees or shrubs, sometimes with a milky exudate from the bark. Leaves spirally arranged, often clustered towards tips of branches, usually pinnate, rarely bipinnate; leaflets usually opposite; stipules absent. Inflorescence often paniculate or thyrsoid, axillary, sometimes terminal, rarely from older wood. Flowers actinomorphic, bisexual or unisexual. Sepals 3–5, free or connate, usually imbricate. Petals 3–6, free or connate below, or adnate to staminal column, contorted or imbricate. Disc often present. Stamens usually 8 or 10; filaments usually connate into a tube. Ovary superior, usually 3–5-locular, each with 1 or 2 ovules; placentation axile. Style 1 or absent; stigma capitate or discoid. Fruit a capsule, drupe or berry. Seeds often arillate or with a fleshy testa, sometimes winged. Endosperm usually well developed.

A pantropical and subtropical family of 51 genera and about 550 species, commonly found as understorey trees in rainforest; about 34 species in 11 genera (2 endemic) occur in Australia; 2 genera and 2 species on Christmas Is. Several genera include important timber trees, including *Swietenia mahogani* L. (Mahogany) from tropical America, *Chloroxylum swietenia* DC. (Satinwood) from India and SE Asia and *Khaya* spp. (African Cedar) from tropical Africa. The timber is of very high quality, with a fine grain, good colour and excellent working properties, and is important in furniture construction. The trees are often tall with apical branching, and are well suited to plantation cultivation. Fruit trees in SE Asia include *Lansium domesticum* Jack (Langsat) and *Sandoricum koetjape* (Burm.) Merr. (Sentol). Many genera are highly ornamental, especially *Aglaia* Lour. which has feathery foliage, often silvery or coppery when young, and others have ornamental fruit.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Meliaceae, *Fl. Java* 2: 116–130 (1965); T.D.Pennington and B.T.Styles, A Generic monograph of the Meliaceae, *Blumea* 22: 419–540 (1975).

Figure 47. **A–C**, MELIACEAE: *Dysoxylum gaudichaudianum*. **A**, flowering branchlet X0.3; **B**, flowers X1 (**A–B**, D.Powell 84, K); **C**, fruit X0.5 (Timor Laut, Meyer, 1884, K). **D–F**, RUTACEAE: *Murraya koenigii*. **D**, flowering shoot X0.3; **E**, fruit X1 (D.Powell 433, K); **F**, flowers X1 (R.Bakhuizen 2365, K). **G–K**, ARALIACEAE: *Schefflera elliptica*. **G**, sterile branchlet X0.5; **H**, inflorescence X0.5 (**G–H**, B.Mitchell 62, CBG); **I**, young flower with front petal removed X7; **J**, older flower with petals fallen X7 (**I–J**, LAE 51295, K); **K**, fruit X4 (B.Mitchell 62, CBG). Drawn by E.Catherine.

KEY TO GENERA

Leaves pinnate; leaflets entire; flowers sessile on short spurs and subtended by several bracteoles; petals adnate below staminal tube; disc tubular, enclosing ovary; staminal tube pilose, white; fruit a large, pyriform, velvety capsule with several arillate seeds **1. DYSOXYLUM**

Leaves bipinnate; leaflets serrate; flowers pedicellate, not on spurs and without bracteoles; petals free; disc annular; staminal tube almost glabrous, violet; fruit a fleshy, glabrous drupe with a single woody pyrene **2. MELIA**

1. DYSOXYLUM

Dysoxylum Blume, *Bjidr.* 172 (1825); from the Greek *dus* (unpleasant) and *xudon* (wood) from the onion or garlic odour of the bark and wood of some species.

Type: *D. alliaceum* (Blume) Blume

Trees. Leaves usually imparipinnate. Inflorescence paniculate, racemose or spicate, in or above axils of fallen or present leaves, or on old wood. Flowers usually bisexual, sometimes subtended by several bracteoles. Sepals usually 4 or 5, free or connate. Petals usually 4 or 5, free or adnate to staminal tube. Disc tubular to cupular, enveloping ovary. Staminal tube broad. Ovary 2–5-locular, each with 1 or 2 ovules. Fruit a loculicidal capsule, globose to pyriform, usually splitting into 3–5 parts. Seeds with an incomplete yellow to red aril or thickened, fleshy testa, often dangling from fruit on mealy white strands.

A genus of about 60 species in SE Asia, Malesia and Australasia. About 14 species occur in Australia; 1 species native on Christmas Is. Several species produce a useful timber.

Dysoxylum gaudichaudianum (A.Juss.) Miq., *Ann. Mus. Bot. Lugduno-Batavum* 4: 15 (1868)

Didymocheton gaudichaudianum A.Juss., *Mém. Mus. Hist. Nat. (Paris)* 19: 231, 272 (1830). T: Rawak, *C.Gaudichaud-Beaupré*; *n.v.* Epithet in honour of C.Gaudichaud-Beaupré who collected the type.

Dysoxylum amooroides Miq., *Ann. Mus. Bot. Lugd. Bat.* 4: 16 (1868). T: New Guinea, *A.Zippelius*; syn: U *n.v.*; Ceram, *J.Teijsmann & W.H. de Vriese*; syn: U *n.v.*

Tree 5–30 m tall. Leaves very large, usually with 9–25 opposite leaflets; rachis to 100 cm long; leaflets ovate to elliptic, unequal-sided, strongly oblique, entire, shortly acuminate; lamina c. 6–20 cm long; petiolules 2–5 mm long. Panicles supra-axillary, up to 40 cm long, sparsely branched. Flowers sessile on short spurs along secondary rachises, subtended by several bracteoles. Sepals 2 mm long. Petals narrowly oblong, 8–10 mm long, adnate in basal half to staminal tube; apex apiculate and sharply incurved. Disc tubular, enclosing ovary and style base. Capsule pyriform, 2–3 cm long, 3–5-locular, velvety, wrinkled, light orange. Seeds up to 10; arils fleshy, reddish. Fig. 47A–C.

Christmas Is. Common as an emergent into the main canopy of the plateau rainforest, and also found on the terraces, especially in the south where the terraces are not well defined and the plateau type of vegetation mingles with that of the terrraces. Distributed from the Philippines and Java through the Malay Islands and New Guinea to Melanesia and Samoa.

Ch.Is.: east coast plateau, *C.W.Andrews 36* (K); Flying Fish Cove, *H.N.Ridley 57* (K); northern plateau, *D.A.Powell 23* (K); terrace between North East Point and Waterfall, *D.A.Powell 84* (K); Waterfall Rd, *A.Pearson P78* (K).

The seeds may be poisonous, but are eaten by birds. The timber is probably of high quality.

2. MELIA

Melia L., *Sp. Pl.* 1: 384 (1753); *Gen. Pl.* 5th edn, 182 (1756); this is the Greek name for Manna Ash (*Fraxinus ornus* L.) in Europe, which has a similar compound leaf.

Type: *M. azedarach* L.

Trees. Leaves bipinnate with a terminal leaflet; leaflets crenulate to pinnately divided. Inflorescence paniculate or thyrsoid, axillary. Flowers at apex of branchlets bisexual, the lateral ones functionally male but of similar appearance. Sepals 4 or 5, connate at base. Petals 4 or 5, free. Stamens usually 10; staminal tube slender. Disc annular. Ovary usually 5-locular, each with 2 ovules. Drupe globose to ellipsoidal, glabrous, with a single, woody, 5-lobed pyrene.

A genus of about 3 species in the tropics of Africa and SE Asia; 1 species in Australia, also naturalised on Christmas Is. Widely planted elsewhere as garden ornamentals.

D.J.Mabberley, A monograph of the genus *Melia* in Asia and the Pacific: The history of White Cedar and Persian Lilac, *Gard. Bull. Singapore* 37: 49–64 (1984).

***Melia azedarach** L., *Sp. Pl.* 1: 384 (1753)

T: Herb. Hort. Cliff. 161, *Melia* 1; lecto: BM, *fide* D.J.Mabberley, *op. cit.* 63–64. Epithet from *Azadaracht*, the name given by the Persian physician Avicenna (980–1037) to some poisonous tree.

Illustrations: J.H.Maiden, *For. Fl. New South Wales* 3: t. 96 (1908); E.J.H.Corner, *Wayside Trees of Malaya* 2: t. 137 (1952); W.D.Francis, *Austral. Rain-forest Trees* 3rd edn, fig. 119, 120 (1970).

Tree to 30 m tall; young shoots floccose with stellate hairs, soon glabrous; bark fissured. Leaves bipinnate; primary pinnae in 2–6 pairs; main rachis 15–80 cm long; leaflets usually 3–7 per pinna, narrowly ovate, somewhat oblique, serrate, acuminate; lamina 3–6 cm long; petiolules 1–4 mm long. Thyrse lax, 8–20 cm long, axillary, without bracteoles; pedicels 2–4 mm long. Sepals 2 mm long, connate at base. Petals narrowly obovate, obtuse, 6–8 mm long, pale violet. Disc annular. Staminal tube c. 5 mm long, pubescent towards apex within, dark violet. Style 3 mm long, glabrous. Drupe subglobose, 8–12 mm long, fleshy orange, with a single pyrene. *Bead Tree, Mindi Kechil, Persian Lilac, White Cedar, Wyndet.*

Christmas Is. Abundant on the western terraces, from the shore to about 250 m altitude, although absent from the taller forest on the plateau or over deep soil. It occurs in secondary growth, sometimes as shoots from roots left in the soil when the area was cleared. A native of SE Asia to Australia (south to N.S.W.), and widely cultivated throughout the tropics.

Ch.Is.: no precise locality, *C.W.Andrews 151* (K); Flying Fish Cove, *H.N.Ridley 41* (K); no precise locality, *D.A.Powell 426* (K).

Recorded by H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 181 (1906), as large trees, but evidently introduced. He noted that it had spread around Flying Fish Cove and up Phosphate Hill, and that it formed a major constituent of secondary forest in cleared areas. The berries are very poisonous, about six reputedly being enough to cause serious illness, but they do not harm birds which form the major means of dispersal. The pyrenes have a soft apex and are used as beads. The leaves and bark are used as fish poisons in Malaya and Australia and an insecticide may also be extracted. Trees used to shade coffee seedlings are reputed to prevent aphid attacks. A leaf used as a bookmark will deter insect pests. All parts of the tree are reputed to have medicinal properties. The wood is of good quality, useful for sports goods, cabinet-making and indoor joinery. It is a fast-growing and attractive shade tree.

60. RUTACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees or shrubs, rarely herbs; branchlets sometimes with spines. Leaves alternate or sometimes opposite, compound or sometimes simple, with many small, translucent oil glands, often aromatic; stipules usually absent. Flowers solitary or in panicles, corymbs or cymes, usually actinomorphic, bisexual. Sepals usually 3–5, often connate, persistent. Petals 3–5, usually free, imbricate or rarely valvate. Disc thick, annular, with 8–10 nectariferous glands. Stamens usually 5–10, sometimes more numerous (*Citrus*), free or cohering; anthers bilocular, dehiscing by longitudinal slits. Ovary superior, usually with 2–5 locules, sometimes more (*Citrus*); placentation axile; style usually 1. Fruit a berry, capsule or schizocarp; seeds 1–many. Endosperm usually present.

There are c. 150 genera with 1600 species in the Rutaceae, distributed in the tropics, subtropics and warm-temperate regions. The greatest diversity is in Australia and S Africa. Of the 320 species in Australia, 95% are endemic. They belong to c. 41 genera, over 50% of which are endemic. On Christmas Is. 5 genera occur, with 9 species, 7 or 8 of which are introduced; 1 genus (1 species) on Cocos (Keeling) Is. The family contains the economically important *Citrus* species which probably originated in SE Asia but are now cultivated throughout the world including on Christmas Is. and Cocos (Keeling) Is. *Clausena* and *Triphasia* are also cultivated on the islands for their fruit. Many species produce aromatic essential oils used in perfumery and in medicine. Ornamental species include *Choisya*, *Skimmia* and *Ruta* in temperate regions, and *Murraya* in the tropics and subtropics. Some species produce valuable wood, including *Flindersia xanthoxyla* (A.Cunn. ex Hook.) Domin (Yellow wood) from eastern Australia.

W.T.Swingle, The Botany of *Citrus* and its Wild Relatives, of the Orange subfamily (Family Rutaceae, subfamily Aurantioideae), in H.J.Webber & L.D.Batchelor, *The Citrus Industry* 1: 129–474 (1943); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Rutaceae, *Fl. Java* 2: 94–109 (1965).

KEY TO GENERA

1 Leaves unifoliolate; petiole winged; stamens 16–40, more than twice the number of petals; fruit 2–21 cm diam. **1. CITRUS**

1: Leaves compound with 3–25 leaflets; petiole not winged; stamens 6–10, not more than twice the number of petals; fruit less than 2 cm diam.

2 Leaves with 5–25 leaflets

3 Inflorescence a lax panicle; buds subglobose; ovary pubescent, on a short gynophore; style 1 mm long, thick **2. CLAUSENA**

3: Inflorescence corymbose; buds long-cylindrical; ovary glabrous, sessile on disc; style 4–9 mm long, slender **3. MURRAYA**

2: Leaves trifoliolate

4 Branchlets with pairs of spines at nodes; leaves alternate; flowers trimerous; petals not hooded, rounded at apex **4. TRIPHASIA**

4: Branchlets unarmed; leaves opposite; flowers 4-merous; petals hooded at apex, with an apical claw **5. ACRONYCHIA**

1. CITRUS

Citrus L., *Sp. Pl.* 2: 782 (1753); *Gen. Pl.* 5th edn, 341 (1754); the ancient name of a fragrant African wood, later transferred to the Citron (*Citrus medica* L.).

Type: *C. medica* L.

Evergreen trees and shrubs, often with spines. Branchlets angled. Leaves spirally arranged, unifoliolate, aromatic, often with a winged, articulated petiole. Flowers 1–several in axillary or rarely terminal racemes, bisexual, fragrant. Sepals usually 4 or 5, fused, persistent. Petals usually 4 or 5, ligulate, fleshy, usually creamy white, gland-dotted outside. Disc annular or cupular, nectariferous. Stamens 16–40; filaments usually cohering, white. Ovary 8–15-locular, each with 4 or more ovules, globose and sharply delimited from the style (on Christmas Is.); style simple; stigma usually capitate. Fruit a hesperidium. Seeds few to many.

A genus of c. 60 species, originating in tropical and subtropical Asia and Malesia; 3 species on Christmas Is. Many species are cultivated and there are also many cultivars and hybrids, making the taxonomy of the group very complex. The *Citrus* fruit is a hesperidium which is a large, subglobose berry, with a thin to thick and pithy skin (pericarp) with many aromatic oil glands, segmented inside with a pulp of juicy vesicles. Commercially important species are *C. limon* (L.) Burm.f. (lemon), *C. sinensis* (L.) Osbeck (orange), *C. reticulata* Blanco (mandarin, clementine or tangerine) and *C. paradisi* Macfad. (grapefruit). A variant of *C. aurantium* L. (Seville orange) produces Bergamot in its fruit peel, an essential oil used in perfumery and in 'Earl Grey' tea. *Citrus* fruits have a high vitamin C content and were important in the recent past as a preventative or cure for scurvy among sailors on long sea voyages. The fruit and leaves have many medicinal uses in SE Asia and Malesia.

B.Molesworth Allen, *Malayan Fruits* 147–165 (1967).

1 Branchlets, inflorescence and pedicels finely pubescent; petiole and wings c. 10 mm or more wide; flowers usually 5–10; pedicels 10–30 mm long; calyx 5–10 mm long; fruit usually 12–21 cm diam., with pithy peel 1.5–2 cm thick **1. C. maxima**

1: Branchlets, inflorescence and pedicels glabrous; petiole and wings 2–6 mm wide; flowers 1–5; pedicels 3–8 mm long; calyx 1–2 mm long; fruit 2–6 cm diam., with thin peel

2 Branchlets almost terete with many spines; calyx cupular, shallowly lobed; petals usually 4; anthers 2 mm long, linear; fruit 4–6 cm diam., the peel adhering, the pulp yellowish green **2. C. aurantifolia**

2: Branchlets strongly angled with few or no spines; calyx deeply lobed; petals usually 5; anthers 1 mm long, ellipsoidal; fruit 2–4 cm diam., the peel easily removed when ripe, the pulp orange **3. C. microcarpa**

1. *Citrus maxima (Burm.) Merr., *Interpr. Herb. Amboin.* 46 (1917)

Aurantium maximum Burm. in G.E.Rumphius, *Herb. Amboin. Actuar. Ind. Univ.* 16 (1755). T: G.E.Rumphius, *Herb. Amboin.* 2: 96, t. 24, fig. 2 & B (1741).

Illustrations: B.Molesworth Allen, *Malayan Fruits* 160, fig. 58 (1967), as *C. grandis*; B.Molesworth Allen, *Common Malaysian Fruits* t. 14 (1975), as *C. grandis*.

Bushy tree to 10 m tall, usually spinescent; spines strong, to 5 cm long; branchlets angled, finely pubescent. Leaves elliptic, entire or shallowly crenate; lamina 5–12 cm long; midrib pubescent below; petiole 1.5–4 cm long with broad wings, c. 1 cm or more wide. Flowers usually in 5–10-flowered racemes, occasionally solitary; rachis 2–6 cm long, pubescent; pedicels 10–30 mm long, pubescent. Calyx campanulate, 5–10 mm long, usually shallowly 4-lobed, shortly pubescent. Petals usually 4, 17–25 mm long. Filaments 11–15 mm long; anthers linear, 2–3 mm long. Style 8–12 mm long. Fruit globose or broadly obovoid, 7–21 cm diam., yellowish green; skin 1.5–2 cm thick, adhering; pulp white or pink, sweet or slightly bitter. Seeds wrinkled. *Pomelo*, *Limau Betawi*.

Christmas Is. Apparently naturalised at scattered locations. Native to Indo-China and Malesia, but now cultivated throughout the tropics.

Ch.Is.: Grants Well, *D.Pearson & D.A.Powell P84* (K); no precise locality, *D.A.Powell 393* (K).

The Pomelo is widely known under the name *Citrus grandis* (L.) Osbeck, but R.W.Scora and D.H.Nicolson, *Taxon* 35: 592–595 (1986), have demonstrated that this was not the earliest validly published name and that the name *C. maxima* (Burm.) Merr. has priority. Introduced by the Chinese mine workers, who planted trees at secret sites throughout the island. These were visited only to collect the fruit. At several of these locations the parent tree has died but self-sown trees have appeared, often at some distance from the original site. The large Robber Crab (*Birgus latro*) is capable of dragging the large fruit for over a hundred metres before tearing it apart. The fruit may be eaten raw as a grapefruit, and the peel makes good marmalade and jam or can be candied. It contains the bitter glucoside naringin, and has a high vitamin C content.

2. *Citrus aurantifolia (Christm.) Swingle, *J. Washington Acad. Sci.* 3: 465 (1913)

Limonia aurantifolia Christm., *Pflanzensyst.* 1: 618 (1777). T: illustration in G.E.Rumphius, *Herb. Amboin.* 2: t. 26 (1741). Epithet from the Latin *aurantiacus* (orange) and *folius* (leaf).

Illustration: B.Molesworth Allen, *Malayan Fruits* 153, fig. 55 (1967).

Small tree to c. 5 m tall; spines many, 4–5 mm long; branchlets almost terete, glabrous. Leaves elliptic to oblong-ovate, crenulate, glabrous; lamina 4–8 cm long; petiole 9–17 mm long, narrowly winged, usually less than 6 mm wide. Inflorescence axillary, racemose, with 1–5 flowers; rachis less than 1 cm long, glabrous; pedicels 3–4 mm long, glabrous. Calyx cupulate, 1–2 mm long, usually 4-lobed, minutely pubescent. Petals usually 4, 9–12 mm long. Filaments 7 mm long; anthers linear, 2 mm long. Style 3 mm long, soon falling. Fruit globose or ellipsoidal, 4–6 cm diam., green or yellowish; peel usually thin, adhering; pulp yellowish green, sour. Seeds smooth. *Limau Asam, Lime, Jerok*

Christmas Is. Occurs by many forest tracks and appears to be self-sown. Probably originating in Malesia but now widely cultivated in all subtropical regions.

Ch.Is.: no precise locality, *D.A.Powell 763* (K).

This is the best *Citrus* to grow on Christmas Is., requiring little attention and producing good crops of fruit. The fruit is high in citric acid and may be used to prepare drinks, for flavouring and pickling. Hybridises freely with other species, and many of these hybrids are cultivated throughout Malesia. Cultivated but not naturalised on Cocos (Keeling) Is.

3. *Citrus microcarpa Bunge, *Enum. Plant. Chin. Bor. Coll.* 10 (1833)

T: China, *coll. unknown*; *n.v.* Epithet from the Greek *micro* (small) and *carpus* (a fruit).

Illustration: B.Molesworth Allen, *Malayan Fruits* 149, fig. 52 (1967).

Small tree to 5 m tall; spines few or none, c. 3 mm long; branchlets strongly angled, glabrous. Leaves elliptic, crenulate, glabrous; lamina 3–7 cm long; petiole 8–12 mm long, very narrowly winged, c. 2–3 mm wide. Flowers axillary or terminal, usually solitary, sometimes to 3; rachis c. 5 mm long, glabrous; pedicels 6–8 mm long, glabrous. Calyx 1 mm long, deeply 5-lobed; lobes acute, minutely pubescent. Petals 5, c. 12 mm long. Filaments 7 mm long; anthers ellipsoidal, c. 1 mm long. Style c. 3 mm long. Fruit globose, 2–4 cm diam., yellow; skin thin, easily peeled; flesh orange, bitter. Seeds large, smooth. *Calamondin, Limau Kesturi, Must Lime.*

Christmas Is. It does not appear to reproduce itself in the wild on Christmas Is. but was cultivated in forest situations and may still be encountered as seemingly wild specimens, most frequently on the higher parts of the island. From tropical Asia, probably originating in China, now widely cultivated.

Ch.Is.: no precise locality, *D.A.Powell 560* (K).

Considered by W.T.Swingle, *The Citrus Industry* 1: 129–474 (1943), to be a hybrid between

Citrus and *Fortunella* (Kumquat). The fruit is like a small, round lime with large seeds and a bitter flavour. It can be used to make a refreshing drink or may be fried in coconut oil and eaten with curries. It can also be pickled or made into chutney, and peel preserved in sugar may be added to stewed fruit.

2. CLAUSENA

Clausena Burm.f., *Fl. Ind.* 87, 243 (1768); after Peder Claussen, a 16th century Danish priest and natural history scholar.

Type: *C. excavata* Burm.f.

Small trees or shrubs. Leaves alternate, often crowded, imparipinnate; leaflets alternate to subopposite, usually strongly oblique, smallest towards leaf base. Inflorescence terminal or axillary, usually paniculate; flowers in cymose clusters. Buds subglobose, circular or star-shaped in section. Calyx 4- or 5-lobed, cupular. Petals 4 or 5, free, imbricate. Stamens 8 or 10, in 2 whorls, those opposite petals slightly shorter; filaments strongly dilated below, often geniculate. Disc annular, nectariferous. Gynophore present; ovary with 2–5 locules, often pubescent, entire or 5-lobed; ovules 2 in each locule; style short, often persistent; stigma sometimes inflated. Fruit a small berry, gland-dotted; segments 2–5. Seeds 1–5.

The genus contains c. 23 species, mainly in SE Asia, India, S China and Taiwan, through Malesia to the Philippines and New Guinea; 1 species in Australia (Qld); 2 species on Christmas Is.; 3 species widespread in tropical Africa. Several species produce edible fruit, and *C. lansium* can be used as a rootstock for *Citrus*. The essential oils have several possible uses.

B.Molesworth Allen, *Malayan Fruits* 165–167 (1967).

Leaflets 15–25, slender 1–3 cm wide; buds circular in section; flowers usually 4-merous; berry 7–10 mm diam., glabrous, translucent pink, with 1 or 2 seeds **1. C. excavata**

Leaflets 7–15, large, 4.5–7 cm wide; buds strongly 5-angled in section; flowers 5-merous; berry 10–20 mm diam., pubescent, dull yellow, with 2–5 seeds **2. C. lansium**

1. *Clausena excavata Burm.f., *Fl. Ind.* 87, t. 29, fig. 2 (1768)

T: Java; *n.v.* Epithet from the Latin *excavatus* (hollowed out), application obscure.

Illustration: E.J.H.Corner, *Wayside Trees of Malaya* 1: 571, fig. 202 (1940).

Small tree to 10 m tall; branchlets pubescent. Leaves with 15–25 leaflets, curry spice scented when crushed; rachis 20–40 cm long, pubescent; leaflets narrowly ovate, unequal-sided, strongly oblique, weakly crenate, acuminate; lamina 3.5–7 cm long, 1–3 cm wide; petiolules 2–4 mm long. Panicles terminal, pubescent, 10–20 cm long. Buds entire, circular in section. Flowers 4 mm across. Calyx usually broadly 4-lobed. Petals usually 4, oblong, 3.5–5 mm long, acute, white. Stamens usually 8, geniculate. Ovary entire, pubescent; gynophore short; style 1 mm long. Berry ellipsoidal, 7–10 mm diam., with persistent style, glabrous, translucent pink. Seeds 1 or 2.

Christmas Is. Naturalised in marginal and open forest. Originally confined to the N and NE flanks of Phosphate Hill, but now increasing its range on the island and competing well with the more stunted vegetation on the terraces. Distributed from India and S China through Indo-China and Malesia to New Guinea and the Philippines.

Ch.Is.: Phosphate Hill, *D.A.Powell* (K); Phosphate Hill, 1910 mined area, North East Promontory, *B.A.Mitchell 175* (CBG, K).

May be mistaken for *Murraya koenigii*, the leaves of which have a similarily foetid smell when crushed.

2. *Clausena lansium (Lour.) Skeels, *U.S. Dept. Agric., Bur. Pl. Ind. Bull.* 176: 29 (1909)

Quinaria lansium Lour., *Fl. Cochinch.* 272 (1790). T: Canton, China, *J. de Loureiro s.n.*; *n.v.* Epithet from the vernacular name for this plant (lansa), used on Ambon Is., Indonesia.

Illustration: B.Molesworth Allen, *op. cit.* 166, fig. 60.

Small tree to c. 7 m tall; branchlets thick, pubescent, tuberculate, with a central resin canal. Leaves with 7–15 leaflets; rachis 20–30 cm long; leaflets ovate, strongly oblique, undulate, crenate, acute; lamina 8–16 cm long, 4.5–7 cm wide; petiolules 3–7 mm long. Panicles terminal, pubescent, sparsely tuberculate, to 20 cm long. Buds strongly 5-angled. Flowers c. 1 cm across. Calyx 1 mm long, 5-lobed. Petals usually 5, keeled, c. 7 mm long, white. Stamens usually 10. Ovary 5-lobed, pubescent; gynophore short; style 1 mm long. Berry spherical, 10–20 mm diam., lightly 5-ridged at apex, finely pubescent, dull yellow. Seeds 2 or 5. *Wampi*.

Christmas Is. Collected in secondary vegatation near Drumsite. Native of S China and Indo-China, but widely cultivated in the tropics and subtropics.

Ch.Is.: 0.8 km S of Drumsite, *D.A.Powell 369* (K).

Introduced by the Chinese labourers, but may be able to reproduce itself. Cultivated commercially in S China for its fruit which may be eaten raw or made into jam. The quality and flavour of the fruit is variable and may be be sweet or sour.

3. MURRAYA

Murraya A.G.Koenig ex L., *Mant. Pl.* 2: 554, 563 (1771) as *Murraea*, *nom. cons.*, corrected by J.A.Murray, *Syst. Veg.* 13th edn, 331 (1774); after J.A.Murray, 18th century Director of the botanical garden at Gottingen, Germany.

Type: *M. exotica* L.

Trees or shrubs. Leaves alternate, imparipinnate; leaflets alternate to subopposite. Inflorescence a terminal or axillary panicle, cyme or corymb. Buds elongate. Sepals 5, connate towards base, persistent. Petals 5, imbricate, erect, recurved at apex. Stamens 10, free, alternately shorter; filaments sometimes flattened; anthers small. Disc annular. Ovary entire, glabrous, usually with 2 locules, each usually with 2 ovules. Style long, slender, soon caducous; stigma capitate. Fruit a drupaceous berry, ovoid or subglobose, with mucilaginous pulp.

A genus of 4 species found from south-east Asia to the Pacific islands; 2 species on Christmas Is. *M. koenigii* is widely used in curries.

Branchlets glabrous, with pale bark; leaflets 5–9, not foetid when crushed; rachis glabrous; berry ovoid, 10–14 mm long, orange-red **1. M. paniculata**

Branchlets pubescent, with almost black bark; leaflets 13–21, curry spice scented; rachis pubescent; berry subglobose, 5–10 mm long, blue-black **2. M. koenigii**

1. Murraya paniculata (L.) Jack, *Malay. Misc.* 1: 31–33 (1820)

Chalcas paniculata L., *Mant. Pl.* 68 (1767). T: probably illustration in G.E.Rumphius, *Herb. Amboin.* 5: 26, t. 17 (1747). Epithet is the Latin for paniculate in reference to the inflorescence.

Illustrations: W.T.Swingle in H.J.Webber & L.D.Batchelor, *The Citrus Industry* 1: 195, fig. 29 (1943); A.B.Graf, *Tropica* t. 872 (1978).

Tree to 7 m tall; branchlets soon glabrescent, with pale bark. Leaves with 5–9 leaflets, not foetid when crushed; rachis 4.5–9 cm long, glabrous; leaflets ovate, elliptic or sub-rhomboidal, acute at base, weakly crenulate or entire, acuminate and notched, glabrous, glossy; lamina 2.5–6 cm long; petiolules 3–5 mm long. Flowers usually several in a terminal, corymbose panicle, fragrant. Sepals 1.5 cm long, acute, connate towards base. Petals oblong-obovate, 10–20 mm long, white. Ovary bilocular. Style 4–9 mm long. Berry

ovoid, 10–14 mm long, glabrous, orange-red. Seeds 1 or 2. *Orange Jessamine*.

Christmas Is. Collected from the limestone pinnacles on Rocky Point and also planted in gardens. A very variable species distributed from India, S China and Taiwan through Malesia to NE Australia and Melanesia.

Ch.Is.: Rocky Point, *D.A.Powell 744* (K).

The wood is hard and dense but tends to split unless carefully seasoned. The yellow root wood is used in Malaya for small objects such as kris (ceremonial dagger) handles.

2. *Murraya koenigii (L.) Spreng., *Syst. Veg.* 2: 315 (1825)

Bergera koenigii L., *Mant. Pl.* 563 (1771). T: India, *J.G.Koenig 6*, Herb. C.Linnaeus 548.1; holo: LINN. Named in honour of J.G.Koenig (1728–1785) who collected the type specimen.

Illustrations: W.T.Swingle, *op. cit.* 201, fig. 30; A.B.Graf, *Exotica* ser. 4, 2: t. 2025 (1982).

Shrub or small tree to 6 m tall; branchlets shortly pubescent, glabrescent; bark almost black. Leaves with 13–21 leaflets, curry spice scented when crushed; rachis 12–20 cm long, pubescent; leaflets narrowly ovate, oblique, serrulate, acuminate with a notched tip, pubescent on midrib; lamina 1.5–5.5 cm long; petiolules 2–4 mm long. Flowers many in a dense, terminal, pubescent corymb. Sepals 1 mm long, connate to about middle, persistent. Petals linear, 6–8 mm long, white. Ovary bilocular. Style c. 4 mm long. Berry subglobose, 5–10 mm long, glabrous, blue-black. Seeds 1 or 2. *Curry Leaf*. Fig. 47D–F.

Christmas Is. Originally introduced as a garden plant, now common in waste ground around settled areas. Native to India, Indo-China and S China, probably introduced to Malesia and other tropical regions.

Ch.Is.: Grants Well, *D.A.Powell 433* (K).

The leaves are a useful curry spice, indispensable in Sri Lankan cookery. They may also be used to flavour salad dressings. The fruits are small but edible. The leaves, bark and fruit are used medicinally in India.

4. TRIPHASIA

Triphasia Lour., *Fl. Cochinch.* 152 (1790); from the Greek *tri* (three) and *phasis* (appearance), in reference to the trimerous flowers and trifoliolate leaves of the type species.

Type: *T. aurantifolia* Lour. = *T. trifolia* (Burm.f.) P.Wilson

Shrubs; branchlets armed at nodes with paired, axillary, sharp spines. Leaves alternate, trifoliolate or unifoliolate (not on Christmas Is.), with many translucent oil glands; petiole very short. Flowers bisexual, axillary, in cymes of up to 4. Calyx cupular, 3- or 5-lobed, persistent. Petals 3 or 5, oblong, fleshy. Stamens usually 6 or 10, free, around a convex disc; filaments broadening towards base; anthers linear. Ovary entire, glabrous, 3–5-locular, each with 1 or 2 ovules. Style thick to slender, caducous; stigma capitate or discoid. Fruit a berry with oil glands in peel. Seeds 1–5 in a mucilaginous pulp.

A genus of 3 species from SE Asia, Malesia, Philippines and New Guinea; 1 species (*T. trifolia*) is widely cultivated in tropical and subtropical regions and has become naturalised in certain areas; it occurs on Christmas Is. and Cocos (Keeling) Is.

Triphasia trifolia (Burm.f.) P.Wilson, *Torreya* 9: 33 (1909)

Limonia trifolia Burm.f., *Fl. Ind.* 103, t. 35 (1768). T: Java; *n.v.* Epithet from the Latin *tri-* (three) and *folium* (a leaf) in reference to the trifoliolate leaves.

Illustration: W.T.Swingle in H.J.Webber & L.D.Batchelor, *The Citrus Industry* 1: 238, fig. 36 (1943).

Sprawling shrub 1–2 m tall; branchlets minutely pubescent, soon glabrescent; spines 4–10 mm long. Leaves distichous, lustrous, dark green; leaflets rhomboidal to ovate, crenulate, obtuse or emarginate, glabrous; lamina of central leaflet largest, 1–4 cm long; petiole 3–4

mm long; petiolules 1–3 mm long. Flowers 1–4, fragrant. Pedicels 2–3 mm long, glabrous. Calyx 3-lobed, c. 1.5 mm long. Petals 3, 7–10 mm long, white. Stamens 6, shorter than petals; filaments white. Ovary fusiform, 3-locular; ovule 1 per locule; style slender; stigma capitate, 3-lobed. Berry globose to ellipsoidal, c. 1 cm long, glabrous, red; style base persistent. Seeds 1–3. *Limeberry*.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. occurs on a scree slope behind Flying Fish Cove where the instability of the soil does not allow tall trees to establish themselves securely and gaps are constantly created in the canopy. On Cocos (Keeling) Is., recorded as naturalised only for North Keeling Is. in *Pisonia grandis* forest in coralline sand. Native to SE Asia and Malesia, now cultivated and sometimes naturalised throughout the tropics and subtropics.

Ch.Is.: Flying Fish Cove, *D.A.Powell 288* (K). C.K.Is.: North Keeling Is., *D.G.Williams 154* (CBG, K, PERTH); North Keeling Is., *D.G.Williams 35* (AD, CBG, K).

The plants on North Keeling Is. are growing near the site of a temporary settlement and may be introduced.

The fragrant, white flowers, red berries and attractive foliage, combined with the sharp spines, make this a useful hedging shrub. A marmalade may be made from the fruit.

5. ACRONYCHIA

Acronychia J.R.Forst. & G.Forst., *Char. Gen. Pl.* 53, t. 27 (1775), *nom. cons.*; from the Greek *akros* (terminal) and *onyx* (a claw), descriptive of the tips of the petals which are incurved and claw-like.

Type: *A. laevis* J.R.Forst. & G.Forst.

Shrubs or small trees, glabrous or with simple hairs. Leaves opposite, digitate, trifoliolate or unifoliolate (not on Christmas Is.), with many translucent oil glands; leaflets articulated. Panicles or corymbs axillary. Flowers bisexual, actinomorphic. Sepals 4, persistent, free, or fused towards base. Petals 4, often hooded with incurved and clawed apices, white or yellowish. Disc annular, convex. Stamens 8, free; filaments flattened, white. Ovary usually entire, sessile, 4-locular, with 2 ovules in each locule. Style slender. Fruit a drupaceous berry, with 2–4 locules, each with 1 or 2 seeds.

A genus of 42 species distributed from India and S China through Malesia to the Solomon Islands and eastern Australia; 1 species on Christmas Is. The centres of diversity are in New Guinea and Australia, the latter with 15 endemic species.

T.G.Hartley, A Revision of the genus *Acronychia* (Rutaceae), *J. Arnold Arbor.* 55: 469–567 (1974).

Acronychia trifoliolata Zoll. & Moritzi in H.Zollinger, *Nat. Geneesk. Arch. Neerl. Ind.* 2: 585 (1845)

var. **trifoliolata**

T: Tengger near Gebok Klakka, Java, *H.Zollinger 2530*; *n.v.* Epithet from the Latin *tri* (three) and *foliolatus* (having leaflets) in reference to the trifoliolate leaves.

A. andrewsii Baker f. in C.W.Andrews, *Monogr. Christmas Is.* 174 (1900). T: Christmas Is., 1897, *C.W.Andrews s.n.*; iso : K.

Small to medium tree to 25 m tall; branchlets glabrous, or very young shoots minutely pubescent. Leaves digitately trifoliolate; leaflets narrowly elliptic, cuneate at base, entire, obtuse to acuminate, glabrous; lamina 5–20 cm long; petiole 4–6 cm long. Flowers in dense, pedunculate panicles c. 3 cm long; pedicels 2–3 mm long, usually minutely pubescent. Calyx c. 1 mm long, deeply 4-lobed; lobes rounded. Petals 4, glabrous, white. Stamens ciliate at base. Ovary pubescent at apex; style 1.5 mm long, pubescent at base; stigma capitate. Fruit ellipsoidal with truncated apex and base, c. 5 mm long, apiculate, 4-lobed,

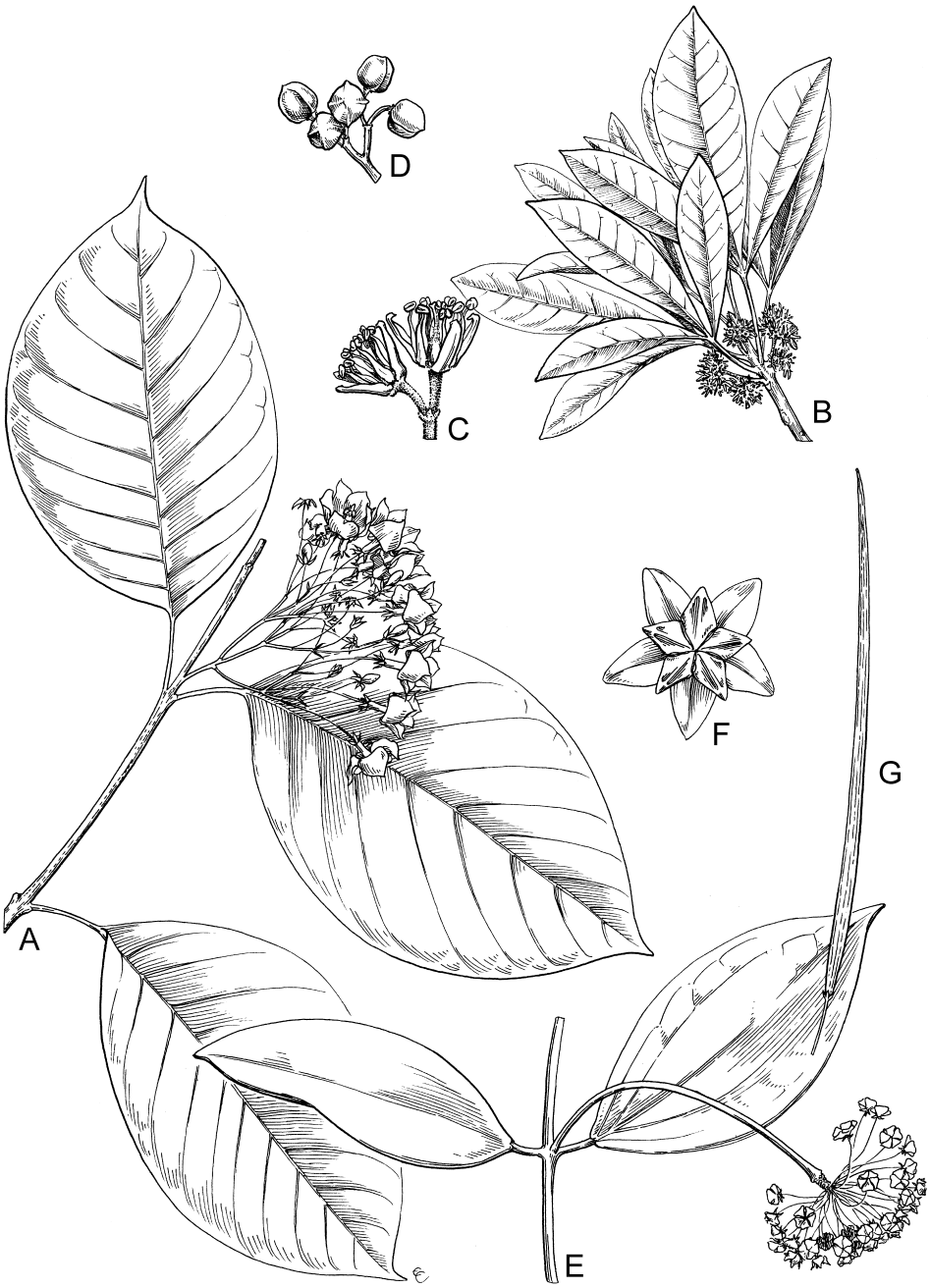

Figure 48. **A**, APOCYNACEAE: *Vallaris glabra*, flowering branchlet X0.5 (D.Powell 868, K). **B–D**, RUTACEAE: *Acronychia trifoliolata* var. *trifoliolata*. **B**, flowering branchlet X0.3; **C**, flowers X2 (C.Andrews, 1897, K); **D**, fruit X1 (D. & B.Du Puy CI30, K). **E–G**, ASCLEPIADACEAE: *Hoya aldrichii*. **E**, flowering stem X0.5 (B.Mitchell 176, K); **F**, flower, top view X3; **G**, fruit X0.5; (**F–G**, C.Andrews, Jan 1897, K). Drawn by E.Catherine.

almost glabrous, yellowish. Seeds usually 4. *Kaya djerouk*. Fig. 48B–D.

Christmas Is. Confined to the terraces. Distributed from Java, Christmas Is. and Sulawesi to New Guinea and the Solomon Islands, in primary and secondary rainforest.

Ch.Is.: near Smith Point, *H.N.Ridley 42* (K); terraces SW of Flying Fish Cove, *D.A.Powell 45* (K); adjacent to Winifred Beach track, *B.A.Mitchell 76* (CBG, K); behind cliff at golf course view point, *D.J. & B.P.Du Puy CI30* (CBG, K).

This is a variable species, the varieties being distinguished by sepal length, disc indumentum, fruit size and mesocarp texture (T.G.Hartley, *op. cit.* 538). The specimens on Christmas Is. have unusually small fruit for var. *trifoliolata*, but this is a highly variable character that cannot be used to distinguish taxa.

61. ZYGOPHYLLACEAE

I.R.H.Telford (A.R., C.S.Is.)

Herbs or shrubs. Leaves opposite, rarely alternate, pinnate or 1- or 2-foliolate, stipulate. Flowers bisexual, solitary or in few-flowered cymes, axillary or terminal, actinomorphic. Sepals 4 or 5, free or connate. Petals 4 or 5, free, alternating with sepals. Stamens 5, 10 or 15, free; anthers 2-locular, dorsifixed, dehiscing longitudinally. Disc convex or depressed, rarely annular or absent. Ovary superior, sometimes stipitate, usually 5-locular, rarely locules 2–12; placentation axile; 1 to many pendulous ovules per locule; stigmas usually 5. Fruit usually a capsule or of 5 indehiscent mericarps often winged, spinose or ornamented. Seeds 1 to many, with or without endosperm.

A family of c. 25 genera and c. 240 species, mainly tropical and warm temperate xerophytes or halophytes; 5 genera and c. 33 species in mainland Australia, of which 1 species occurs on the Coral Sea Is. and Ashmore Reef.

TRIBULUS

Tribulus L., *Sp. Pl.* 1: 386 (1753); *Gen Pl.* 5th edn, 183 (1754); from the Latin name for a 4-pronged weapon, in reference to the spinose fruit of some species.

Type: *T. terrestris* L.

Annual or perennial herbs. Leaves opposite with one of each pair reduced, or alternate, paripinnate. Flowers axillary to smaller leaf when leaves opposite, or leaf opposed when leaves alternate, usually solitary. Sepals 4 or 5, free. Petals 4 or 5. Disc annular or lobed. Stamens 10, the episepalous 5 sometimes sterile. Ovary usually 5-locular, rarely to 12-locular; ovules 1–5 per locule. Fruit of 5 indehiscent cocci, or fewer by abortion, spinose or (not in our area) verrucose or winged. Seeds 2–5 per coccus, separated by septa that develop after fertilisation.

An almost pantropical genus of c. 20 species; 9 species in mainland Australia; 1 of these on the Coral Sea Is. and Ashmore Reef.

Tribulus cistoides L., *Sp. Pl.* 1: 387 (1753)

T: 'habitat in America calidiore'; *n.v.* Epithet from the genus *Cistus* and the Greek suffix *-oides* (resembling) implying a resemblance between this plant and members of the genus *Cistus*.

Illustration: A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 209 (1985).

Stems prostrate, silky, to 60 cm from perennating tap-root. Leaves opposite, the larger 3–8 cm long, leaflets 6–8 pairs; the smaller 1–5 cm long, leaflets 4–6 pairs; leaflets elliptic,

oblique or rounded or cordate at base, obtuse or acute, mucronate, glabrescent above, silky beneath, subsessile; lamina 5–20 mm long; stipules lanceolate-falcate, 3–8 mm long. Pedicels 18–30 mm long. Sepals lanceolate, 7–11 mm long, silky. Petals obovate, 10–18 mm long, yellow. Mericarps 4 or 5, each with 2–4 sharp spines, 5–10 mm diam. including spines; pedicels to 4 cm long. *Bulls Head, Caltrop*.

Ashmore Reef, Coral Sea Is. On Ashmore Reef forming dense patches on East and Middle Is. On the Coral Sea Is. occurs in herbfields with *Lepturus repens* and *Ipomoea pes-caprae* and in *Argusia argentea* shrub community, in coralline sand; also tropical mainland Australia; pantropical.

A.R.: East Is., 12 Mar. 1986, *A.Grant* (CBG). C.S.Is.: Cato Is., *G.L.Shaughnessy 1* (CBG); Turtle Is., Lihou Reef, 12 Dec. 1979, *A.Stokes & K.McNamara* (CANB, CBG); NE Cay, Herald Cays, *I.R.Telford 11533* (BISH, BRI, CBG, US).

62. OXALIDACEAE

D.J.Du Puy (Ch.Is.)

Mainly perennial or annual herbs, rarely shrubs or trees. Stem sometimes reduced to a bracteate bulb, or rhizomatous, stoloniferous or scandent, sometimes with bulbils. Leaves alternate, often in a rosette, usually pinnately or palmately compound with the leaflets articulated on the petiole, usually exstipulate. Flowers actinomorphic, bisexual, solitary or in bracteate, axillary, often umbel-like cymes. Sepals 5, free, persistent, imbricate. Petals 5, imbricate and often convolute, free, or fused at base. Stamens 10, all fertile, in 2 whorls of different lengths, connate at base and forming an annulus; anthers 2-locular, dehiscing by longitudinal slits. Ovary superior, of 5 free or fused carpels each with 1–several ovules; placentation axile. Styles 5, free, often heterostylous. Fruit a dry, loculicidal, 5-valved capsule or rarely a fleshy, indehiscent berry. Seeds many, often with an aril; endosperm present.

A mainly tropical and subtropical family of 6 genera and about 850 species; 1 genus in Australia; 1 genus on Christmas Is.

The family includes *Averrhoa* which is sometimes placed in a separate family, the Averrhoaceae. Two species of *Averrhoa* are cultivated on Christmas Is. for their fruit which are acid and are said to have many medicinal uses (J.F.Veldkamp, *Fl. Males.* ser. I, 7: 151–178, 1971). They are trees with imparipinnate leaves, velvety new growth, panicles of reddish flowers and large (up to 12 cm long), 5-lobed, yellow-green, fleshy fruits with up to 14 seeds. *Averrhoa carambola* L. is the most palatable and can be distinguished by its 7–13 leaflets, axillary panicles, petals up to 8 mm long and sharply angled fruit which are stellate in cross-section, while *A. bilimbi* L. has 15–39 leaflets, cauliflorous panicles, petals 10–20 mm long and weakly lobed fruit.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Oxalidaceae, *Fl. Java* 1: 244–248 (1963); J.F.Veldkamp, Oxalidaceae, *Fl. Males.* ser. I, 7: 151–178 (1971).

OXALIS

Oxalis L., *Sp. Pl.* 1: 433 (1753); *Gen. Pl.* 5th edn, 198 (1754); derived from the Greek *oxys* (acid), in reference to the sharp-tasting oxalic acid accumulated by many species.

Type: *O. acetosella* L.

Annual or perennial herbs, sometimes scandent, stoloniferous or stemless with rhizomes or bulbs. Leaves alternate or whorled, borne on aerial stems or on underground bulbs, usually

palmately compound, mostly with 3 leaflets; stipules usually absent. Flowers usually in axillary cymes, clustered or umbel-like, sometimes solitary; pedicels jointed. Sepals persistent, usually shortly connate at base. Petals convolute, clawed, free or coherent. Disc absent. Stamens 10 in 2 whorls, those opposite the sepals the largest and often with a dorsal tooth. Ovary 5-locular, each locule with about 1–10 ovules. Stigma capitate or peltate. Fruit a capsule. Seeds with an elastic aril which expels the seed from the capsule.

There are about 750 species of *Oxalis*, mainly from tropical and subtropical S America and Africa, with few temperate and cold-temperate species. The Australian flora includes about 18 species, with 1 endemic; 2 introduced species naturalised on Christmas Is.

A.Lourteig, Oxalidaceae extra-austroamericanae 2, *Oxalis* L. Section *Corniculatae* DC., *Phytologia* 42: 57–198 (1979).

Economically, *Oxalis* species are important as pernicious weeds and as ornamentals, and some species are used as food plants. Some weed species are host plants for part of the life-cycle of some fungal diseases of agricultural crops. The leaves of *Oxalis* species are often touch-sensitive and close up at night. The styles occur in three different lengths in different plants. They are often incompatible with plants with styles of similar length. This heterostyly functions to encourage cross-pollination.

Plant creeping, rooting at nodes; leaves palmately 3-foliate, with stipules; leaflets obcordate; inflorescence umbel-like; petals yellow **1. O. corniculata**

Plant erect; leaves pinnately 3-foliate (terminal leaflet on an extension of the rachis), without stipules; leaflets elliptic to oblong, not notched; inflorescence 2–4-branched at apex; petals pink with a yellow base **2. O. barrelieri**

1. *Oxalis corniculata L., *Sp. Pl.* 1: 435 (1753)

subsp. **corniculata**

T: cult. Hort. Upsal., Herb. C.P.Thunberg 11084; neotype: UPS *n.v.*, *fide* A.Lourteig, *Phytologia* 42: 60, 100 (1979). Epithet from the Latin *corniculatus* (having a horn-like appendage), perhaps in reference to the erect capsule.

Illustrations: C.A.Backer, *Onkruidfl. Jav. Suikerrietgr. Atlas* t. 371 (1938); A.Lourteig, *Phytologia* 42: 101, fig. 5 (1979).

Perennial, creeping herb, rooting at the nodes. Leaves alternate, sub-opposite or tufted, palmately 3-foliolate; petiole slender, 2–9 cm long; leaflets sessile, broadly obovate, cuneate at base, deeply incised at apex, entire, strongly obcordate; lamina 0.5–1.5 cm long, glaucous below, sparsely pubescent with ciliate margin; stipules small. Flowers usually 2–5 in a pseudo-umbel subtended by a whorl of bracts; peduncle 4.5–9 cm long; pedicels 7–12 mm long, jointed below calyx. Sepals narrowly ovate, 3–4 mm long, ±acute. Petals narrowly obovate, 5–8 mm long, rounded to emarginate, yellow. Stamens not toothed. Capsule always erect from a spreading pedicel, linear-cylindrical, 12–18 mm long, beaked, pubescent, each locule usually with 5–10 seeds. *Sikup Dada*.

Christmas Is. It was first noticed on Christmas Is. in 1959, and now a widespread, invasive weed of open ground where the vegetation is frequently cut, such as sports grounds and lawns. A cosmopolitan species, probably originating in the European Mediterranean region, colonising open, disturbed areas such as fields, gardens, roadsides, tracks and settlements.

Ch.Is.: no precise locality, *D.A.Powell 12* (K); central plateau, alongside railway near camp 4, *B.A.Mitchell 124* (CBG, K); at entrance to golf course, *R.Shivas 841* (PERTH).

The tangy leaves are used in salads, and are said to have medicinal properties.

2. *Oxalis barrelieri L., *Sp. Pl.* 2nd edn, 624 (1763)

T: illustration in J.Barreliero, *Pl. Gall. Hisp. Ital.* t. 1139 (1714). Epithet in honour of J.Barreliero who published an illustration of the plant.

Illustrations: E.J.H.Corner and K.Watanabe, *Ill. Guide Trop. Pl.* 321 (1969); J.F.Veldkamp, *Fl. Males.* ser. I, 7: fig. 1F–G (1971).

Erect herb, usually up to 1 m tall, sparsely pubescent. Leaves subopposite, pinnately 3-foliolate; petiole slender, 1.5–6 cm long, pubescent; leaflets 1–3.5 cm long; terminal leaflet stalked, elliptic, cuneate to emarginate at base, entire, rounded to obtuse, sparsely pubescent, glaucous below; stipules absent. Peduncle usually 2.5–5.5 cm long, dichasially 2- or 4-branched, each branch monochasially several-flowered, bracteate. Pedicels 1–3 mm long. Sepals narrowly ovate, 2–4 mm long, acute. Petals narrowly obovate, 6–9 long, rounded, pale lilac with yellowish base. Filaments of longer (episepalous) stamens with dorsal tooth. Capsule 5–10 mm long, 5-lobed, 5-angled; locules with 3 or 4 seeds.

Christmas Is. Sometimes grown in gardens and has also been collected in secondary vegetation. A native of tropical S America. This species has been widely cultivated and has established itself in many places.

Ch.Is.: disused road to South Point, *D.A.Powell 396* (K).

Grown for its sour-tasting leaves. In Malesia, only the variant with mid-length styles occurs, but fertile seed is set, indicating that there is no genetic incompatability system linked to the heterostyly in this species.

63. ARALIACEAE

D.J.Du Puy (Ch.Is.)
A.E.Orchard (M.Is.)

Trees, shrubs, climbers or occasionally herbs, sometimes epiphytic. Leaves usually alternate, rarely opposite or whorled, sometimes entire, often compound and large, or simple and lobed; petiole base usually broad and sheathing; stipules sometimes connate. Flowers usually bisexual, actinomorphic, small, usually in umbels or heads which are often variously combined into compound, terminal inflorescences. Perianth and stamens epigynous. Sepals greatly reduced or absent. Petals usually 5, free, mostly valvate. Stamens as many as and alternating with the petals, sometimes twice as many, inserted below disc margin; anthers longitudinally dehiscent. Disc broad, nectariferous. Ovary inferior, usually 1–5-locular, each locule with 1 apical ovule; styles and stigmas 1–5, sometimes connate, often adnate to disc. Fruit drupaceous, fleshy, containing 1–12 pyrenes. Endosperm present.

A family of c. 60 genera and 1100 species, mostly tropical and subtropical, with a few representatives in temperate regions; 2 species of *Schefflera* (1 native) and 1 introduced species of *Polyscias* occur on Christmas Is.; 1 species of *Stilbocarpa* occurs on the subantarctic islands. The 3 genera *Schefflera*, *Polyscias*, and *Oreopanax* Decne. & Planch. (from tropical America) contain almost half the species. *Panax ginseng* C.A.Mey., (Ginseng Plant), is prized for its root which is reputed to have aphrodisiac and general tonic properties. *Tetrapanax papyrifera* (Hook.) K.Koch has pithy stems from which 'rice paper' is produced in China. Several species of *Schefflera*, *Polyscias* and *Dizygotheca* N.E.Br. are cultivated as ornamentals. *Hedera helix* L. (English Ivy) is commonly cultivated in temperate regions and in the high mountains of the tropics such as in Java.

G.Bentham, Araliaceae, *Fl. Austral.* 3: 378–385 (1867); H.Harms, Araliaceae, *Pflanzenfam.* 3(8): 1–62 (1894, 1897); T.F.Cheeseman, Araliaceae, *Vasc. Fl. Macquarie Is.* 27–28 (1919); B.W.Taylor, Araliaceae, *Fl. Veg. Soils Macquarie Is.* 131–133 (1955); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Araliaceae, *Fl. Java* 2: 161–171 (1965); W.R.Philipson, Araliaceae, *Fl. Males.* ser. I, 9: 1–105 (1979); A.C.Smith, Araliaceae, *Fl. Vit. Nova* 3: 681–652 (1985).

KEY TO GENERA

1 Leaves compound or divided (Ch.Is.)

2 Leaves palmately compound, with 5–15 radiating leaflets; leaflet margins entire; drupe usually with 4–12 pyrenes **1. SCHEFFLERA**

2: Leaves tripinnate, with many often laciniate leaflets; leaflet margins irregularly serrate, with mucronate teeth; drupe with 2 or occasionally 3 pyrenes **2. POLYSCIAS**

1: Leaves simple (M.Is.) **3. STILBOCARPA**

1. SCHEFFLERA

Schefflera J.R.Forst. & G.Forst., *Char. Gen. Pl.* 45 (1775), *nom. cons.*; after J.C.Scheffler, a 17th century German botanist.

Type: *S. digitata* J.R.Forst. & G.Forst.

Trees or erect to climbing shrubs, sometimes epiphytic, often aromatic. Leaves spirally arranged, mostly palmate or compound-palmate, often large; petiole base sheathing; leaflets with petiolules; stipules often connate into an axillary scale. Inflorescence terminal, compound; flowers usually in stalked umbels or heads; pedicels not articulated. Flowers bisexual or male, often 5- or 6-merous, scented. Petals usually 4–15, valvate. Stamens usually 4–15. Ovary usually 4–12-locular; stigmas usually sessile and initially immersed in disc. Fruit often ridged (strongly when dried); disc forming an apical cap; pyrenes 4–12.

A pantropical and subtropical genus, its generic delimitation and subgeneric divisions variously interpreted, and including between 125 and 450 species; 2 species (1 native and 1 naturalised) on Christmas Is. It is badly in need of a complete taxonomic revision. Some species have strong roots that form a network around their supporting tree, resembling the strangling figs, but they are never strong enough to kill it. Several species are cultivated as ornamentals in tropical gardens.

D.G.Frodin, Studies in *Schefflera* (Araliaceae): the *Cephaloschefflera* complex, *J. Arnold Arbor.* 56: 427–448 (1975).

Climbing shrub; leaves palmately 5–7-foliolate; inflorescence panicle-like, pyramidal; flowers pedicellate in lax umbels; petals and stamens 5 or 6; drupe yellow, with 4–6 pyrenes **1. S. elliptica**

Shrub or small tree; leaves palmately 8–15-foliolate; inflorescence racemose, robust, rigid, linear; flowers sessile, tightly clustered in dense heads; petals and stamens 11–15; drupe black, with 9–12 pyrenes **2. S. actinophylla**

1. Schefflera elliptica (Blume) Harms in A.Engler & K.Prantl, *Pflanzenfam.* 3(8): 39 (1894)

Sciadophyllum ellipticum Blume, *Bijdr.* 878 (1826); *Heptapleurum ellipticum* (Blume) Seem., *J. Bot.* 3: 78 (1865). T: Salak, Java, *C.L.Blume s.n.*; ?iso: K. Epithet from the Latin *ellipticus* (elliptic), in reference to the leaflets.

Heptapleurum natale Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 196–197 (1906). T: Christmas Is., 1904, *H.N.Ridley 1411*; iso: K.

Epiphytic or terrestrial climbing shrub to c. 10 m tall, glabrous. Leaves palmate, with 5–7 leaflets, glabrous, glossy; petiole c. 5–12 cm long; leaflets elliptic to oblong, cuneate to truncate at base, obtuse to shortly acuminate, c. 4–14 cm long; petiolules 1.5–5 cm long. Inflorescence panicle-like, pyramidal, c. 7–12 cm long; flowers in umbels of c. 5–20; pedicels 2–7 mm long. Sepals absent. Petals 5 or 6, ovate, 2–3 mm long, subacute, reddish green. Stamens 5 or 6, ovate, spreading, yellow. Disc apical. Ovary turbinate; stigmas 5 or 6. Drupe subspherical, c. 7 mm diam., fleshy, 4–6-ridged, yellow with a paler cap; pyrenes 4–6. Fig. 47G–K.

Christmas Is. Common throughout the primary and secondary forest and often hanging from the branches of canopy trees; also on exposed limestone rocks and cliffs, forming a tangle. A rainforest species, distributed from Indo-China throughout Malesia and the Philippines to New Guinea, northern Australia (Qld) and Palau.

Ch.Is.: no precise locality, *C.W.Andrews s.n.* (K); no precise locality, *H.N.Ridley 141* (K); junction of South Point and Toms Ridge roads, *A.Pearson P87* (K); northern plateau, *D.A.Powell 95 & 281* (K); near the Grotto, *R.Shivas 864* (PERTH).

2. *Schefflera actinophylla (Endl.) Harms in A.Engler & K.Prantl, *Pflanzenfam.* 3(8): 36 (1894)

Brassaia actinophylla Endl., *Nov. Stirp. Dec.* 89 (1839). T: illustration by *F.L.Bauer*, t. 334–336, of a specimen collected in Qld, Australia; *n.v.* Epithet from the Greek *aktinos* (a ray) and *phyllon* (a leaf), descriptive of the umbrella-like leaves in which the leaflets radiate out from the apex of the petiole.

Illustrations: A.B.Graf, *Tropica* 132 & 139 (1978), as *Brassaia actinophylla*; B.D.Morley & H.R.Toelken (eds), *Fl. Pl. Australia* 217, fig. 129 (1983).

Shrub or small tree to c. 8 m tall, glabrous. Leaves large, palmate, with c. 8–15 radiating leaflets, glabrous, glossy; petiole 30–60 cm long; leaflets oblong-obovate, obtuse to cordate at base, shortly acuminate, c. 10–25 cm long; petiolules c. 5–10 cm long. Inflorescence of several raceme-like branches 30–70 cm long in a terminal cluster, robust, purplish; flowers in shortly stalked heads, evenly distributed along rachis; flowers c. 11–14 per head, sessile, tightly clustered, each subtended by an involucre of 4 bracts. Sepals absent. Petals 11–15, subulate, 3–4 mm long, caducous, red. Stamens 11–15, spreading, pink. Disc ridged, red. Stigmas c. 11–12, yellow. Drupe subspherical, c. 7 mm diam., black; pyrenes c. 9–12, flattened. *Australian Umbrella Tree, Octopus Tree*.

Christmas Is. Introduced to a garden in Settlement in 1963, and seedlings have been distributed to other gardens. It has since spread into areas of secondary growth in the region of Drumsite. Native to Australia (N.T., Qld., N.S.W.), New Guinea, the Solomon and Aru Islands, frequently cultivated and sometimes naturalised elsewhere in the tropics.

Ch.Is.: no precise locality, *D.A.Powell 524* (K); no precise locality, *D.A.Powell 849* (K).

The seeds are distributed on Christmas Is. by the Christmas Island Thrush (*Turdus poliocephalus erythropleurus*) which eat the fruit. The species is cultivated as an ornamental, mainly for its exotic, umbrella-shaped foliage, in gardens, as a street tree, and as a pot-plant. It sometimes germinates as an epiphyte on the trunks of trees or palms, its roots forming a basket around the tree in the manner of a strangling fig.

2. POLYSCIAS

Polyscias J.R.Forst. & G.Forst., *Char. Gen. Pl.* 63, t. 32 (1775); from the Greek *poly* (many) and *skias* (canopy, umbel), descriptive of the many umbels of flowers in the inflorescence.

Type: *P. pinnata* J.R.Forst. & G.Forst. = *P. scutellaria* (Burm.f.) Fosberg

Shrubs or trees, often aromatic. Leaves spirally arranged, usually pinnate, bipinnate or tripinnate; petiole base sheathing; leaflets opposite, sometimes lobed, entire to dentate; stipules inconspicuous. Inflorescence usually compound; flowers in stalked umbels; pedicels articulated. Calyx an undulate or weakly dentate rim near ovary apex. Petals usually 4 or 5, valvate. Stamens usually 4 or 5. Ovary usually 2–5-locular; styles connate into a beak or initially cohering but becoming free and recurved. Fruit subspherical, often ridged or bilaterally compressed when dry; calyx and stigmas persistent; pyrenes usually 1–5.

A genus of c. 100 species distributed throughout the Old World tropics, from Africa to Australia and the Pacific islands, with a centre of diversity in New Guinea and the western Pacific islands; 1 species has been introduced on Christmas Is.

***Polyscias fruticosa** (L.) Harms in A.Engler & K.Prantl, *Pflanzenfam.* 3(8): 45 (1894)

Panax fruticosum L., *Sp. Pl.* 2nd edn, 1513 (1763). T: Herb. C.Linnaeus 1237.5; syn: LINN; illustration of *Scutellaria tertia* in G.E.Rumphius, *Herb. Amboin.* 4: 78, t. 33 (1743); syn. Epithet from the Latin *frutex* (shrub), referring to the shrubby growth habit of this species.

Illustrations: A.B.Graf, *Tropica* 141 (1978); A.B.Graf, *Tropica* 3rd edn, 141, 144 (1986).

Shrub 1–4 m tall, glabrous. Leaves tripinnate, with c. 10 primary pinnae; leaflets often laciniate, irregularly serrate; lamina 15–55 cm long. Inflorescence terminal, c. 10–30 cm long, with many branches in whorls; flowers in compact umbels of 12–22; pedicels c. 2–4 mm long. Calyx a narrow, sinuous rim. Petals 5, ovate, c. 8 mm long, acute, caducous, greenish. Stamens 5; filaments cream. Ovary 2- or occasionally 3-locular; styles initially cohering, forming a beak, becoming free and recurved in fruit. Drupe 3–4 mm diam., bilaterally compressed, black; pyrenes usually 2, flattened. *Parsley Panax.*

Christmas Is. Cultivated in gardens such as in the grounds of the hospital and also occurs sporadically among well-established secondary vegetation. Probably native to Malesia, but widely cultivated in the tropics and its natural distribution has become obscured.

Ch.Is.: western terraces at South Point, *D.A.Powell 668* (K).

The finely dissected foliage of *P. fruticosa* makes it an attractive garden ornamental. It is slow-growing and seldom flowers on Christmas Is., although fertile fruit are sometimes produced.

3. STILBOCARPA

Stilbocarpa (Hook.f.) Decne. & Planch., *Rev. Hort.* ser. 4, 3: 105 (1854); derivation not specified but probably in allusion to the shining fruit.

Aralia subg. *Stilbocarpa* Hook.f., *Fl. Nov.-Zel.* 1: 95 (1852).

Type: *S. polaris* (Hombr. & Jacquinot ex Hook.f.) A.Gray

Perennial herb. Leaves rosulate at apex of a fleshy rhizome, petiolate, entire, palmately veined. Inflorescence a compound umbel, borne on a hollow hirsute peduncle; primary bracts of inflorescence entire or 2–3-lobed. Flowers many. Sepals absent. Petals 5. Stamens 2–5. Ovary 2–4-locular. Fruit a berry.

A monotypic genus confined to subantarctic islands.

H.H.Allan, *Fl. New Zealand* 1: 430 (1961); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 38 (1984).

Stilbocarpa polaris (Hombr. & Jacquinot ex Hook.f.) A.Gray, *Bot. U.S. Explor. Exped. Bot. Phan.* 7: 4 (1854)

Aralia polaris Hombr. & Jacquinot ex Hook.f., *Fl. Antarct.* 1: 19 (1844). T: Lord Auckland's Group [Auckland Is.] and Campbell's Island [Campbell Is.], *J.B.Hombron & C.Jacquinot, J.D.Hooker*; syn: all *n.v.* Epithet from the Latin *polaris* (polar), in reference to the region of the type locality.

Illustrations: J.B.Hombron & C.Jacquinot, *Voy. Pôle Sud* t. 2 (1843), as *Aralia polaris*; J.D.Hooker, *Icon. Pl.* 8: pl. 747 (1848), as *Aralia polaris*; B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* pl. 7, 13, 30 (1955); T.Flannery & T.Rodd, *Australia's Wilderness Heritage* 2: 370 (1988).

Plant to 2 m tall, usually less; rhizome fleshy, 4 cm diam., to 60 cm long, with annular rings, glabrous. Leaves orbicular to reniform with a basal sinus, dentate to bidentate, hirsute on both surfaces; lamina 2.5–45 cm long, usually 7–25 cm; petiole hollow, 2.5–50 cm long, usually 10–30 cm, sparingly to densely hirsute with hairs 10–20 mm long, sheathing, developed above into an oblong ligule 4–12 cm long. Inflorescence to 30 cm diam.; peduncle to 30 cm tall; primary rays 3–10, 3–15 cm long; secondary rays 6–10. Fruit deep purplish black, shiny, depressed-globular, 3.5–4 mm diam., hollow at apex; locules 2–4. Seed 1 per locule. *Macquarie Island Cabbage*. Fig. 18.

Macquarie Is. Widespread and abundant on all except very exposed sites, forming pure stands in some places. Also found on Auckland, Campbell and Antipodes Islands. Flowers Nov.–Jan.; fruits Jan.–Feb.

M.Is.: S of Nuggets, 20 Dec. 1948, *N.R.Laird* (CHR, HO); Hasselborough Bay, *R.D.Seppelt 11972* (HO); 500 m W of Brothers Point, *R.D.Seppelt 12403* (AD, HO, MEL); coastal slopes E of Boiler Rocks, *R.D.Seppelt 12519* (AD, HO, MEL); SE end of Scoble Lake, *R.D.Seppelt 12540* (AD, HO, MEL).

Plants are very variable in size, from a few centimetres tall to 1–2 m, with leaves from 2–3 cm to 30 cm diam. This species is very palatable to rats and rabbits and is eliminated where numbers of these feral animals are high. *Stilbocarpa* was used by sealers as an antiscorbutic.

64. APIACEAE

A.E.Orchard (M.Is., H.Is.)

Aromatic perennial, biennial or annual herbs or rarely subshrubs; stems often with hollow internodes. Leaves alternate, rarely opposite, often very large, pinnately or ternately compound or dissected, or palmate or sometimes simple; petiole often with a sheathing base, exstipulate or stipulate. Inflorescence a simple or compound umbel, sometimes reduced to a single flower or sub-dichasial cluster; umbels usually subtended by an involucre of free or connate bracts. Flowers small, 5-merous (gynoecium 2-merous), usually bisexual. Sepals usually reduced or absent. Petals free, inflexed at tip. Stamens alternating with petals, inserted on an epigynous nectary disc. Ovary inferior; styles free in upper part, often swollen and fused into a stylopodium at base. Carpophore present or absent. Fruit a dry schizocarp of 2 mericarps each with a single seed.

A cosmopolitan family of about 300 genera and 3000 species, best developed in the temperate Northern hemiphere; in Australia about 45 genera and 200 species; on the subantarctic islands 2 genera and 3 species. Many species are cultivated for food, spice or ornament, including *Anethum graveolens* L. (dill), *Apium graveolens* L. (celery), *Daucus carota* L. (carrot), *Pastinaca sativa* L. (parsnip), *Petroselinum crispum* (Mill.) Nyman ex *auct. anon.* [A.W.Hill] (parsley); others such as *Conium maculatum* L. (hemlock) and *Foeniculum vulgare* Mill. (fennel) are weeds of cultivation.

G.Bentham, Umbelliferae, *Fl. Austral.* 3: 334–378 (1867); T.F.Cheeseman, Umbelliferae, *Vasc. Fl. Macquarie Is.* 26–27 (1919); B.W.Taylor, Umbelliferae, *Fl. Veg. Soils Macquarie Is.* 128–130 (1955); V.H.Heywood (ed.), The biology and chemistry of the Umbelliferae, *Bot. J. Linn. Soc.* 64, Suppl. 1: 1–438 (1971).

KEY TO GENERA

Plants forming cushions; petiole stem-clasping **1. AZORELLA**

Plants not forming cushions; petiole not stem-clasping **2. HYDROCOTYLE**

Trachymene cussonii (Montrouz.) Burtt of New Caledonia and a common herb on beaches of coral cays of the Great Barrier Reef should be expected on the Coral Sea Is.

1. AZORELLA

Azorella Lam., *Encycl.* 1: 344 (1783); derivation unclear, possibly coined by P.Commerson, collector of the type species.

Type: *A. filamentosa* Lam.

Perennial herbs, usually tufted or forming cushions. Leaves alternate, congested, entire or more often palmately dissected; petiole sheathing, exstipulate. Umbels terminal, simple, of 1 to c. 20 flowers; peduncle short. Flowers bisexual, rarely unisexual. Calyx well-developed. Petals brown to yellowish. Carpophore absent. Fruit terete or compressed; mericarps separated by a narrow, sunken commissure.

A genus of 30–70 poorly defined species, mainly confined to the high Andes of South America, but extending from Costa Rica to Patagonia and the subantarctic islands; on the Australian subantarctic islands, 1 species each on Heard, MacDonald and Macquarie Islands.

H.H.Allan, *Fl. New Zealand* 1: 451–452 (1961); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 37 (1984); A.E.Orchard, *Azorella* Lamarck (Apiaceae) on Heard and Macquarie Islands with description of a new species, *Muelleria* 7: 15–20 (1989).

Leaf lamina 3 (more rarely 5) -lobed, the lobes divided almost to the base, acute, pungent with a long setose point; flowers solitary or sometimes paired **1. A. macquariensis**

Leaf lamina usually 5- or 6-lobed (sometimes 4- or 7-lobed), the lobes divided only halfway to the base, blunt, with at most a tiny mucro; flowers usually in clusters of 3 **2. A. selago**

1. Azorella macquariensis Orchard, *Muelleria* 7: 16–18 (1989)

T: north side of Pyramid Lake, Macquarie Island, 4 Nov. 1981, *R.D.Seppelt 12039*; holo: HO. Epithet from the locality of the type specimen.

[*A. selago auct. non* Hook.f.: J.D.Hooker, *Fl. Antarct.* 2: 284–285 (1846) *p.p.* and all later references to *A. selago* on Macquarie Is.]

Illustrations: B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* pls 16, 17, 18, 29 (1955), as *A. selago*; A.E.Orchard, *Muelleria* 7: 17, fig. 1 (1989).

Perennial cushion-forming herb. Leaf lamina ±reniform in outline, usually 3-lobed, sometimes 5-lobed, glabrous or sparsely and coarsely setose on upper surface, the lobes lanceolate, free almost to base, acute and pungent with a long setose point; petiole 3–4 mm long, broadly winged, the wings fused at lamina base to form a truncate 'ligule'. Flowers solitary or sometimes paired, bisexual. Involucral bracts 2, leaf-like or lanceolate, fused at base to form a cup. Fruit yellow-brown, almost sessile or on pedicel 1 mm long, hidden by upper leaves, obovoid, 1.3–1.7 mm long, weakly ribbed; sepals usually deciduous.

Macquarie Is. Endemic. Dominates the feldmark community and other exposed windswept situations, forming extensive cushions and tight mats. Flowers Dec.–Feb.; fruits Jan.–Apr.

M.Is.: eastern side Sawyer Creek Valley, *R.D.Seppelt 11939* (HO); SW side of Green Gorge, *R.D.Seppelt 12390* (HO); near Flynn Lake, 29 Nov. 1950, *B.W.Taylor* (MEL); North Mt, 4 Mar. 1951, *B.W.Taylor* (MEL); plateau, Nov. 1976, *P.A.Tyler* (HO).

2. Azorella selago Hook.f., *Fl. Antarct.* 2: 284 (1846)

T: Cape Cumberland, Kerguelen Is., 1840, *J.D.Hooker*; syn: HO; Christmas Harbour, Kerguelen Is., 1840, *J.D.Hooker*; syn: HO; Isla Hermite [Hermit Is.], Tierra del Fuego, *J.D.Hooker 8*; lecto: K *n.v.*, *fide* D.M.Moore, *Brit. Antarct. Surv. Sci. Rep.* 60: 94 (1968). Derivation of the epithet presumably refers to a fancied resemblance to some species of *Selago*.

Illustrations: J.D.Hooker, *Fl. Antarct.* pl. 99 (1845); A.Chastain, *Fl. Veg. Iles Kerguelen* pls 2, 3, 23 (1958); D.M.Moore, *op. cit.* 95, fig. 14c; A.E.Orchard, *Muelleria* 7: 19, fig. 2 (1989).

Perennial cushion-forming herb. Leaf lamina ±reniform in outline, 4–7-lobed (usually 5 or

6-lobed), glabrous or sparsely and coarsely setose dorsally, the lobes oblong-deltoid, c. ½ or less of depth of lamina, rounded or slightly apiculate, the outermost lobes sometimes acute or long-apiculate; petiole usually 3.3–5 mm long, broadly winged, the wings produced into free auricles at base of lamina. Flowers in groups of 3, bisexual. Involucral bracts 2, lobed, leaf-like, fused at base forming a cup. Fruit olive-brown to yellow-brown on pedicel 2 mm long, at least ½ exserted from leaves, ovoid to obovoid, 1.7–2 mm long, weakly ribbed; sepals persistent. Figs 8, 59, 65, 81.

Heard Is. It is the dominant species on the island, abundant on all rocky sites between the limit of seaspray and c. 100 m alt. Extends from Tierra del Fuego to Falkland, Marion, Crozet, Kerguelen, Heard and MacDonald Islands.

H.Is.: old ANARE Stn, Atlas Cove, *G.R.Copson 103* (HO); Spit Bay, Feb. 1950, *R.Kenny* (MEL); Skua Beach, 23 Dec. 1986, *J.J.Scott* (HO); Fairchild Beach, 23 Dec. 1986. *J.J.Scott* (HO); near former ANARE base camp, Atlas Cove, *J.M.B.Smith 770* (HO).

Azorella selago has been recorded from the MacDonald Is. by S.W.Greene & D.W.H.Walton, *Polar Record* 17: 473–84 (1975). Although no specimens have been examined for this study, there is no reason to doubt the identification.

2. HYDROCOTYLE

Hydrocotyle L., *Sp. Pl.* 1: 234 (1753); *Gen. Pl.* 5th edn, 109 (1754); from the greek *hydro* (water), and *kotyle* (a dish or plate), in reference to the round leaf with slightly depressed centres characteristic of some species.

Types: *H. vulgaris* L.

Annual or more often perennial herbs; when perennial, stems rooting at lower nodes at least, or stoloniferous. Leaves alternate, usually widely spaced, petiolate with scarious stipules, rhomboidal to orbicular or reniform, sometimes peltate, entire or variously palmately dissected. Inflorescence usually a pedunculate, simple umbel, sometimes compound or spicate. Flowers unisexual or bisexual. Sepals minute or absent. Petals entire, variously coloured. Carpophore undivided and persistent in most annual species, absent in perennial species. Fruit with mericarps usually distinctly 5-ribbed, smooth or sculptured.

Over 130 species, mainly confined to temperate areas of the southern hemisphere and tropics. About 55 species in Australia, mostly endemic; 1 species on the Australian subantarctic islands.

H.H.Allan, *Fl. New Zealand* 1: 445–451 (1961); C.J.Webb *et al.*, *Fl. New Zealand* 4: 129–133 (1988).

Hydrocotyle novae-zeelandiae DC., *Prodr.* 4: 67 (1830)

T: New Zealand, *J.S.C.D.D'Urville*; *n.v.* Epithet from the locality of the type collection.

Perennial herb; stems prostrate, rooting at nodes, to 1 mm diam. Leaves orbicular, lobed, coriaceous, glabrous, glossy green above; margins purple; petiole 2–3 cm long (rarely to 7 cm), with sparse simple retrorse hairs; lobes 6 or 7, about 1/3 depth of lamina with 3–5 crenate teeth; sinuses open at base, closed at top by overlapping lobes. Inflorescence 3-flowered, on retrorsely pilose peduncle 2–3.5 cm long. Fruit greenish brown, 1.5–7.7 mm long, 2–2.3 mm wide; sinus narrow, sunken; mericarps with acute dorsal ridge, the median rib distinct, prominent at first, becoming sunken at maturity.

Macquarie Is. Locally abundant in the northern half of the island to 200 m. A polymorphic species also found in New Zealand on North, South, Stewart, Chatham, Auckland and Campbell Islands. Flowers Jan.–Feb.; fruits (in cultivation) in March.

M.Is.: between Aurora Cave and Aurora hillocks, *G.R.Copson 4* (HO); between the track and Boiler Rocks, 25 Jan. 1987 (grown on in Hobart to March 1987), *P.M.Selkirk* (HO); Bauer Bay, near edge of Bauer Bay Ck, *R.D.Seppelt 12533* (HO); Boiler Rocks, *R.D.Seppelt 12782* (HO).

Hydrocotyle novae-zeelandiae is an extremely variable species much in need of revision. H.H.Allan, *Fl. New Zealand* 1: 449 (1961) recognised 7 varieties in New Zealand. The Macquarie Is. plants most closely resemble *H. novae-zeelandiae* var. *montana* Kirk but differ from South Is. specimens examined in their more slender rhizomes and smaller fruits, in the sunken sinus between the mericarps and the acute dorsal ridge. The description above has been made from plants from the Bauer Bay/Aurora Cove area. Two collections from Handspike Point, (20 Dec. 1950 & 22 Mar. 1951, *B.W.Taylor,* HO), differ in their thicker rhizomes, leaves with open sinuses between the lobes and triangular (instead of crenate) teeth, hairs confined to upper part of petiole and peduncle, and 5 to c. 8 flowers per inflorescence. Without fruits it is difficult to be sure how these relate to the more southerly plants, but they probably represent another variant within the *H. novae-zeelandiae* complex.

65. GENTIANACEAE

I.R.H.Telford (C.K.Is.)

Annual or perennial herbs or rarely shrubs. Leaves usually opposite, rarely whorled or alternate, simple, exstipulate. Inflorescence an axillary or terminal cyme or flowers solitary. Flowers bisexual, actinomorphic. Calyx usually tubular, 4- or 5-lobed. Corolla tubular, 4- or 5-lobed; lobes convolute in bud. Stamens as many as and alternating with corolla lobes, epipetalous, inserted in corolla tube; anthers 2-locular, dehiscing longitudinally or by pores. Ovary superior; carpels 2, usually unilocular; placentation usually parietal; ovules many; style simple; stigma ±capitate, entire or 2-lobed, papillate. Fruit usually a 2-valved septicidal capsule. Seeds many; endosperm present.

An almost cosmopolitan family of c. 80 genera and c. 1000 species; 1 species native to Cocos (Keeling) Is., not in mainland Australia; 7 genera (2 introduced) and c. 15 species (7 introduced) in Australia.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Gentianaceae, *Fl. Java* 2: 437–441 (1965); L.H.Cramer, Gentianaceae, *Revised Handb. Fl. Ceylon* 3: 55–78 (1981).

ENICOSTEMA

Enicostema Blume, *Bijdr.* 848 (1826), *nom. cons.*; from the Greek *enicos* (single or exhibiting unity), *stema* (thread, stamen), in reference to the fusion of the staminal filaments.

Type: *E. littorale* Blume = *E. axillare* subsp. *littorale* (Blume) A.Raynal

Perennial herbs; stems 4-angular, arising from thickened rootstock. Leaves opposite, 3- or 5-nerved. Inflorescence an axillary head-like cyme. Calyx shortly tubular, 5-lobed. Corolla tube short, 5-lobed. Stamens 5, included in corolla tube; filaments with their lower portions united into a tube, each with a lobe at the base of the free part; anthers dehiscing longitudinally; connective with acute apical appendage. Ovary 1-locular, appearing 2-locular by deeply intruded placentas; placentation parietal; style short; stigma capitate. Capsule ellipsoidal with the valves inflexed on both margins. Seeds ±globose, foveolate.

A genus of 3 species of tropical America, Africa, Asia and western Malesia; 1 species on Cocos (Keeling) Is.; not represented in continental Australia.

A.M.Raynal, Revision du genre *Enicostema* Blume (Gentianaceae), *Adansonia* 9: 57–85 (1969).

Enicostema axillare (Lam.) A.Raynal, *Adansonia* 9: 75 (1969)

subsp. **littorale** (Blume) A.Raynal, *Adansonia* 9: 78 (1969)

E. littorale Blume, *Bijdr.* 848 (1826). T: Java, *C.L.Blume*; holo: L; iso: U, *fide* A.Raynal, *loc. cit.*

Stems to 80 cm, bearing decurrent ridges between nodes. Leaves elliptic, subsessile, acuminate, 3-nerved, glabrous; lamina 15–60 mm long, 2–10 mm wide. Cymes 3–5-flowered, subsessile on peduncle to 5 mm long. Calyx 4–6 mm long. Corolla tube 6–7 mm long, green; lobes elliptic, 2–3 mm long, white, yellowing with age. Stamens inserted below middle of corolla tube. Capsule 4–7 mm long. Seeds c. 0.5 mm diam.

Cocos (Keeling) Is. Grows in herb communities in openings in *Cocos* plantations dominated by *Zoysia matrella* and *Ipomoea pes-caprae* in moist depressions in calcareous sand. Also through Malesia from Java to Timor.

C.K.Is.: near Tanjong Klikil, (Pulo Panjang), West Is., *I.R.Telford 9990 & C.Howard* (AD, CBG, K, L, MEL, PERTH); SE end, West Is., *D.G.Williams 79* (BISH, BRI, CBG, L, NSW).

The species consists of 3 subspecies of tropical Africa, southern Asia and western Malesia. *Enicostema axillare* subsp. *littorale* embraces the strand populations of the NE Indian Ocean.

66. APOCYNACEAE

R.M.Barker (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Shrubs, small trees or rarely climbers, often with latex. Leaves opposite, alternate or whorled, simple, usually exstipulate. Flowers bisexual, actinomorphic, axillary or terminal, frequently cymose. Calyx usually 5-lobed, sometimes with minute glands on basal inside surface. Corolla usually 5-lobed, usually salver-shaped (on Christmas Is.); throat often with scales or hairs, sometimes constricted; corona lacking. Stamens 5, usually included in tube; filaments usually short; anthers frequently forming a ring about and sometimes fused with the stigma, 2-locular, the cells often appendaged. Carpels 2; ovary superior, 1- or 2-locular; ovules many; style simple; stigma often bi-apiculate, frequently with a collar. Fruit (on Christmas Is.) a follicle, or more rarely drupaceous. Seeds few to many, sometimes comose; endosperm present.

Distributed worldwide with c. 180 genera and 1500 species, mainly tropical but also extending to temperate areas; in Australia c. 14 genera with 65 species; on Christmas Is. 4 genera, each with 1 species; 1 genus (1 species) on Cocos (Keeling) Is. Two species of *Plumeria* L. (frangipani) are commonly cultivated in European gardens on Christmas Is. although lacking from Malay gardens because the latter associate them with death.

K.Schumann, Apocynaceae, *Pflanzenfam.* 4(2): 109–189 (1895); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Apocynaceae, *Fl. Java* 2: 218–244 (1965).

KEY TO GENERA

1 Woody creeper; stamens exserted; flowers unpleasantly scented **5. VALLARIS**

1: Small trees or shrubs; stamens included; flowers fragrant or unscented

2 Leaves spirally arranged; inflorescence terminal

3 Flowers subtended by 2 large caducous bracts; mouth of corolla tube with scales; stamens in apical part of tube; fruit drupaceous; found along shore terraces **4. CERBERA**

3: Flowers subtended by minute bracts; mouth of corolla tube without scales; stamens at base of corolla tube; fruit a follicle; cultivated **†PLUMERIA**

2: Leaves opposite or in whorls of 2 or 3; inflorescence axillary

4 Small tree; flowers white, fragrant; segments overlapping to right; fruit drupaceous

5 Fruit half syncarpous; endocarp smooth **2. OCHROSIA**

5: Fruit apocarpous; endocarp with fibrous outgrowths **3. NEISOSPERMA**

4: Shrub; flowers red, white or pink, not fragrant; segments overlapping to left; fruit a cylindrical follicle **1. CATHARANTHUS**

†*Plumeria* (Frangipani) is cultivated on Christmas and Cocos (Keeling) Islands and is not dealt with further in the text.

1. CATHARANTHUS

Catharanthus G.Don, *Gen. Hist.* 4: 71, 95 (1837); from the Greek *katharos* (pure) and *anthos* (a flower), in reference to the neatness and beauty of the flowers.

Type: not designated.

Lochnera Rchb. ex Endl., *Gen. Pl.* 583 (1838). T: *L. rosea* (L.) Rchb. ex K.Schum.

Erect herbs or shrubs. Leaves decussate; lateral venation oblique to midrib. Inflorescence axillary, cymose. Bracts minute or lacking. Calyx lobes linear, not keeled. Corolla salver-shaped; tube widened and thickened apically, constricted at mouth, the mouth with bristles; lobes overlapping to left. Stamens included at top of corolla tube. Ovary glabrous; style glabrous; stigma with a pubescent collar and a hyaline petticoat below. Fruit a cylindrical follicle. Seeds cylindrical, ecomose.

A genus of c. 5 or 6 species, apparently mostly Madagascan or Indian in origin; 1 species on Christmas Is.

G.H.M.Lawrence, *Vinca* and *Catharanthus*, *Baileya* 7: 113–119 (1959); W.T.Stearn, *Catharanthus roseus*, the correct name for the Madagascar periwinkle, *Lloydia* 29: 197 (1966); F.Markgraf, *Catharanthus*, *Blumea* 19: 150 (1971).

*Catharanthus roseus (L.) G.Don, *Gen. Hist.* 4: 95 (1837)

Vinca rosea L., *Syst. Nat.* 10th edn, 2: 944 (1759). T: from seed brought from Madagascar to Paris and sown in the King's garden at Trianon, whence P.Miller obtained seed for the Chelsea Garden. Miller's figure in *Figures of the Most Beautiful, Useful and Uncommon Plants* 2: 124, t. 186 (1757) on which Linnaeus possibly based his description or the specimen in Herb. C.Linnaeus 299.4; LINN. Epithet is the Latin for rose-red.

Illustration: G.H.M.Lawrence, *op. cit.* 117, fig. 38.

Shrub, usually single-stemmed, woody at base, c. 20–60 cm high. Leaves spathulate to obovate, obtuse, entire, apiculate, glabrous (other forms pubescent, particularly in young parts), bi-stipulate; lamina 2–5 cm long, 1–2.5 cm wide; petiole to 1 cm long, glabrous. Flowers 2 or 3 in leaf axils, very shortly pedicellate. Calyx lobes linear, acute, 2–4 mm long, glabrous. Corolla red, white or pink; tube 2.5–3 cm long; lobes spathulate, acuminate, 2–2.5 cm long. Stamens with very short filaments; anthers without appendages. Ovary with nectaries of similar size. Follicle 2–3 cm long, c. 0.2 cm wide, longitudinally furrowed, glabrous. Seeds c. 25, c. 2 mm long, tuberculate, dark brown.

Christmas Is. Introduced and widely cultivated by Europeans and has become naturalised along the fringes of all settlements. This pantropical species almost certainly originated in Madagascar.

Ch.Is.: Settlement, *D.A.Powell 15* (K); on road to Waterfall at end of North Settlement, *P. van Tets 40* (CBG, GAUBA).

Recorded for Cocos (Keeling) Is. by F.Wood-Jones, *Coral and Atolls* (1912), possibly from a cultivated plant but not recently collected and probably not persisting.

Catharanthus roseus is of biochemical interest, some of its alkaloids having anti-carcinogenic properties. There are a number of cultivars based primarily on flower colour e.g. '*Alba*' with white flowers, '*Ocellata*' with white flowers with a pink eye and '*Roseus*', the typical form with uniformly pink flowers.

2. OCHROSIA

Ochrosia Juss., *Gen. Pl.* 144 (1789); from the Greek *ochros* (pale yellow), possibly referring to the fruit of the type species.

Type: *O. borbonica* J.F.Gmel.

Small trees with milky juice. Leaves in whorls of 2–5, with many parallel main veins all more or less perpendicular to midrib. Inflorescence axillary, cymose. Bracts small. Calyx lobes small, keeled. Corolla salver-shaped; tube widened and then constricted at mouth; lobes overlapping to right. Stamens with short filaments, included, inserted at top of tube. Ovary glabrous; style glabrous; stigma bi-apiculate, with a collar below. Fruit with 2 partially united carpels, drupaceous; endocarp hard, smooth, consisting of 2 cavities with spongy tissue. Seeds 1–3, flat, narrowly winged.

A genus of c. 23 species, the majority of which occur on the Pacific islands; 2 species in northern Australia; 1 species on Christmas Is.

M.Pichon, Classification des Apocynacées III Genre *Ochrosia*, *Bull. Mus. Hist. Nat. (Paris)* ser. 2, 19: 205–212 (1947); F.Markgraf, Florae Malesianae Praecursores LIX Apocynaceae V. *Ochrosia*, *Neisosperma*, *Blumea* 25: 233–247 (1979).

Ochrosia ackeringae (Teijsm. & Binn.) Miq., *Ann. Mus. Lugd.-Bat.* 4: 138, t. 5 (1869)

Lactaria ackeringae Teijsm. & Binn., *Nat. Tijd. Neth. Ind.* 29: 249 (1867). T: Bangka Is., [near Sumatra], *J.E.Akkeringa s.n.*; syn: L *n.v.*, *fide* F.Markgraf, *Blumea* 25: 238, (1979); Bangka, *coll. unknown*; probable syn: K. Epithet from the name of the collector of one syntype.

O. ackeringae var. *angustifolia* Baker f. in C.W.Andrews, *Monogr. Christmas Is.* 182 (1900). T: Christmas Is., 1897, *C.W.Andrews 35*; iso: K.

Small tree to 15 m tall; trunk to 20 cm in girth. Leaves usually 2 or 3 per whorl, elliptic, attenuate at base, entire, obtuse, acute or very rarely acuminate, glabrous; lamina 6–15 cm long, 1.5–3.5 cm wide; petiole c. 1 cm long. Flowers in dichasial cymes, fragrant, white. Calyx lobes ovate, c. 1 mm long, obtuse. Corolla tube c. 10 mm long; lobes narrowly elliptic, c. 7 mm long. Filaments c. 0.5 mm long. Style glabrous. Fruit V-shaped, the carpels united at the base, c. 3 cm long, 1 cm wide, fragrant, yellow. Fig. 51.

Christmas Is. A common species found on all terraces as part of the forest cover. Found throughout Malesia in coastal rainforest or strand vegetation.

Ch.Is.: from high terrace, c. 275 m above sea level on road to summit, 7 Oct. 1887, *J.J.Lister s.n.* (K); South Point, *H.N.Ridley 148* (K, SING); Murray Hill track, *H.N.Ridley s.n.* (SING); shore terrace, *D.A.Powell 37* (K); Cemetery Rd, North East Point, *B.A.Mitchell 34* (CBG).

Christmas Is. material has in the past been recognised as a different variety because of its narrower leaves, but F.Markgraf (*loc. cit.*) in his survey of Malesian material did not uphold this difference. R.C.Bakhuizen van den Brink Jr (in C.A.Backer & R.C.Bakhuizen van den Brink Jr, *Fl. Java*, 1965) considered that the specific epithet should be spelt '*akkeringae*' after the collector, but in the protologue the collector's name is spelt Ackeringa and this spelling has been maintained here. H.N.Ridley in *J. Straits Branch Roy. Asiat. Soc.* 45: 202 (1906) mistakenly cited A.B.Rendle as the author of var. *angustifolia*.

3. NEISOSPERMA

Neisosperma Raf., *Sylva Tellur.* 162 (1838); derivation of generic name unclear.

Type: *N. muricata* Raf. = *N. oppositifolium* (Lam.) Fosberg & Sachet

Trees. Leaves opposite or whorled. Inflorescence an axillary dichotomous or trichotomous cyme. Calyx shortly lobed, eglandular. Corolla tube slender; lobes contorted. Fruit apocarpous; carpels 2, or 1 by abortion, drupaceous; endocarp hard, fibrous or echinate, without a central hollow filled with soft tissue.

A genus of 18 species distributed from the Seychelles through the islands of the NE Indian and the W Pacific Oceans to Tonga, including SE Asia and north-eastern Australia. One species on Cocos (Keeling) Is., also in north-eastern Australia.

F.Markgraf, Florae Malesianae Praecursores LIX Apocynaceae V. *Ochrosia*, *Neisosperma*, *Blumea* 25: 233–247 (1979).

Neisosperma oppositifolium (Lam.) Fosberg & Sachet, *Micronesica* 8: 48 (1972), as *Neiosperma*

Cerbera oppositifolia Lam., *Encycl.* 1: 62 (1783); *Ochrosia oppositifolia* (Lam.) K.Schum. in A.Engler & K.Prantl, *Nat. Pflanzenfam.* 4(2): 156 (1895). T: illustration in G.E.Rumphius, *Herb. Amboin.* 2: t. 84 (1742). Epithet from the Latin *oppositus* (opposite) and *folium* (a leaf), in reference to the leaf insertion.

Cerbera parviflora G.Forst., *Prodr.* 19 (1786); *Ochrosia parviflora* (G.Forst.) Hensl., *Ann. Nat. Hist.* 1: 345 (1838). T: Friendly Is. [Tonga] and Savage Is.; *n.v.*

Ochrosia cowleyi F.M.Bailey, *Queensland Agric. J.* 1: 299 (1897). T: cultivated, Kamerunga State Nursery ex Dalrymple Is., Qld, *E.Cowley;* holo: BRI *n.v.*

Tree to 15 m. Leaves opposite or 3- or 4-whorled, obovate; lamina 6–35 cm long; petiole 3–6 cm long. Inflorescence 6–20 cm long. Corolla tube c. 5 mm long; lobes c. 8 mm long. Drupelets ellipsoidal, 6–8 cm long with an apical curved beak, green, ripening to yellow; endocarp with many fibrous outgrowths. *Kayu Laki*. Fig. 49.

Cocos (Keeling) Is. Grows in strand communities with *Scaevola taccada* and *Morinda citrifolia* in coralline sand. Occurs from Ceylon through the tropical NE Indian and W Pacific Oceans to Tonga.

C.K.Is.: Keeling Is., East Indies, *C.Darwin 3596 p.p.* (CGE); settlement, West Is., *D.G.Williams 25* (BISH, CBG, K); Pulu Labu, *D.G.Williams 175 & Amat Noor* (AD, CBG).

Darwin's collection was cited by J.S.Henslow, *loc. cit.*, with a note by Darwin: 'Forms straight handsome trees, with a smooth bark, which are commonly dispersed two or three together. The fruit is bright green, like that of a walnut.'

On Cocos (Keeling) Is., the trees, though scarce, yielded a good hard wood suitable for furniture, walls, floors and doorposts.

4. CERBERA

Cerbera L., *Sp. Pl.* 1: 208 (1753); *Gen Pl.* 5th edn, 98 (1754) from the Greek doglike monster Cerberus, whose bite was poisonous, a reference to the poisonous nature of the plants.

Type: not clarified. Each of the 3 original species has been designated lectotype at some stage.

Shrubs or small trees. Leaves spirally arranged; venation oblique. Flowers in terminal panicles on a thick peduncle. Bracts large, caducous. Calyx lobes linear, not keeled. Corolla salver-shaped; tube widened and thickened towards apex, the mouth with scales; lobes

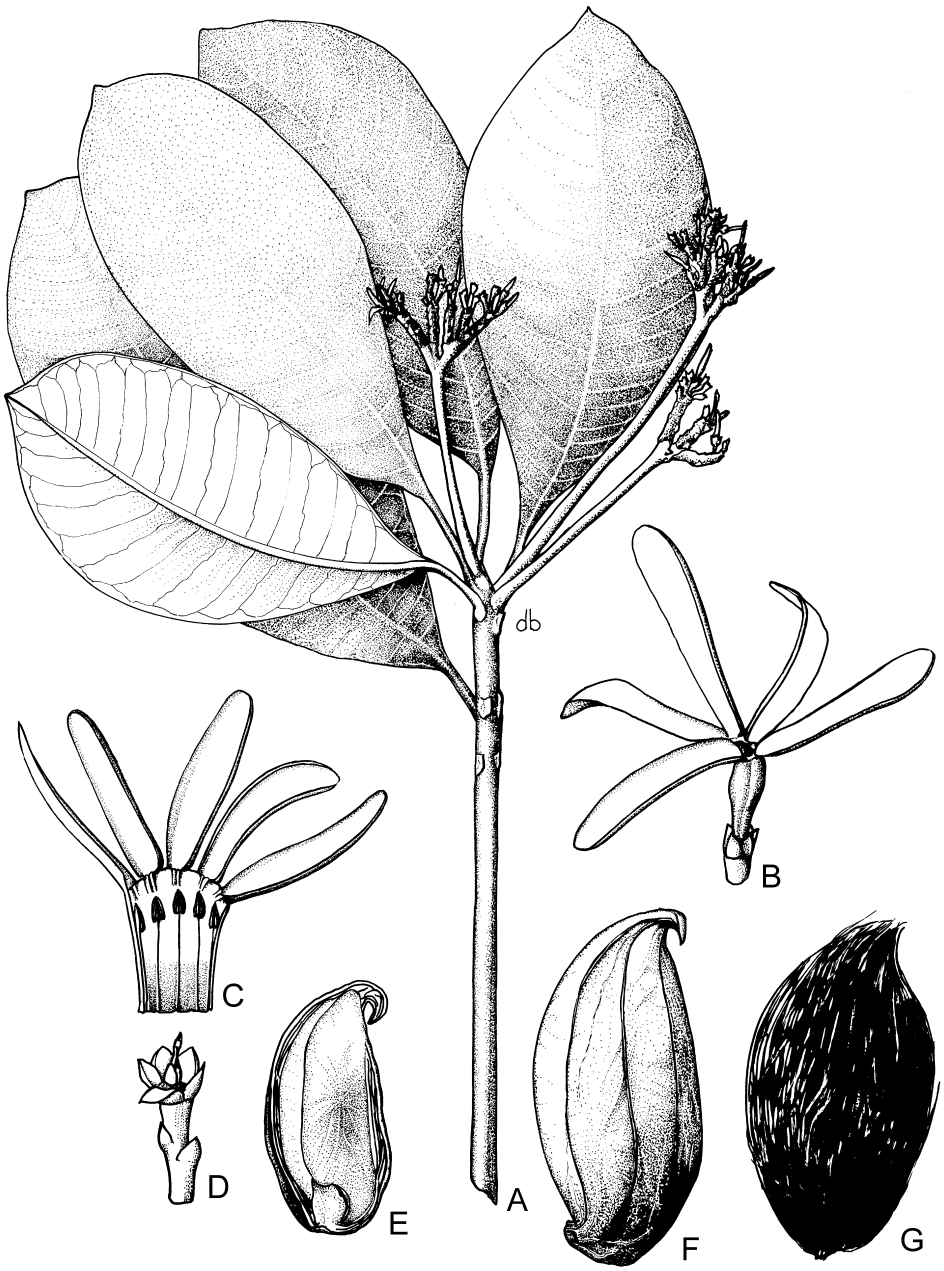

Figure 49. **A–G,** APOCYNACEAE: *Neisosperma oppositifolium*. **A**, flowering branchlet X0.5 (C.Darwin, Apr. 1836, CGE); **B**, flower X2.5; **C**, corolla opened out X2.5; **D,** flower, corolla removed X2.5 (**B–D**, D.Williams 25, CBG); **E,** fruit L.S. X0.5; **F**, fruit X0.5; **G**, fruit, exocarp removed, showing fibrous endocarp X0.5 (**E–G**, D.Williams 175, CBG). Drawn by D.Boyer.

overlapping to left. Ovary glabrous; style glabrous; stigma bi-apiculate with a pubescent collar below. Fruit a large, thinly fleshy drupe, fibrous inside. Seed 1, enclosed by woody pericarp, large.

A genus of c. 6 species found along coastlines of the Indian and western Pacific Oceans; 2 species in Australia; 1 species on Christmas Is.

Cerbera manghas L., *Sp. Pl.* 1: 208 (1753)

T: Ceylon, *P.Hermann s.n.*; ?iso: BM; or possibly a *P.Osbeck* specimen in Herb. C.Linnaeus; *n.v.* Typification of this species is under review by Dr Leeuwenberg of Wageningen (*pers. comm.* L.Forman). Epithet probably from the Indian name for this species.

[*C. odollam auct. non* Gaertn.: C.W.Andrews, *Monogr. Christmas Is.* 182 (1900)]

Shrub or small tree to 10 m. Bark smooth, dark grey, with many leaf scars in younger parts. Leaves ovate, entire, acuminate, glabrous, the main lateral venation ±parallel and 0.5–1 cm apart; lamina 11–16 cm long, 4–6 cm wide; petiole 1–2 cm long. Flowers fragrant; peduncles 2–5 cm long. Bracts ovate, 2 cm long, 1.3 cm wide, glabrous. Calyx lobes c. 2 cm long. Corolla tube 3 cm long, greenish white, with 5 apical antheriferous ridges, pubescent between ridges; lobes c. 1.5 cm long, white with deep pink base. Filaments minute; anthers without appendages. Disc lacking. Stigma thick, discoid, bifid. Drupes 1 or 2, large, ellipsoidal or globose, dark purple; endocarp thick, woody, fibrous.

Christmas Is. Found within thickets of vegetation among limestone pinnacles of the shore terrace. Occurs from India through to Timor.

Ch.Is.: Rocky Point, *C.W.Andrews 104* (K); Waterfall Rd, *A.Pearson P86* (K).

The fruit is described from Javan material, not having been collected on Christmas Is. The fruit is dispersed by sea water and the fibrous endocarp, along with the seeds, is often found among shore drift (H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 203, 1906).

5. VALLARIS

Vallaris Burm.f., *Fl. Indica* 51 (1768); from *vallus* (a stake in a palisade) referring to the use of these twining shrubs in Java for fencing.

Type: *V. pergulana* Burm.f. = *V. glabra* (L.) Kuntze

Twining, woody creepers. Leaves decussate; lateral venation oblique. Flowers terminal or supra-axillary. Bracts small. Calyx lobes linear, not keeled. Corolla shortly salver-shaped; tube not widened and thickened; mouth closed by exserted stamens; lobes overlapping to right. Stamens inserted on top of tube, sagittate, cohering to form a cone over the stigma. Ovary pubescent at apex; style pubescent; stigma bi-apiculate above a collar, cohering to connective of stamens. Follicles oblong, many-seeded. Seed with an apical coma.

A genus of c. 3 species, all apparently from Malesia; 1 species on Christmas Is.

Rudjiman, *Meded. Landbouwhogeschool* 82(11): 1–17 (1982).

***Vallaris glabra** (L.) Kuntze, *Rev. Gen. Pl.* 2: 417 (1891)

Pergularia glabra L., *Mant. Pl.* 1: 53 (1767). T: Herb. C.Linnaeus 306.1; syn: LINN, *fide* Rudjiman, *op. cit.* 5. Epithet from the Latin *glaber* (glabrous).

Creeper. Leaves elliptic, obtuse at base, entire, acuminate, glabrous; lamina 6–12 cm long, 4–7 cm wide. Flowers in supra-axillary panicles, unpleasantly scented; pedicels pubescent. Bracts linear, 3–4 mm long. Calyx lobes c. 5 mm long, acute. Corolla tube green, c. 5–7 mm long, external apex pubescent; lobes very broad, 10–12 mm long, acuminate, pubescent, white or greenish white. Stamens: filaments thick, pubescent; anthers with a large dorsal tubercle on the connective between locules; connective apiculate. Fruit not seen. Fig. 48A.

Christmas Is. This species was presumably introduced into the gardens of Christmas Is. as it occurred at South Point prior to the demolition of houses in that area in 1968–1969 (D.A.Powell, *pers. comm.*). It apparently no longer exists at that locality but is still to be found in the Drumsite area.

Ch.Is.: Drumsite, *D.A.Powell 868* (K).

67. ASCLEPIADACEAE

R.M.Barker (Ch.Is.)

Perennial herbs or shrubs, often climbing, sometimes epiphytic, often with milky juice. Leaves mostly opposite, simple, with or without minute stipules. Inflorescence usually arising between the petioles of a pair of leaves, frequently cymose and the cymes umbelliform. Flowers bisexual, actinomorphic. Calyx 5-lobed, often with minute glands on basal surface inside. Corolla 5-lobed, variously shaped but on Christmas Is. rotate or campanulate, often fleshy; corona usually present, attached to corolla or gynostegium. Stamens 5; filaments united or free but margins touching; anthers appressed against stigma, often cohering with it into a dome or tubular shape (gynostegium); locules usually 2; pollen cohering into a hard clump (pollinium) in Christmas Is. species. Carpels 2; ovary superior, usually free and 1-locular; ovules many; style 0, 1 or 2; stigma large, 5-angled, with a removable translator in the angles which (in Christmas Is. species) binds 2 pollinia together. Follicles 1 or 2. Seeds many, often comose at one end; endosperm present, sparse.

A large family of c. 250 genera and 2000 species found predominantly in tropical and subtropical areas of the world; c. 20 genera and 75 species in Australia; 1 genus (1 species naturalised) on Christmas Is., another is probably only cultivated; 1 genus (1 species) on Cocos (Keeling) Is. reported but apparently not naturalised. Most of the family is poorly known and much in need of revision.

K.Schumann, Asclepiadaceae, *Nat. Pflanzenfam.* 4(2): 189–306 (1895); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Asclepiadaceae, *Fl. Java* 2: 244–274 (1965).

KEY TO GENERA

1 Epiphytic twiner; flowers in umbels (Ch.Is.) **HOYA**

1: Terrestrial shrub or shrub-like herb; flowers in cymes

2 Leaves broadly obovate with cordate base; corolla purple and white (Ch.Is.) **†CALOTROPIS**

2: Leaves narrowly lanceolate with cuneate base; corolla red (C.K.Is.) **†ASCLEPIAS**

†*Calotropis gigantea* (L.) W.T.Aiton is cultivated. D.A.Powell states that it was introduced by the Chinese (into gardens?) in 1966, e.g. *D.A.Powell 724* (K).

†*Asclepias curassavica* L. was reported from Cocos (Keeling) Is. by F.Wood-Jones, *Corals and Atolls* (1912). No other collection has been noted and the species may not have persisted.

HOYA

Hoya R.Br., *Mem. Wern. Nat. Hist. Soc.* 1: 26 (1811); after Thomas Hoy, fellow of the Horticultural Society and gardener at Syon House.

Type: *H. carnosa* (L.) R.Br.

Climbing herbs or shrubs, usually epiphytic. Leaves opposite, fleshy or leathery; petiole usually with an apical nectary. Inflorescence an umbel, arising between leaf pairs. Calyx smaller than corolla. Corolla segments valvate in bud, exceeding corona, often pubescent; corona scales 5, alternating with corolla lobes, covering anthers. Anthers each producing 2 pollinia with 1 from each of adjacent anthers fused by stigma secretions to form a pair, the dark-coloured area of fusion (corpuscle) visible between the corona lobes; twin pollinia variable in shape. Follicle usually 1, long, linear. Seeds comose.

A genus of c. 200 species occurring naturally from China to Australia. Some commonly cultivated for their waxy flowers. Taxonomically it is poorly known and much in need of revision. There is a superfluity of names and many species regarded as endemic are almost certainly conspecific with others. This applies to the Christmas Is. material which has been regarded as endemic but probably belongs with other more widespread species.

Hoya aldrichii Hemsl., *J. Linn. Soc., Bot.* 25: 355 (1890)

T: N of Flying Fish Cove, Christmas Is., Sept.–Oct. 1887, *J.J.Lister & Officers of H.M. Survey Vessel* Egeria; syn: K; Christmas Is., *Captain J.P.Maclear of H.M.S.* Flying Fish; syn: K. Epithet named in honour of Captain Aldrich, commander of the 'Egeria', which visited Christmas Is. in 1887.

Tall climber. Stems glabrous, rooting at nodes; bark pale. Leaves elliptic, rounded at base, entire, acuminate or acute, glabrous; lamina 7.5–15 cm long, 3.5–6 cm wide; petiole 1–1.5 cm long, thickened, somewhat flattened. Flowers 15–30 in umbels produced progressively at apex of thickened peduncle 6–10 cm long, fragrant at night; pedicel 2–2.5 cm long, glabrous. Calyx 2 mm long, externally sparsely pubescent. Corolla lobes c. 6 mm long, acute, glabrous externally, internally densely short-pubescent, white or pink. Corona pink or deep purple-pink; lobes 3–4 mm long, 1.5 mm wide, stellate. Pollinia obscurely winged. Follicle glabrous, c. 14 mm long, 5–10 mm wide. Seeds oblong, c. 5 mm long; coma c. 2–3 cm long. Figs 48E–G, 75.

Christmas Is. A common epiphyte in shrublands of the coastal terraces.

Ch.Is.: N of Flying Fish Cove, Oct. 1887, *J.J.Lister et al.* (K); Flying Fish Cove, Jan. 1897, *C.W.Andrews* (K); Phosphate Hill, Oct. 1904, *H.N.Ridley* (K); South Point, *H.N.Ridley 94* (SING); N of the Dales, adjacent to North West Point access track, *B.A.Mitchell 176* (CBG).

W.B.Hemsley, *loc. cit.* regarded this species as close to *H. cinnamomifolia* Hook. while other annotations on the K specimens indicate that other botanists (e.g. A.A.Bullock) regarded the species as synonymous with *H. pottsii* Traill. The material is not unlike specimens identified at Kew as *H. diversifolia* Blume although it would appear not to agree with R.E.Rintz's (*Malayan Nature J.* 30: 467, 1978) concept of this species. Until there is a revision of *Hoya* in its entirety it seems best to treat the material as *H. aldrichii*.

Figure 50. *Celastrus paniculatus*
Photograph — D.Du Puy.

Figure 51. *Ochrosia ackeringae*
Photograph — D.Du Puy.

Figure 52. *Argusia argentea*
Photograph — D.Du Puy.

Figure 53. *Ipomoea nil*
Photograph — A.George.

Figure 54. *Clerodendrum inerme*
Photograph — D.Du Puy.

Figure 55. *Berrya cordifolia*
Photograph — D.Du Puy.

Figure 56. *Pemphis acidula*
Photograph — A.George.

Figure 57. *Turnera ulmifolia*
Photograph — A.George.

Figure 58. *Melanthera biflora*
Photograph — I.Telford.

Figure 59. *Acaena magellanica* (red-brown flowers), *Azorella selago* (cushion plants) & *Pringlea antiscorbutica* (pale flowers)
Photograph — G.Johnstone.

Figure 60. Mikania micrantha
Photograph — D.Du Puy.

Figure 61. *Tithonia diversifolia*
Photograph — D.Du Puy.

Figure 62. *Thrixspermum carinatifolium*
Photograph — P.Goh.

Figure 63. *Arenga listeri*
Photograph — P.Goh.

Figure 64. *Mariscus javanicus*
Photograph — D.Du Puy.

Figure 65. *Azorella selago* (right), *Poa cookii* (left)
Photograph — A.McGregor.

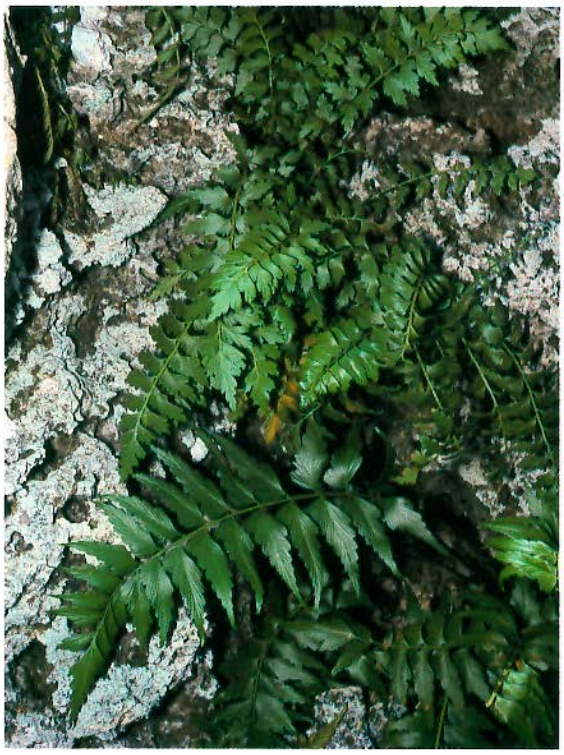

Figure 66. *Davallia denticulata*
Photograph — D.Du Puy.

Figure 67. *Asplenium listeri*
Photograph — D.Du Puy.

Figure 68. *Pyrrosia lanceolata*
Photograph — D.Du Puy.

Figure 69. *Huperzia australiana*
Photograph — D.Calder.

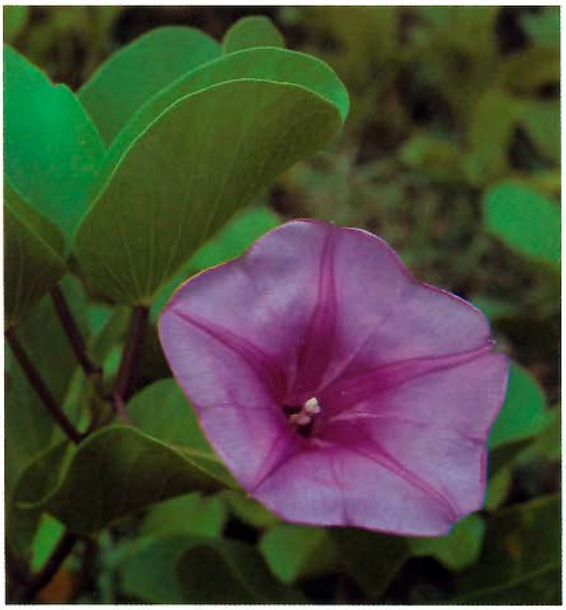

Figure 70. *Calophyllum inophyllum*
Photograph — A.George.

Figure 71. *Ipomoea pes-caprae* subsp. *brasiliensis*
Photograph — I.Telford.

Figure 72. *Morinda citrifolia*
Photograph — I.Telford.

Figure 73. *Scaevola taccada*
Photograph — A.George.

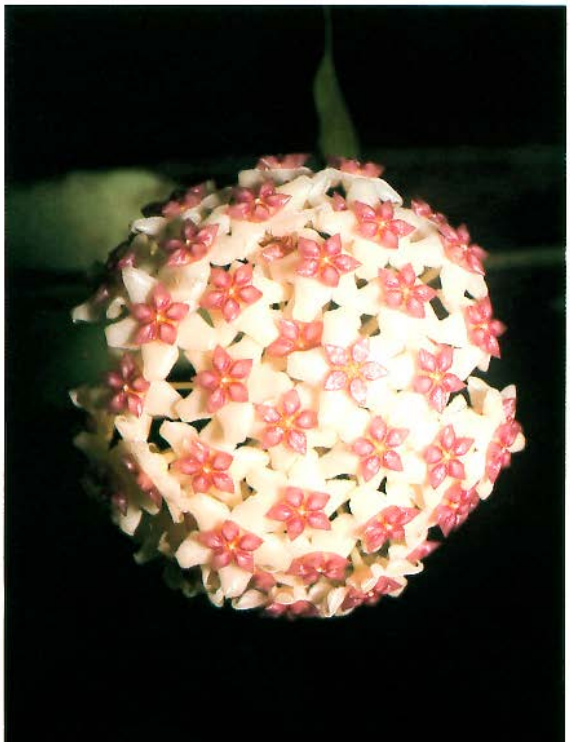

Figure 74. *Stachytarpheta jamaicensis*
Photograph — A.George.

Figure 75. *Hoya aldrichii*
Photograph — D.Du Puy.

Figure 76. *Guettarda speciosa*
Photograph — I.Telford.

Figure 77. *Aidia* aff. *racemosa*
Photograph — D.Du Puy.

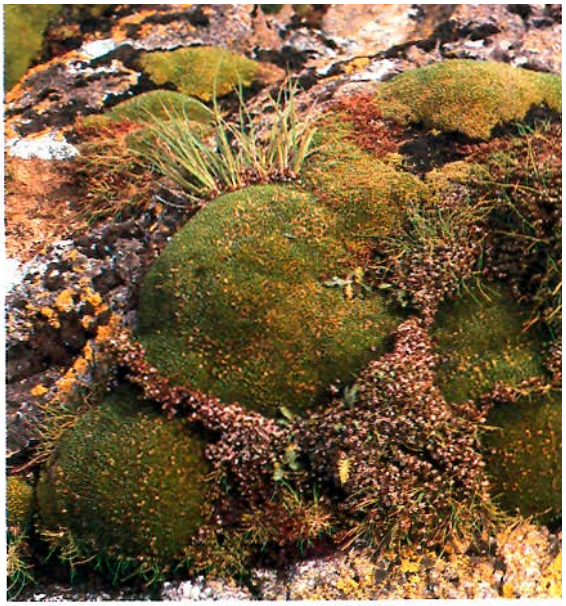

Figure 78. *Pleurophyllum hookeri*
Photograph — R.Seppelt.

Figure 79. *Pringlea antiscorbutica*
Photograph — G.Johnstone.

Figure 80. *Colobanthus muscoides* (cushion plants), *Crassula moschata* (white flowers), *Puccinellia macquariensis*
Photograph — R.Seppelt.

Figure 81. Azorella selago (bright green), *Poa cookii* (blue-green)
Photograph — G.Johnstone.

68. SOLANACEAE

R.M.Barker (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Herbs, shrubs or small trees, rarely woody vines, glabrous or pubescent; prickles present or absent. Leaves alternate, sometimes almost opposite, simple to pinnate, exstipulate. Inflorescence terminal, lateral, axillary, extra-axillary or leaf-opposed, cymose, appearing racemose, paniculate or subumbellate, or flowers solitary. Flowers bisexual or rarely unisexual, actinomorphic or zygomorphic. Calyx tubular to campanulate, with 3–10 lobes, persistent. Corolla campanulate, tubular, funnel-shaped, urn-shaped or salver-shaped; limb rotate to stellate, with 3–10 lobes; lobes valvate, plicate, volutive or imbricate in bud. Stamens usually 5 or 4, rarely 1, 2, 3 or 8, equal or unequal in length, inserted in corolla tube and alternate with lobes; anthers 1- or 2-locular, dorsifixed or basifixed, sometimes cohering, dehiscing by longitudinal slits, or terminal pores or slits. Ovary superior, 2–5-locular, often on a hypogynous disc; ovules many; placentation axile; style simple; stigma capitate or bifid. Fruit a capsule or berry. Seeds usually many, often flattened; embryo curved, spiral or straight. Endosperm present.

A family of c. 90 genera and over 2600 species, widely distributed in tropical and temperate regions but mostly native to Central and S America and, to a less extent, Australia. In Australia 23 genera and 200 species. On Christmas Is. 7 genera and 9 species, apparently all introduced; on Cocos (Keeling) Is. 3 genera and 3 species naturalised.

The family contains important food plants such as *Solanum tuberosum* L. (Potato), *S. melongena* L. (Eggplant), *Lycopersicon esculentum* Mill. (Tomato), *Capsicum* spp. (Chili, Peppers and Capsicum), and *Physalis peruviana* L. (Cape Gooseberry). Species of *Browallia*, *Brunfelsia*, *Cestrum*, *Datura*, *Lycium*, *Nicotiana*, *Nierembergia*, *Petunia*, *Physalis*, *Salpiglossis*, *Schizanthus*, *Solandra*, *Solanum* and *Streptosolen* are often cultivated as ornamentals. Some species have a high alkaloid content and are poisonous, or are drug plants used medicinally or as narcotics, e.g. *Atropa belladonna* L. (Deadly Nightshade), *Datura* spp. (Thornapple), *Hyoscyamus niger* L. (Black Henbane) and *Nicotiana* spp. (Tobacco).

R.W.Purdie, D.E.Symon & L.A.Haegi, Solanaceae, *Fl. Australia* 29: 1–208 (1982); D.E.Symon, The Solanaceae of New Guinea, *J. Adelaide Bot. Gard.* 8: 1–171 (1985).

This treatment is based largely on R.W.Purdie *et al.*, *loc. cit.*

KEY TO GENERA

1 Anthers opening by pores

2 Calyx 10-toothed from truncate apex; flowers axillary; leaves entire; berry red — **2. LYCIANTHES**

2: Calyx 5-lobed; flowers lateral; leaves usually lobed; berry yellow or black — **3. SOLANUM**

1: Anthers opening by longitudinal slits

3 Corolla up to 20 cm long; fruit a spiny capsule — **7. DATURA**

3: Corolla less than 20 cm long; fruit a berry or if a capsule, not spiny

4 Shrub with spinescent branchlets; stamens exserted, free — **†LYCIUM**

4: Herbs without spines; stamens included or if exserted, not free

5 Corolla tube long, far exceeding calyx; fruit a capsule — **1. NICOTIANA**

5: Corolla tube short, of similar length to calyx; fruit a berry

6 Leaves pinnatisect; anthers with terminal appendages **4. LYCOPERSICON**

6: Leaves entire or shallowly toothed; anthers without terminal appendages

7 Berry enclosed by persistent, angular, lantern-shaped calyx; corolla yellow or cream with darker centre **6. PHYSALIS**

7: Berry not enclosed by fruiting calyx; corolla white or greenish white **5. CAPSICUM**

†*Lycium chinense* Mill. has been recorded for Christmas Is. (*D.Powell 662*, K) but the collection was not seen by the author.

1. NICOTIANA

Nicotiana L., *Sp. Pl.* 1: 180 (1753); *Gen. Pl.* 5th edn, 84 (1754); after Jean Nicot (1530–1600), consul from the King of France to Lisbon in 1560, who sent seeds of the tobacco plant to France.

Type: *N. tabacum* L.

Annual or short-lived perennial herbs or shrubs, glabrous or pubescent with glandular or non-glandular hairs. Leaves radical and/or cauline, petiolate or sessile, simple, entire to sinuate. Inflorescence panicle-like, rarely raceme-like or flowers solitary. Flowers bisexual, actinomorphic or slightly zygomorphic. Calyx tubular to narrowly campanulate, 5-lobed; margins connate, often forming translucent intersepalar membranes. Corolla tubular or salver-shaped, white, green, yellow or pink; limb 5-lobed. Stamens 5, equal or unequal; anthers 2-locular, dehiscing by longitudinal slits. Ovary 2-locular; stigma capitate. Fruit a smooth-walled capsule; dehiscence apical, usually by 4 valves. Seeds reniform to C-shaped.

A genus of 60–70 species, mostly native to S America but also found in N America, south-western Africa (1 species), Australia and the South Pacific region. In Australia, 16 species endemic and 1 introduced species (*N. glauca* Graham) widely naturalised; on Christmas Is. 1 introduced species. Many species are important as drug plants, having a history of use for smoking, chewing or snuff production, in areas to which they are native or introduced. Commercial tobacco is mainly derived from *N. tabacum* L. and *N. rustica* L.

T.H.Goodspeed *et al.*, The genus *Nicotiana*, *Chron. Bot.* 16: 1–536 (1954).

*Nicotiana tabacum L., *Sp. Pl.* 1: 180 (1753)

T: America, Herb. C.Linnaeus 245.1; possible syn: LINN, *fide* T.H.Goodspeed, *op. cit.* 372. Epithet from *tobaca* or *tobago* from the instrument used by the Indians to inhale the finely powdered leaves.

Erect diffuse herb to 2 m, with multicellular glandular hairs, viscid. Leaves ovate to elliptic from auriculate base, grading to linear bracts in inflorescence; lamina to 12 cm long and 4 cm wide. Inflorescence a terminal panicle. Calyx 15–17 mm long, slightly irregularly 5-lobed. Corolla tube 5 cm long; lobes c. 7 mm long, acuminate, pink. Stamens unequal, inserted just above ovary; filament pubescent at base, the longer pairs 3–3.5 cm long, just exserted from tube; anthers 2.5 mm long. Ovary glabrous, inserted on thick orange-yellow disc; style glabrous, 3.5 cm long; stigma expanded, 1.5 mm diam. Capsule enclosed in enlarged calyx, ovate, c. 1 cm long, glabrous, brown. Seeds c. 0.5 mm long, reticulate.

Christmas Is. Cultivated in gardens, presumably for local use for smoking as cigarettes. It is occasionally found as a spontaneous escape. A specimen from Waterfall in 1982 (*D.A.Powell 629*, K) was found in an area where there had been no cultivation for some time. Originally from America, the species is cultivated worldwide for the production of tobacco.

Ch.Is.: W of South Point, old settlement, *B.A.Mitchell 26* (AD, CBG); edge of road at Waterfall, *D.A.Powell 629* (K).

2. LYCIANTHES

Lycianthes (Dunal) Hassl., *Annuaire Conserv. Jard. Bot. Genève* 20: 173–183 (1917), *nom. cons.*; *Solanum* subsect. *Lycianthes* Dunal in DC., *Prodr.* 13: 29, 156–183 (1852); name presumably derived from the resemblance of the flowers to those of *Lycium*.

Type: *L. lycioides* (L.) Hassl.

Herbs, shrubs or creepers, glabrous or variously pubescent. Leaves spirally arranged but often in unequal pairs, petiolate, subentire. Flowers bisexual, actinomorphic, solitary or in groups in the axils. Calyx campanulate, truncate, often apparently 5–10-toothed by elongation of 10 ribs, persistent in fruit. Corolla rotate or campanulate, white or coloured; limb 5-lobed. Stamens usually 5, inserted on tube; anthers 2-locular, basifixed, dehiscing by small, terminal pores. Ovary 2-locular; stigma capitate. Fruit a berry, dry or succulent, not enclosed by calyx. Seeds discoid.

A genus of c. 200 species, the majority of which occur in tropical America, with a few in Asia. One species on Christmas Is. It is doubtfully distinct from *Solanum*, as shown by D.E.Symon, *J. Adelaide Bot. Gard.* 8: 1–171 (1985) treating this same species under *Solanum*.

G.Bitter, Die Gattung *Lycianthes*, *Abh. Nat. Ver. Bremen* 24: 292–520 (1919 or 1920).

Lycianthes biflora (Lour.) Bitter, *Abh. Nat. Ver. Bremen* 24: 461 (1919 or 1920)

Solanum biflorum Lour., *Fl. Cochinch.* 1: 129 (1790). T: possibly in J. de Loureiro's herb. at BM, LINN or P; *n.v.* Epithet from the Latin *bi-* (two) and *flos* (a flower).

Herb to 1 m tall; young stems ±zig-zag, appressed-pubescent with simple hairs. Leaves often in unequal pairs, ovate, subentire or rarely lobed, obtuse to acuminate, mostly subglabrous; lamina to 9 cm long; petiole to 1 cm long. Flowers usually 1 or 2 in axils, rarely to 6; pedicels thickening upwards, sparsely pubescent, to 8 mm long, elongating to 2 cm long in fruit. Calyx sparsely pubescent; tube 2 mm long; teeth 10, slender, thickening in fruit to c. 3 mm long. Corolla white; lobes narrowly ovate, c. 8 mm long, sparsely pubescent externally. Anthers 2.5 mm long, in cylinder about style. Stigma exceeding anthers. Berry c. 9 mm diam., red. Seeds c. 2 mm diam. Fig. 82A–B.

Christmas Is. Found in open places on the plateau and near Waterfall.

Ch.Is.: no precise locality, 30 Nov. 1888, *J.J.Lister et al.* (K); middle of island, Feb. 1898, *C.W.Andrews* (K); Phosphate Hill, *H.N.Ridley 34* (K); no precise locality, *D.A.Powell 164* (K).

Lycianthes biflora is a species complex which exhibits much variation with respect to pubescence. It is in need of revision throughout its range in India, Asia and Malesia.

3. SOLANUM

Solanum L., *Sp. Pl.* 1: 184 (1753); *Gen. Pl.* 5th edn, 85 (1754); from the Latin *solamen* (solace or comfort), possibly alluding to the reputed narcotic properties of the type species.

Type: *S. nigrum* L.

Annual or perennial herbs, shrubs or small trees, sometimes trailing or climbing, sometimes sucker forming, usually pubescent; hairs glandular or non-glandular, simple or stellate; prickles present or absent. Leaves petiolate, entire, lobed or pinnate. Inflorescences cyme-like, or becoming raceme-like, subumbellate or panicle-like, variously inserted. Flowers usually bisexual, actinomorphic. Calyx campanulate, rotate or cup-shaped, usually 5-lobed, sometimes enlarged in fruit. Corolla usually stellate and deeply incised to rotate, usually 5-lobed, purple, blue, white or yellow. Stamens 5, usually equal, inserted in corolla throat; anthers 2-locular, sometimes cohering around style, dehiscing by terminal pores or slits, rarely by longitudinal slits. Ovary usually 2-locular. Stigma terminal, capitate or bifid. Fruit usually a berry, succulent, papery or bony. Seeds orbicular to subreniform.

A cosmopolitan genus of c. 1500 species, chiefly in tropical and subtropical Central and South America with secondary centres of speciation in Australia and Africa. In Australia 117 species of which 94 are native and 87 endemic; on Christmas Is. 2 species; 1 of these also on Cocos (Keeling) Is.

Several species contain steroidal alkaloids and are poisonous or suspected of being toxic. A few, including 2 Australian species (*S. aviculare* G.Forst. and *S. laciniatum* Aiton), are cultivated overseas for solasodine as a source of corticosteroid drugs. Several species are cultivated for their decorative flowers and foliage.

D.E.Symon, *Solanum* in Australia, *J. Adelaide Bot. Gard.* 4: 1–367 (1981); M.D.Whalen, D.E.Costich & C.H.Heiser, Taxonomy of *Solanum* Section *Lasiocarpa*, *Gentes Herb.* 12(2): 41–129 (1981); M.D.Whalen, Conspectus of species groups in *Solanum* subgenus *Leptostemonum*, *Gentes Herb.* 12(4): 179–282 (1984).

Armed shrub with stellate hairs; berry yellowish, pubescent **1. S.** aff. **ferox**

Unarmed herb or shrub with simple or glandular hairs; berry black or purple-black, glabrous **2. S. americanum**

1. Solanum aff. ferox L., *Sp. Pl.* 2nd edn, 1: 267 (1762)

T: in Malabaria, [Madras area, India]; *n.v.* Epithet is the Latin for fierce, in reference to the prickles.

?*S. involucratum* Blume, *Bijdr.* 701 (1826). T: Netherlands, Indies; *n.v.*

Prickly shrub to 3 m high, densely covered with stellate hairs, denser on undersurface of leaves, sparser with age; prickles to 1 cm long on branches and petioles, sparser on main lateral veins. Leaves ovate, triangularly lobed, discolorous; lamina to 25 cm long, 23 cm wide; petiole to 10 cm long, not appearing winged. Inflorescence lateral, shortly pedunculate, cymose, to 6-flowered; pedicels to 10 mm long, prickly. Calyx c. 9 mm long, very shortly lobed. Corolla lobes c. 1–2 cm long, densely stellate-pubescent at least externally, white (H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 208, 1906). Anthers 5–6 mm long. Ovary c. 10 mm diam., covered with porrect-stellate hairs; style glabrous. Fruit not seen.

Christmas Is. First collected by C.W.Andrews in 1897, this is an apparently rare species of secondary regrowth. Found in Malesia and also on Cape York Peninsula in Australia.

Ch.Is.: Phosphate Hill Rd, *C.W.Andrews 99* (K); Phosphate Hill, *H.N.Ridley 20* (SING); centre of Christmas Is., 2.4 km W from 6.25 mile peg, *D.A.Powell 62* (K).

The specimens appear to agree with the Linnaean protologue in having the fruit enclosed by the enlarged and thorny calyx (H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 208, 1906) unlike the Australian material described by D.E.Symon, *loc. cit.* but further specimens and a study of the type are required before this can be confirmed. *Solanum involucratum* Blume from Indonesia also has the fruit enclosed by the calyx and its distinction or otherwise from *S. ferox* needs to be investigated.

2. Solanum americanum Mill., *Gard. Dict.* 8th edn, no. 5 (1768)

T: cult., Chelsea Physic garden, origin Virginia, N America, *P.Miller s.n.*; lecto: BM, *fide* J.M.Edmonds, *J. Arnold Arbor.* 52: 634 (1971). Epithet derived from the country of origin of the type collection.

Unarmed herb or short-lived perennial shrub, glabrescent with simple eglandular hairs. Leaves obovate, entire or shallowly-lobed, concolorous; lamina to 6 cm long, 4 cm wide; petiole c. 1 cm long, appearing winged by decurrent lamina. Inflorescence lateral, shortly pedunculate, subumbelliform, c. 7-flowered; peduncle c. 1–2 cm long; pedicels c. 1 cm long. Calyx c. 2 mm long; lobes triangular. Corolla c. 4 mm long, pubescent externally on lobes, white. Anthers c. 1.5 mm long. Ovary glabrous. Berry globular, c. 5 mm diam., black, not enclosed by calyx.

Christmas Is., Cocos (Keeling) Is. Fairly common on Christmas Is., but rarely collected; grows among stunted marginal growth. On Cocos (Keeling) Is. a rare weed recorded from

one island of the main atoll. A variable and cosmopolitan weed, used in New Guinea and the Pacific as a green vegetable.

Ch.Is.: no precise locality, *D.A.Powell 410* (K); cleared rainforest at Grants Well, *R.Shivas 811* (PERTH). C.K.Is.: Direction Is., 18 July 1987, *D.G.Williams s.n.* (CBG).

Considered by some authors to be better treated as an infraspecific taxon of *S. nigrum* L.

4. LYCOPERSICON

Lycopersicon Mill., *Gard. Dict.* 4th Abr. edn, (1754); from the Greek *lyco* (a wolf) and *persicon* (a peach), possibly alluding to its inferior quality compared with the peach, or to its supposed poisonous properties; erroneously identified with a plant named *Lycopersicon* by the Greek Galen (c. 130–200 AD).

Type: *L. lycopersicum* (L.) H.Karst. ex Farw., based on *Solanum lycopersicum* L. = *L. esculentum* Mill.

Perennial or short-lived herbs, sprawling, aromatic, pubescent with glandular and non-glandular simple hairs. Leaves petiolate, pinnately lobed or pinnate (often irregularly); leaflets entire or lobed, sessile or petiolate. Inflorescence usually lateral, racemose or cymose. Flowers bisexual, actinomorphic; pedicels articulate above middle. Calyx deeply 5-lobed; lobes lanceolate. Corolla stellate, 5-lobed, yellow; lobes valvate in bud. Stamens 5, equal, inserted in throat of corolla tube; anthers 2-locular, each with apical, sterile, conical appendage, cohering to form a cone around style, dehiscing inwards by longitudinal slits. Ovary 2-locular; stigma capitate. Fruit a berry. Seeds ellipsoidal.

A genus of c. 10 species native to western S America and the Galapagos Islands; 1 species on Christmas Is. Closely related to the genus *Solanum*, and sometimes treated as a section of that genus. It differs in having appendaged anthers. The genus contains the cultivated tomato, an important food crop, grown worldwide and naturalised in many countries in subtropical and tropical areas, including Australia.

C.H.Muller, A revision of the genus *Lycopersicon*, *U.S. Dept. Agric. Misc. Publ.* no. 382 (1940); L.C.Luckwill, the genus *Lycopersicon*, *Aberdeen Univ. Studies* no. 120 (1943); C.M.Rick, The tomato, *Sci. Amer.* 239: 66–76 (1978); D.E.Symon, The solanaceous genera, *Browallia*, *Capsicum*, *Cestrum*, *Cyphomandra*, *Hyoscyamus*, *Lycopersicon*, *Nierembergia*, *Physalis*, *Petunia*, *Salpichroa* and *Withania*, naturalised in Australia, *J. Adelaide Bot. Gard.* 3: 133–166 (1981).

***Lycopersicon esculentum** Mill., *Gard. Dict.* 8th edn, no. 2 (1768), *nom. cons.*

T: Herb. C.Linnaeus 248.16; lecto: LINN, *fide* E.E.Terrel *et al.*, *Taxon* 32: 310 (1983). Epithet is the Latin for edible.

Solanum lycopersicum L., *Sp. Pl.* 1: 185 (1753); *Lycopersicon lycopersicum* (L.) H.Karst. ex Farw., *Ann. Rep. Comm. Parks Boulevards Detroit* 11: 83 (1900). T: in America calidiore, Herb. C.Linnaeus 248.16; lecto: LINN, *fide* E.E.Terrell *et al.*, *Taxon* 32: 310 (1983).

Short-lived herb, 50–150 cm tall, often densely pubescent, aromatic. Leaves ovate, deeply pinnatisect with 7–9 major lobes; lamina to 30 cm long; petiole 2–5 cm long. Inflorescence raceme- or cyme-like. Calyx lobes narrowly lanceolate, 4–5 mm long. Corolla to 25 mm diam; lobes narrowly triangular, c. 8 mm long, often reflexed. Anthers 5–10 mm long, including sterile appendage 2–3 mm long. Ovary glabrous or pubescent. Berry globular or depressed-globular, 10–20 mm diam., red at maturity. Seeds 2–3 mm long, pilose, yellow-grey. *Cherry Tomato*.

Christmas Is. There is only 1 recent collection of this species despite its introduction to Christmas Is. in 1904 (H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 167, 1906). It is found in open areas in marginal undergrowth. Originally from S America, now cultivated worldwide.

Ch.Is.: no precise locality, 26 Sept. 1984, *D.A.Powell 757 & Kim Chey* (K).

According to D.A.Powell, up to the late 1950s the Cherry Tomato was used as a salad vegetable on Christmas Is., but now that the cultivated tomato is brought to the island by ship and plane there is no longer any demand for the smaller fruits of the Cherry Tomato. *Lycopersicon esculentum* Mill. was conserved as a *nomen specificum conservandum* at the XIV International Botanical Congress, Berlin, 1987, *Int. Code Bot. Nomenclature* 288 (1988).

5. CAPSICUM

Capsicum L., *Sp. Pl.* 1: 188 (1753); *Gen. Pl.* 5th edn, 86 (1754); possibly from the Greek *kapto* (to bite) because of the hot taste of the fruit and seeds.

Type: *C. annuum* L.

Short-lived shrubs or herbs, glabrous or with simple hairs. Leaves alternate or sometimes paired, petiolate, simple, entire. Flowers bisexual, actinomorphic, 1–5 in leaf axils or forks of stems. Calyx tubular, with 5 minute teeth sometimes visible, not circumscissile. Corolla stellate, usually white; lobes 5, valvate in bud. Stamens 5, inserted at base of tube; anthers 2-locular, dehiscing by longitudinal slits. Ovary 2-locular; stigma capitate. Fruit a subfleshy berry. Seeds flattened; outline subcircular to reniform.

A genus of c. 10 species from tropical America; 1 naturalised species on Christmas Is. *Capsicum annuum* L. is cultivated for use in Malay cuisine, but not naturalised on Cocos (Keeling) Is. Some species cultivated throughout the world as vegetables (peppers), condiments (chili, paprika) or ornamentals.

W.G.D'Arcy & W.H.Eshbaugh, New World Peppers (*Capsicum* – Solanaceae) north of Columbia: A résumé, *Baileya* 19: 93–105 (1974).

***Capsicum frutescens** L., *Sp. Pl.* 1: 189 (1753)

T: India, Herb. A. van Royen L-902560; lecto: L: *n.v.*, *fide* C.B.Heiser & B.Pickersgill, *Taxon* 18: 280 (1969). Epithet is the Latin for becoming shrubby.

Herb or subshrub; branches subquadrangular with dense, soft hairs in young parts on one face, glabrescent. Leaves ovate, oblique at base, acuminate; lamina to 9 cm long; petiole to 2.5 cm long. Flowers 2 or 3 per axil or fork (look for scars); pedicel 1.5–2 cm long, recurved in flower, erect in fruit. Calyx 1.5–2 mm long, not toothed. Corolla 5.5–6 mm long, colour not known. Stamens with filaments c. 1.5 mm long; anthers c. 1.4 mm long, green with white slits. Style c. 3 mm long, just exceeding anthers; stigma small. Fruit narrowly ovoid to ellipsoidal, to 15 mm long, 6 mm wide, orange-red. Seeds thickened about margin, c. 3 mm diam., yellow.

Christmas Is. Only a single collection has been seen from Christmas Is. and so its status (cultivated or naturalised) is not known. Originating in tropical America, now widely cultivated.

Ch.Is.: Phosphate Hill, north east promontory, *B.A.Mitchell 12* (AD, CBG).

The small fruit and non-solitary flowers seem to conform most closely with *C. frutescens* although this is very closely related to *C. annuum* L., and W.G.D'Arcy & W.H.Eshbaugh, *op. cit.* 93 state that *Capsicum* species may not be separable on herbarium sheets due to obscuring of diagnostic characters by the drying process.

6. PHYSALIS

Physalis L., *Sp. Pl.* 1: 182 (1753); *Gen. Pl.* 5th edn, 85 (1754); from the Greek *physallis* (bladder), in reference to the inflated fruiting calyx.

Type: *P. alkekengi* L.

Annuals, rhizomatous perennials or short-lived shrubs, glabrous or pubescent with eglandular or glandular hairs. Leaves alternate, 1 or 2 per node (when 2, unequal, not opposite), petiolate, simple, entire, toothed or lobed. Flowers bisexual, actinomorphic, solitary, axillary and in stem forks. Calyx tubular to campanulate, 5-lobed. Corolla broadly campanulate to rotate, yellow, often with dark spots towards base; tube short; limb expanded, shallowly 5-lobed. Stamens 5, equal or unequal, inserted towards base of corolla tube; anthers 2-locular, dehiscing by longitudinal slits. Ovary 2-locular; stigma capitate. Fruit a berry enclosed by inflated calyx. Seeds disc-shaped to broadly reniform.

A widespread genus of c. 100 species, most common in N and S America but with some species occurring naturally in temperate and tropical Asia. Several species with edible berries are cultivated for their fruit. In Australia 7 species introduced and naturalised to varying degrees as weeds of waste and cultivated ground; on Christmas Is. 2 species with 1 species (*P. minima* L.) introduced prior to settlement; on Cocos (Keeling) Is. 1 species naturalised.

H.Heine, *Physalis*, *Fl. Nouv.-Caléd.* 7: 126–132 (1976).

Plant obviously pubescent; flowers yellow with darker centre **1. P. pubescens**

Plant almost glabrous; flowers cream with brown spots at base of petals **2. P. minima**

1. Physalis pubescens L., *Sp. Pl.* 1: 183 (1753)

T: 'in India utraque', Herb. C.Linnaeus 247.11; syn: LINN, *fide* W.G.D'Arcy, *Ann. Missouri Bot. Gard.* 60: 669 (1973), but probably with other elements needing to be taken into account before lectotypification is considered. Epithet is the Latin for softly hairy.

[*P. minima auct. non* L.: C.W.Andrews, *Monogr. Christmas Is.* 183 (1900)]

Sprawling herb, obviously pubescent with simple eglandular hairs. Leaves ovate, asymmetric at base, entire to irregularly-toothed, acute to acuminate; lamina to 4.5 cm long and 3 cm wide; petiole to 3 cm long. Pedicels slender, to 7 mm long, densely pubescent. Calyx 2–3 mm long, densely pubescent outside. Corolla 7 mm long, pubescent externally, yellow with darker centre. Filaments c. 3 mm long; anthers 1 mm long. Berry 7–8 mm long, glabrous, red; fruiting calyx c. 10 mm long; pedicel to 10 mm long. Seeds 1.5 mm long dimpled, yellow.

Christmas Is. Probably first collected by J.J.Lister in 1887/1888, although this specimen has not been seen and it may be referrable to the next taxon. H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 208 (1906) documented 3 forms of the 1 species on Christmas Is. and this taxon identifies with his form from 'dry hot places near the sea, at the Waterfall', which he describes as a 'shorter more prostrate plant with broader pubescent leaves more dentate and rather larger fruit'. An apparently pantropical species probably naturalised in Australia.

Ch.Is.: Phosphate Hill, *C.W.Andrews 160* (K); near the sea, Waterfall, *H.N.Ridley 38a* (K, SING); Smith Point, *H.N.Ridley 38a, b* (SING).

2. Physalis minima L., *Sp. Pl.* 1: 183 (1753)

T: Herb. P.Hermann 97; lecto: BM *n.v.*, *fide* H.Heine, *Fl. Nouv.-Caléd.* 7: 131 (1976). Epithet is the Latin for very small.

?*P. angulata* L., *Sp. Pl.* 1: 183 (1753). T: India – possibly Herb. C.Linnaeus 247.9; LINN, *fide* D.E.Symon, *J. Adelaide Bot. Gard.* 3: 153 (1981).

Small herb to 50 cm high, bushy or erect, almost glabrous. Leaves ovate, sometimes asymmetric at base, entire or irregularly toothed, acute to acuminate; lamina to 9 cm long

and 5 cm wide; petiole to 4–6 cm long. Pedicels slender, 8–12 mm long. Calyx 4 mm long, sparsely and shortly appressed-pubescent externally. Corolla 6–7 mm long, sparsely and shortly pubescent externally, cream, brown at base of petals. Filaments c. 3 mm long; anthers 1.5–2.5 mm long. Berry c. 8 mm long on short, thickened, annular disc, glabrous; inflated fruiting calyx 7–25 mm long, glabrous, pale green with 5 fine, purplish ridges; pedicel apparently not lengthening in fruit. Seeds c. 1.5 mm long, minutely pitted, brownish.

Christmas Is., Cocos (Keeling) Is. Found in open waste places all over Christmas Is. but never very common. On Cocos (Keeling) Is. an occasional weed of open areas. Possibly native to America but now found throughout SE Asia and the Pacific.

Ch.Is.: Flying Fish Cove, *H.N.Ridley 38* (K, SING); Waterfall Rd to blowhole, *A.Pearson P28* (K); at edge of track from Waterfall to main road, 9 Aug. 1986, *R.Shivas 915* (PERTH). C.K.Is.: Home Is., *I.Telford 10071 & C.Howard* (AD, CBG, K); NW lagoon shore, North Keeling Is., *D.G.Williams 155* (AD, CBG).

Material named *P. minima* here should also be compared with *P. angulata* L. which is another confused species whose relationship to *P. minima* is in need of investigation. H.Heine, *Fl. Nouv.-Caléd.* 7: 127 (1976) separated the two predominantly on size differences but also on the number of angles of the fruiting calyx, 5 in *P. minima* and 10 in *P. angulata*.

7. DATURA

Datura L., *Sp. Pl.* 1: 179 (1753); *Gen. Pl.* 5th edn, 83 (1754); derivation obscure but possibly the Arabic *Tatorah, fide* A.G.Avery *et al.*, *Chron. Bot.* 20: 17 (1959).

Type: *D. stramonium* L.

Annual or short-lived perennial herbs, glabrous or pubescent with simple, glandular or eglandular hairs. Leaves alternate, petiolate, simple, entire or lobed. Flowers bisexual, actinomorphic, solitary in forks of stems. Calyx tubular, 5-lobed, circumscissile near base; basal part persistent in fruit, usually enlarging. Corolla funnel- or trumpet-shaped, single (on Christmas Is.), white or coloured; limb shortly 5-lobed, folded and twisted in bud. Stamens 5, inserted in lower half of tube; anthers 2-locular, dehiscing by longitudinal slits. Ovary 2–4-locular; stigma saddle-shaped. Fruit a spiny or tuberculate capsule, opening from apex. Seeds D-shaped.

A genus of c. 10 species, worldwide from tropical and warm-temperate regions; 6 species in Australia, only 1 of these possibly native; 1 species on Christmas Is. Some species have a long history of use as drug plants.

A.G.Avery, S.Satina & J.Rietsema, Blakeslee: the genus *Datura*, *Chron. Bot.* 20: 1–289 (1959); L.Haegi, Taxonomic account of *Datura* L. (Solanaceae) in Australia with a note on *Brugmansia* Pers., *Austral. J. Bot.* 24: 415–435 (1976).

Datura metel L., *Sp. Pl.* 1: 179 (1753)

T: ?specimen in *Hort. Cliff.*; syn: BM, *fide* A.G.Avery *et al.*, *Chron. Bot.* 20: 33 (1959). Epithet is derived from *mathil*, the Arabic name for this plant.

D. alba Rumph. ex Nees, *Trans. Linn. Soc.* 17: 73 (1837). T: based on G.E.Rumphius, *Herb. Amboin.* 5: 243, t. 87, fig. 1 (1747).

Straggly herb to 2 m, glabrescent with simple, eglandular hairs. Leaves ovate to broadly ovate, usually asymmetric, sometimes lobed at base, subentire, acuminate to acute; lamina to 13 cm long and 9 cm wide; petiole 3–6 cm long. Calyx c. 10 cm long, glabrous externally. Corolla c. 20 cm long, fragrant, opening at dusk, white; lobes with slender acumen 1–2 cm long. Stamens included; filaments c. 5 cm long, glabrous, decurrent; anthers 11 mm long. Ovary shortly pubescent with conical protuberances; style c. 16 cm long; stigma just exceeding anthers. Capsule spherical, 2–3 cm diam., spiny all over, splitting into 4 unequal parts, brown; spines 6–8 mm long, shortly pubescent. Seeds c. 4 mm long, faintly dimpled,

grooved laterally, yellow.

Christmas Is. First collected by J.J.Lister. H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 209 (1906), recorded it as abundant along the coast from Smith Point to Cemetery Rd and also from Waterfall. He noted that it occurred near cultivated ground but whether it should be considered native or an early introduction is not known. Cultivated worldwide in warmer areas.

Ch.Is.: no precise locality, *C.W.Andrews s.n.* (K); Flying Fish Cove, *H.N.Ridley ?19* (K, SING); Waterfall Rd, *A.Pearson P24* (K); along NE coast road to Waterfall, *R.Shivas 898A* (PERTH); road to Waterfall at end of North Settlement, *P. van Tets 36* (CBG, GAUBA).

A confused and variable species in need of revision throughout its range. The Christmas Is. material differs from Australian collections by its single, white corolla (cf. double to triple and purple externally in Australia) and by slender spines which cover the fruit (cf. short broad tubercles in the Australian material). The slender, fruiting spines of the Christmas Is. material resemble more those of *D. wrightii* Regel but D.E.Symon and L.Haegi (*Datura* L. (Solanaceae) is a New World genus, in J.G.Hawkes *et al.* (eds), Solanaceae III, Taxonomy, chemistry and evolution 197–210, 1991) are of the opinion that *D. metel* consists of a number of cultivars, some of which have fruit in which the spines are slender and pubescent.

69. CONVOLVULACEAE

R.M.Barker (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R., C.S.Is.)

Herbs or shrubs, often twining, climbing or creeping. Leaves spirally arranged, usually petiolate, usually simple, sometimes shallowly or deeply divided, exstipulate. Inflorescence usually cymose, 1–many-flowered, usually axillary and bracteate. Flowers bisexual, actinomorphic, frequently showy. Sepals usually 5, usually free, often persistent and sometimes enlarging in fruit. Corolla usually campanulate or funnel-shaped; limb entire or 4- or 5-lobed. Stamens 4 or 5, inserted at base of corolla tube, alternating with lobes; pollen smooth or spiny. Disc annular or cupular, nectariferous. Ovary superior, 1–4-locular; ovules 2 per locule; style simple or more rarely bifid; stigma entire or 2-lobed, variously shaped but frequently globular. Fruit usually a 2-, 4- or 8-valved, dry capsule, more rarely irregularly dehiscent or indehiscent. Seeds glabrous or pubescent, usually 1–4; endosperm present.

A family of c. 60 genera and c. 1600 species in tropical to temperate regions; c. 18 genera and c. 100 species in Australia; 6 genera and 17 species on Christmas Is.; 1 genus and 2 species on Cocos (Keeling) Is.; 1 genus and 2 species on Ashmore Reef; 1 genus and 2 species on the Coral Sea Is. Usually twiners found in open well-lit areas, particularly on the edges of forests. They are also often associated with littoral areas because of the ability of the fruit or seeds to be transported by sea-water, e.g. *Ipomoea pes-caprae*, *I. macrantha*, *Merremia peltata* and *Stictocardia tiliifolia*.

Operculina turpethum (L.) Silva Manso has been recorded for the Coral Sea Is., but apparently from a misdetermination of *Ipomoea macrantha*.

Many genera of Convolvulaceae are closely related and are not always easily separable. This applies to *Merremia* and *Ipomoea* which are distinguished almost entirely by their pollen, with the former having smooth and the latter spiny pollen. *Merremia* often has curved or spiral anthers, *Ipomoea* straight ones. For those with access to a microscope this character is easily recognisable at low magnification and its use in the key should provide no difficulty. However, since such access cannot be assumed other characters have been found which will serve to separate the representatives on Christmas Is.

Xenostegia is separable from *Merremia* only by its smooth pollen being porate rather than colporate and the shape of the stigma papillae, neither characteristics easily usable in a generic key.

The order of the genera is the same as that used by S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 390–512 (1953) and is more or less based on H.Hallier, *Bot. Jahrb. Syst.* 18: 81–160 (1893). The subfamily Convolvuloideae, to which all the Christmas Is. genera belong, is further subdivided into the *Convolvuleae* (genera 1–4) with smooth pollen and the *Ipomoeae* (genera 5 & 6) with spiny pollen.

H.Hallier, Convolvulaceae Africanae, *Bot. Jahrb. Syst.* 18: 81–160 (1893); S.J. van Ooststroom, Convolvulaceae, *Fl. Males.* ser. I, 4: 390–512 (1953); B.Verdcourt, *Fl. Trop. E. Africa*, Convolvulaceae: 1–161 (1963); C.A.Backer, R.C.Bakhuizen van den Brink Jr & S.J. van Ooststroom, Convolvulaceae, *Fl. Java* 2: 483–498 (1965).

KEY TO GENERA

1 Stamens exserted; flowers fragrant, white, in axillary panicles; style bifid; sepals enlarging in fruit and falling off with it; pollen smooth — **1. PORANA**

1: Stamens included or if exserted, flowers red; flowers fragrant or not, variable in colour but if white then with coloured throat or midline bands, solitary or cymose in axils; style simple; sepals enlarging in fruit or not, persisting after fruit falls; pollen smooth or spiny

2 Plant with minute black glands on lower surface of leaves and on calyx lobes; fruit indehiscent, completely surrounded and enclosed by expanded calyx lobes which weather to a lacy network of vascular tissue; pollen spiny — **6. STICTOCARDIA**

2: Plant without black glands; fruit dehiscent, not completely surrounded by calyx lobes; pollen smooth or spiny

3 Plant with stellate hairs; stigmas 2, filiform, thickened and recurved at apex; inflorescence an umbelliform cyme; pollen smooth — **2. JACQUEMONTIA**

3: Plant without stellate hairs; stigma biglobose; inflorescence not an umbelliform cyme; pollen smooth or spiny

4 Flowers yellow; anther locules spirally inserted or parallel; pollen smooth — **3. MERREMIA**

4: Flowers not yellow; anther locules parallel; pollen smooth or spiny

5 Petiole of mature leaves more than 10 mm long; pollen spiny — **5. IPOMOEA**

5: Petiole of mature leaves up to 3 mm long; pollen smooth — **4. XENOSTEGIA**

1. PORANA

Porana Burm.f., *Fl. Indica* 51, t. 21 (1768); variable explanations of this name exist, possibly based on a Malay name or possibly from the Greek *poreno* (to travel) referring to the extensive twining stems.

Type: *P. volubilis* Burm.f.

Herbaceous or large woody climbers. Leaves petiolate, often cordate at base, entire. Inflorescence usually an axillary raceme or panicle; bracts minute. Sepals 5, ±equal; outer 3 enlarging in fruit, falling with it. Corolla funnel-shaped or campanulate; limb usually 5-lobed. Stamens 5, inserted near base of tube, included or exserted; anther locules parallel; pollen smooth. Ovary 1- or 2-locular; ovules 2 per locule; style 1, simple or bifid with unequal branches; stigma globose or biglobose. Fruit a ±globose, 2-valved capsule or indehiscent. Seed 1, glabrous.

A genus of c. 20 species, mostly of tropical Asia, but also in Africa and Australia. One

species on Christmas Is. which is frequently cultivated elsewhere for ornamental purposes.

***Porana volubilis** Burm.f., *Fl. Indica* 51, t. 21, fig. 1 (1768)

T: Java, *C.Kleynhoff s.n.*; *n.v.*, possibly in N.L.Burman's herb. at G. Epithet is the Latin for twining in reference to the habit.

Illustration: S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 403, fig. 9 (1953).

Woody climber with pubescent younger stems and glabrous, verrucose older stems. Leaves ovate, cordate at base, entire, acuminate, glabrous or sparingly pubescent; lamina 3–6 cm long, 2–4.5 cm wide; petiole 1–1.5 cm long. Inflorescence a broad, terminal, many flowered panicle; young buds and rachises appressed-pubescent. Flowers fragrant. Sepals obovate, c. 5 mm long, sparingly appressed-pubescent, enlarging in fruit. Corolla white, campanulate, deeply 5-lobed; lobes c. 7 mm long. Stamens exserted, unequal. Style bifid with unequal branches; stigmas globose. Capsule not seen.

Christmas Is. Presumably an escape from cultivation as the only collection was found growing over an old disused shed close to Settlement. D.A.Powell (*pers. comm.*) suggested that it was introduced in the 1960s. A species found throughout SE Asia.

Ch.Is.: close to Settlement, *D.A.Powell 754* (K).

2. JACQUEMONTIA

Jacquemontia Choisy, *Mém. Soc. Phys. Genève* 6: 476 (1833); after V.Jacquemont (1801–1832), a French naturalist who worked in the Antilles and also studied the alpine Himalayan flora.

Type: *J. azurea* (Desv.) Choisy

Herbs or woody twiners, usually with stellate hairs. Leaves petiolate, usually entire and unlobed. Inflorescence an axillary, pedunculate head or umbelliform cyme; bracts small and linear or large and leaf-like. Sepals 5, equal or the outer ones larger. Corolla funnel-shaped or campanulate with 5 distinct mid-petalline bands; limb 5-toothed or -lobed. Stamens 5, included; pollen smooth. Ovary 2-locular; ovules 2 per locule; style 1, simple; stigmas 2. Fruit a globose, 4- or 8-valved capsule. Seeds 1–4, glabrous or shortly pubescent; angles often with a narrow wing along their length.

A genus of c. 120 species, predominantly from the American tropics; 2 species in Australia; 1 species on Christmas Is.

Jacquemontia paniculata (Burm.f.) Hallier f., *Bot. Jahrb. Syst.* 16: 541 (1893); *Bot. Jahrb. Syst.* 18: 95 (1893)

Ipomoea paniculata Burm.f., *Fl. Indica* 50, t. 21, fig. 3 (1768). T: Batavia, Java, *C.Kleynhoff* in N.L.Burman 413 (88); holo: G, *fide* B.Verdcourt, *Fl. Trop. E. Africa,* Convolvulaceae: 34 (1963). Epithet is the Latin for paniculate, in reference to the inflorescence.

Convolvulus parviflorus Vahl, *Symb. Bot.* 3: 29 (1794). T: Java, East Indies, comm. *N.L.Burman*; ?C, no specimen found, *fide* B.Verdcourt, *op. cit.* 35.

Illustration: S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 433, fig. 19 (1953).

Small twining herb; stems slender, terete, stellate-hairy or glabrescent. Leaves ovate, cordate at base, entire, acuminate, sparsely pubescent; lamina 2.5–6.5 cm long, 1.5–4 cm wide; petiole 1–2.5 cm long, densely pubescent. Inflorescence an umbelliform cyme; peduncle 1–5 cm long; pedicels 2–3 mm long, elongating in fruit; bracts linear, small. Sepals densely pubescent; outer 3 larger, ovate, c. 6 mm long, acuminate, attenuate at base; inner narrower, with broader base. Corolla funnel-shaped, 5-lobed, pink; lobes mucronulate. Stamens subequal; filaments pubescent on thickened bases. Ovary glabrous; stigmas filiform, thickened and recurved at apex. Capsule c. 4 mm long, glabrous, 8-valved. Seeds c. 1.5 mm long, black, glabrous, ±trigonous; angles narrowly winged.

Christmas Is. First collected by C.W.Andrews in 1897 from White Beach. H.N.Ridley (*J. Straits Branch Roy. Asiat. Soc.* 45: 207, 1906) recorded it as common at Smith Point and Rocky Point. The only recent collection is from North West Point and D.A.Powell (*pers. comm.*) regarded the species as uncommon. Recorded from Africa, Madagascar, Asia and Malesia.

Ch.Is.: White Beach at Settlement, *C.W.Andrews 33* (BM, K); near Magistrate's House, Flying Fish Cove, *H.N.Ridley 26* (K); North West Point, *D.A.Powell 224 & Kim Chey* (K).

3. MERREMIA

Merremia Dennst. ex Endl., *Gen. Pl.* 1403 (1841), *nom. cons.*; after Blasius Merrem, 1761–1804, a professor of mathematics and physics at Duisburg and Marburg.

Type: *M. hederacea* (Burm.f.) Hallier f.

Annual or perennial herbs or shrubs, often twining and prostrate. Leaves petiolate, entire or lobed. Inflorescence a 1–many-flowered corymb or cyme, axillary; bracts small. Sepals 5, usually ±equal, sometimes enlarging. Corolla funnel-shaped or campanulate, often yellow with a darker centre; limb entire or slightly lobed. Stamens 5, included; filaments widened at point of insertion; anther locules parallel or spirally twisted; pollen smooth. Ovary 2–4-locular; ovule 1 per locule (on Christmas Is.); style 1; stigma biglobular. Fruit a capsule, 4-valved or splitting irregularly. Seeds glabrous or pubescent.

A genus of c. 80 species in the tropics; 12 species in Australia; 2 species on Christmas Is. Not markedly different from *Ipomoea* except in its smooth pollen.

Twining prostrate herb; leaves to 4 cm long, not peltate; corolla 0.6–1.2 cm long; anther locules parallel, glabrous **1. M. hederacea**

Large twiner often completely covering trees; leaves to 13 cm long, peltate; corolla c. 6 cm long; anther locules twisted, pubescent **2. M. peltata**

1. Merremia hederacea (Burm.f.) Hallier f., *Bot. Jahrb. Syst.* 18: 118 (1893)

Evolvulus hederaceus Burm.f., *Fl. Indica* 77, t. 30, fig. 2 (1768). T: Java, *coll. unknown* (Herb. N.L.Burman); holo: G *n.v.*, *fide* S.J. van Ooststroom, *Blumea* 3: 306 (1939) but not located there by B.Verdcourt, *Fl. Trop. E. Africa*, Convolvulaceae: 54 (1963) although he cited the collector as *D.Pryon*. Epithet from the genus *Hedera* (Ivy) and the Latin suffex *-aceus* (resembling) implying that this plant resembles Ivy.

Ipomoea chryseides Ker Gawl., *Bot. Reg.* 4, t. 270 (1818). T: East India, *J.G.Koenig* in Herb. J.Banks; syn: BM *n.v.*, *fide* B.Verdcourt, *loc. cit*.

Prostrate twining herb. Stems slender, glabrous or sparsely pubescent, often rooting at nodes in older parts, often reddish. Leaves ovate to triangular, cordate to hastate at base, entire to crenulate, acute, sparsely appressed-pubescent; lamina to 4 cm long; petiole slender, 1–3.5 cm long, with an adaxial line of pubescence. Inflorescence cymose or flowers solitary; peduncle to 4 cm long; pedicels c. 2 mm long. Sepals obovate, truncate with a small mucro, glabrous apart from indumentum along apex; inner sepals c. 5 mm long, the outer 3 somewhat shorter. Corolla campanulate, c. 8 mm long, bright yellow. Anther locules parallel, glabrous. Stigma exserted. Capsule depressed-globose, 3 mm long, 4-valved. Seeds 4, shortly pubescent or subglabrous.

Christmas Is. A common pantropical weed first collected by H.N.Ridley from Phosphate Hill, Christmas Is. in 1904 (H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 205 (1906), as *Ipomoea chryseides*), now appearing in semi-cleared areas.

Ch.Is.: South Point Rd, c. 13.5 km from South Point, *A.Pearson P57* (K); Ross Hill Gardens, *D.A.Powell 174* (K).

2. Merremia peltata (L.) Merr., *Interpr. Herb. Amboin.* 441 (1917)

Convolvulus peltatus L., *Sp. Pl.* 2: 1194 (1753); *Ipomoea peltata* (L.) Choisy, *Mém. Soc. Phys. Genève* 6: 453 (1833). T: illustration in G.E.Rumphius, *Herb. Amboin.* 5: 428, t. 157 (1747), *fide* B.Verdcourt, *Fl. Trop. E. Africa*, Convolvulaceae: 50 (1963). Epithet is the Latin for peltate (shield-shaped), in reference to the leaf form.

Large twiner arising from a subterranean tuber. Stems robust, glabrous, with milky juice. Leaves ovate-orbicular to orbicular, entire, often acuminate, peltate, glabrous; lamina 6–15 cm wide; petiole 2–6 cm long. Inflorescence a several-flowered corymb; peduncle stout, to 4 cm long; pedicels to 3 cm long in bud, elongating in fruit; bracts caducous. Sepals subequal, glabrous, obtuse or mucronulate, c. 2 cm long; inner 2 somewhat narrower. Corolla funnel-shaped, c. 6 cm long, bright yellow. Anthers twisted, surrounded by long filamentous hairs. Fruit not seen, but capsule 4-valved, the valves splitting longitudinally into segments, *fide* S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 453 (1953). Seeds 4, pubescent, yellow or brown.

Christmas Is. Occurs along the eastern side of Christmas Is. D.A.Powell (*pers. comm.*) reported that several areas are covered by this plant. The areas are usually weathered volcanics and protected from the south east trade winds. *Merremia peltata* is found throughout Malesia into Australia and Polynesia as well as from Madagascar, Mascarenes and Seychelles with a record also from tropical eastern Africa (Zanzibar).

Ch.Is.: Murray Hill track, *H.N.Ridley 90* (K); no precise locality, *C.W.Andrews* (BM); Grants Well, *A.Pearson & D.A.Powell P94* (K); eastern side of Christmas Is., *D.A.Powell 413* (K).

4. XENOSTEGIA

Xenostegia Austin & Staples, *Brittonia* 32: 533 (1980); derivation not explained.

Type: *X. tridentata* (L.) Austin & Staples

Herbs, prostrate or creeping. Leaves petiolate, usually lobed or dentate at base. Inflorescence cymose, axillary; peduncle long. Sepals subequal or outer 2 slightly longer. Corolla funnel-shaped or campanulate, the limb slightly 5-lobed. Stamens 5, inserted near base of corolla tube, included; anther locules parallel to each other; pollen smooth. Ovary 2- or 4-locular; ovule 1 per locule; style 1, simple; stigma biglobular. Fruit a 4-valved capsule. Seeds 1–4, glabrous.

A recently-recognised genus presently with only 2 species, one more or less confined to Africa, the other very polymorphic and pantropical. The latter species is found on Christmas Is.

I.K.Ferguson, B.Verdcourt & M.M.Poole, Pollen morphology in the genera *Merremia* and *Operculina* (Convolvulaceae) and its taxonomic significance, *Kew Bull.* 31: 763 (1977); D.F.Austin & G.W.Staples, III *Xenostegia*, a new genus of Convolvulaceae, *Brittonia* 32: 533 (1980).

Xenostegia tridentata (L.) Austin & Staples, *Brittonia* 32: 533 (1980)

Convolvulus tridentatus L., *Sp. Pl.* 157 (1753). T: India, illustration in H.A.Rheede, *Hort. Malab.* 11: t. 65 (1692), *fide* B.Verdcourt *Fl. Trop. E. Africa*, Convolvulaceae: 51 (1963). Epithet from the Latin *tri-* (three) and *dentatus* (toothed), in reference to the leaves.

Herbaceous twiner with slender, glabrous, striate stems. Leaves lanceolate, 3- or 4-toothed and hastate at base, acute, glabrous; lamina 2–7 cm long, 0.6–1.5 cm wide; petiole to 3 mm long. Peduncle 6–12 cm long, initially decurrent with petiole, glabrous but often pubescent near base. Bracts minute. Sepals lanceolate, acuminate, c. 7–8 mm long, glabrous. Corolla 16–20 mm long, funnel-shaped to campanulate, white or cream with maroon throat. Capsule ovoid, glabrous; walls papery but dissepiment usually persisting after dehiscence. Seeds black, subtrigonous, c. 3 mm long.

Christmas Is. There is one recent collection. A polymorphic species found throughout tropical Africa and Asia and throughout Malesia.

Ch.Is.: old track in central area, *D.A.Powell 525* (K).

This material conforms with S.J. van Ooststroom's description of *Merremia tridentata* subsp. *hastata* (*Fl. Males.* ser. I, 4: 445, 1953) or *Merremia tridentata* subsp. *angustifolia* var. *angustifolia* of B.Verdcourt (*Fl. Trop. E. Africa,* Convolvulaceae: 51, 1963). However, D.F.Austin & G.W.Staples, *loc. cit.*, cast some doubt on these infraspecific taxa and clarification is needed.

5. IPOMOEA

Ipomoea L., *Sp. Pl.* 1: 159 (1753); *Gen Pl.* 5th edn, 76 (1754); from the Greek *ipos* (a kind of worm) and *homoios* (similar to), because of the trailing stems.

Type: *I. pes-trigridis* L.

Quamoclit Moench, *Methodus* 453 (1794). T: *Q. coccinea* (L.) Moench

Batatas Choisy, *Mém. Soc. Phys. Genève* 6: 434 (1834). T: *B. edulis* (Thunb.) Choisy (*Convolvulus edulis* Thunb.)

Annual or perennial herbs or shrubs, often twining or climbing. Leaves petiolate, entire or lobed, sometimes pseudo-stipulate. Inflorescence often cymose, axillary, usually 1–3-flowered, rarely many-flowered; bracts usually small. Sepals 5, usually of similar size, persistent. Corolla funnel-shaped, or more rarely salver-shaped; limb 5-lobed, each lobe with 2 distinct nerves to its centre. Stamens 5, inserted near base of corolla tube, included or exserted; filaments usually pubescent at point of insertion; pollen spiny. Ovary 2–4-locular; style 1, simple; stigma capitate, entire or 2-lobed. Fruit a globose capsule, usually 4-valved, sometimes splitting irregularly. Seeds 1–4, glabrous or hairy.

A genus of c. 500 species from the tropical and subtropical regions of the world; c. 45 species in Australia; 11 species on Christmas Is.; 2 species on Cocos (Keeling) Is., Ashmore Reef and the Coral (Sea) Is.

C.R.Gunn, Moonflowers. *Ipomoea* Sect. *Calonyction*, in temperate North America, *Brittonia* 24: 150–168 (1972).

1 Stems and leaves pubescent

2 Flowers pale blue with white throat; sepals lanceolate, strigose **1. I. nil**

2: Flowers white with darker centre; sepals ovate, usually glabrous **4. I. obscura**

1: Stems and leaves glabrous

3 Leaves with lobes separate to base

4 Leaves comb-like (pectinate); flowers deep red; sepals awned; stamens exserted **9. I. quamoclit**

4: Leaves palmate with 5–7 narrowly ovate leaflets; flowers pink; sepals obtuse; stamens included **7. I. cairica**

3: Leaves simple or sometimes lobed, but lobes not separate to base or midrib

5 Leaves palmately lobed; lobes 5–7; flowers deep pink, darker in throat; stem twiner **10. I. mauritiana**

5: Leaves not palmately lobed, or if so obscurely 3–5-lobed; flowers variable in colour, if pink with dark throat then plant prostrate and rooting at nodes

6 Flowers deep scarlet; stamens exserted; calyx lobes with a long curved apical awn **8. I. hederifolia**

6: Flowers not deep scarlet; stamens included; calyx lobes lacking long apical awn

7 Floral tube to 9 cm long, white with greenish bands, opening at night **11. I. macrantha**

7: Flowers much less than 9 cm long, if white then lacking greenish bands, not opening at night

8 Freshwater aquatic plant with hollow or spongy stems; flowers pink with darker centre or entirely white **5. I. aquatica**

8: Terrestrial plant without hollow stems; flowers rarely pink with darker centre, if so plant found on seashore

9 Ovary hairy at apex; seeds glabrous; leaves triangular or 3–5-lobed

10 Flowers white with violet throat; stems prostrate, rooting at nodes; plant producing edible underground tubers; sepals usually without fimbriate margins **3. I. batatas**

10: Flowers pinkish mauve; stems usually twining, sometimes prostrate; plant not producing underground tubers; sepals with fimbriate margins **2. I. triloba**

9: Ovary glabrous; seeds pubescent; leaves ovate to orbicular

11 Leaf apex emarginate; flowers deep pink with darker centre, rarely entirely white; plant usually of seashore **6. I. pes-caprae**

11: Leaf apex attenuate or acuminate; flowers white or pale yellow with darker mid-line and deep purple centre; not usually found on seashore **4. I. obscura**

1. *Ipomoea nil (L.) Roth, *Catal. Bot.* 1: 36 (1797)

Convolvulus nil L., *Sp. Pl.* 2nd edn, 1: 219 (1762). T: America, Virginia and Carolina; illustration in J.J.Dillenius, *Hort. Elth.* t. 80, fig. 92 (1832); syn, *fide* B.Verdcourt, *Fl. Trop. E. Africa*, Convolvulaceae: 113 (1963). Epithet *nil* is derived from the Arabic name for this plant.

Herbaceous creeper; stems light green or purplish, with retrorse hairs. Leaves ±orbicular, cordate to sagittate at base, entire, usually 3-lobed, acuminate, appressed-strigose; lamina 3–9 cm long, 3–14 cm wide; petiole 0.5–8.5 cm long. Inflorescence cymose or flowers solitary; peduncle to 8 cm long; bracts lanceolate, 2–5 mm long; pedicels 7–12 mm long, thickened in fruit. Sepals lanceolate, with long hairs at base; outer pair c. 2 cm long; inner 3 shorter. Corolla funnel-shaped, 4–4.5 cm long, glabrous externally, pale blue with white throat. Stamens and style included; stigma c. equal to stamens. Ovary glabrous. Capsule c. 10 mm long, usually 2-valved (on Christmas Is.), 1-seeded, glabrous. Seed subglobose, c. 5 mm diam, shortly pubescent, black. Fig. 53.

Christmas Is. Found in 1963 in cleared areas beside roads. Now extremely widespread and probably the most common wayside plant. Probably originally introduced as a garden ornamental. Pantropical.

Ch.Is.: Rocky Point, base of first inland cliff, *A.Pearson P39* (K); no precise locality, *D.A.Powell 698* (K); Phosphate Hill area, *B.A.Mitchell 142* (CBG); NE of island near Grotto on first terrace, *R.Shivas 874* (PERTH).

2. *Ipomoea triloba L., *Sp. Pl.* 1: 161 (1753)

T: America, Herb. C.Linnaeus 219.10; possible syn: LINN. Epithet from the Latin *tri-* (three-) and *lobatus* (lobed), in reference to the leaves.

Herb, usually twining, rarely prostrate; stems glabrous. Leaves ovate, cordate at base, 3-lobed, glabrous; lamina 2–3.5 cm long, 1–3.5 cm wide; petiole 6–7 cm long, glabrous. Inflorescence cymose, 2- or 3-flowered; peduncle stout, c. 1 cm long; bracts linear, c. 4 mm long; pedicels 3–5 mm long. Sepals oblong, c. 7 mm long, unequal, mucronulate, long-pilose particularly near basal margin. Corolla narrowly funnel-shaped, c. 1.5 cm long, glabrous externally, pinkish mauve, opening early morning and fading early. Stamens included. Ovary pubescent. Capsule c. 5–6 mm long, bristly pubescent, 4-valved. Seeds c. 3–4 mm long, glabrous, brown with darker mottling.

Christmas Is. Collected in 1963 in a cleared area beside the road, more recently found as an occasional coloniser in the Drumsite area. Native of tropical America, found throughout Malesia in waste places.

Ch.Is.: Rocky Point, base of first inland cliff, *A.Pearson P40* (K); Drumsite Mine office area, *B.A.Mitchell 146* (CBG); old mine site, 0.5 km N of airport, *R.Shivas 934* (PERTH).

3. *Ipomoea batatas (L.) Lam., *Tabl. Encycl.* 1: 465 (1793)

Convolvulus batatas L., *Sp. Pl.* 1: 154 (1753). T: India, Herb. C.Linnaeus 218.12; lecto: LINN, *fide* B.Verdcourt, *Fl. Trop. E. Africa,* Convolvulaceae: 114 (1963). Epithet from the old generic name used by C.Bauhin in 1623 for this species. *Batatas* is the early American word from which potato is derived.

Prostrate, scrambling herb with underground edible tubers; stems glabrous, often rooting at nodes. Leaves triangular, cordate at base, sometimes shallowly and palmately 3–5-lobed, acute, glabrous; lamina 3.5–11 cm long, 4–12 cm wide; petiole 4–8 cm long. Inflorescences cymose, 1–several-flowered; peduncle 7–9 cm long, glabrous; bracts c. 3 mm long; pedicels c. 3–7 mm long, glabrous. Sepals ovate, unequal, glabrous; outer pair 9–10 mm long; inner 3, long-acuminate, c. 12 mm long. Corolla campanulate to funnel-shaped, c. 3.5 cm long, glabrous, white with violet throat. Stamens and style included; stigma biglobose, exceeding stamens. Ovary densely white pubescent at apex. Fruit not seen, apparently rarely produced in Malesian specimens (S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 469, 1953). Seeds glabrous. *Sweet Potato*.

Christmas Is. Common in waste places and regarded as something of a nuisance in such areas (D.A.Powell, *pers. comm.*, 1985). Widely cultivated throughout tropical areas for its edible tubers.

Ch.Is.: Rocky Point, base of first inland cliff, *A.Pearson P38* (K).

4. Ipomoea obscura (L.) Ker Gawl., *Bot. Reg.* 3, t. 239 (1817)

Convolvulus obscurus L., *Sp. Pl.* 2nd edn, 220 (1762). T: Batavia, Java, illustration in J.J.Dillenius, *Hort. Elth.* t. 83, fig. 95 (1732); syn, *fide* B.Verdcourt, *Fl. Trop. E. Africa,* Convolvulaceae: 116 (1963). Epithet is the Latin for dark, shady, indistinct.

Twining or prostrate herb; stems slender, subglabrous; older parts woody. Leaves ovate, cordate at base, entire, acuminate, usually subglabrous except ciliate margin, rarely pubescent all over; lamina 3.2–4 cm long, 3.3–3.8 cm wide; petiole 2.2–3 cm long. Flowers usually solitary; peduncle slender, to 10 cm long; bracts minute; pedicels thickened, 1–2 cm long. Sepals ovate, 3–4 mm long, apiculate, subglabrous. Corolla funnel-shaped, c. 2–2.5 cm long, pale yellow with darker centre. Stamens and style included; filaments very unequal. Ovary glabrous. Capsule ovoid, 7–8 mm long, 4-valved, glabrous. Seeds 4, pubescent, black.

Christmas Is. Grows on waste ground. Observed around Drumsite area on the fringes of habitation. Found in Africa, tropical Asia, Malesia, Australia and Fiji.

Ch.Is.: road between Settlement and Drumsite, *D.A.Powell 225* (K).

5. *Ipomoea aquatica Forssk., *Fl. Aegypt.-Arab.* 44 (1775)

T: Zebid, Yemen, *P.Forsskal*; holo: C; iso: BM, *fide* B.Verdcourt, *Fl. Trop. E. Africa,* Convolvulaceae: 120 (1963). Epithet from the Latin *aquaticus* (growing in water) in reference to the habitat of this species.

Herbaceous, prostrate, perennial or annual herb with trailing (on mud) or floating (in water) hollow stems, rooting at nodes, glabrous. Leaves variable, but the Christmas Is. material triangular, cordate at base, entire, obtuse; lamina 10.5 cm long, c. 7 cm wide; petiole 10 cm long. Inflorescence cymose or flowers solitary; peduncle c. 1 cm long; bracts minute; pedicels 3–4 cm long, glabrous. Sepals ovate, subequal, 7–9 mm long, glabrous. Corolla funnel-shaped, 4–5 cm long, glabrous, pink with darker centre to entirely white. Stamens and style included; stigma biglobose, above stamens. Fruit not seen.

Christmas Is. Cultivated by the Chinese population as a vegetable, particularly in wet areas

of Ross Hill Gardens. Pantropical, in wet areas.

Ch.Is.: eastern terrace, *D.A.Powell 431* (K).

Known locally as 'kangkong'. D.A.Powell noted on one specimen (*D.A.Powell 431*, K) that another variety known as 'dry kangkong' is grown in gardens without excessive use of water. This is also documented by C.A.Backer for the Malay Peninsula (S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 473, 1953).

6. Ipomoea pes-caprae (L.) R.Br. in J.H.Tuckey, *Narr. Exped. R. Zaire* 477 (Mar. 1818); Sweet, *Hort. Suburb. Lond.* 35 (July 1818)

subsp. **brasiliensis** (L.) Ooststr., Fl. Males. ser. I, 4: 476, fig. 50, 1953

Convolvulus brasiliensis L., *Sp. Pl.* 1: 159 (1753). T: from Brazil; *n.v.* Epithets from the Latin *pes* (a foot) and *capra* (a goat) presumably referring to the leaf shape; and brasiliensis, referring to the country of origin of the type collection.

Glabrous, trailing perennial; tap-root thick; stems thick, to 30 cm long, rooting at nodes. Leaves upright, often only on one side of stem, ovate to orbicular, rounded, cuneate or cordate at base, entire, emarginate or bilobed; lamina 3–10 cm long and wide; petiole to 17 cm long, with 2 glands at apex. Inflorescence a 1-sided cyme, 1–several-flowered; peduncle 3–16 cm long, glabrous; bracts c. 3 mm long, fugacious; pedicels 12–45 mm long. Sepals ovate, subequal or the outer slightly shorter, 5–11 mm long, mucronulate, glabrous. Corolla funnel-shaped, 3–5 cm long, glabrous, pink or red-purple, darker in centre. Stamens and style included. Capsule 12–17 mm long, 4-valved, glabrous. Seeds 4, 6–10 mm long, pubescent. Fig. 71.

Christmas Is., Cocos (Keeling) Is., Ashmore Reef, Coral Sea Is. On Christmas Is. it occurs at Flying Fish Cove and Dolly Beach (D.A.Powell, *pers. comm.*, 1985). H.N.Ridley first collected the species in 1890 and recorded it again in 1906, noting it as common from Isabella Beach and Waterfall Bay as well as Flying Fish Cove. On Cocos (Keeling) Is. common at beach margins and in openings in *Cocos* plantations in coralline sand. On Ashmore Reef grows in herbfield in coralline sand. On the Coral Sea Is. recorded from Lihou Reef in herbfield with *Lepturus repens*. A common pantropical species found on beaches.

Ch.Is.: Waterfall, *H.N.Ridley 193* (SING). C.K.Is.: near landing jetty, West Is., *A.S.George 16258* (BRI, CBG); near Tanjong Klikil, West Is., *I.R.Telford 9992 & C.Howard* (AD, CBG). A.R.: West Is., *J.Hicks 27* (CBG). C.S.Is.: Turtle Is., Lihou Reef, *J.Hicks 25* (CBG).

7. *Ipomoea cairica (L.) Sweet, *Hort. Brit.* 287 (1827)

Convolvulus cairicus L., *Syst. Nat.* 10th edn, 922 (1759). T: illustration of *Convolvulus aegyptius* in J.Vesling, *Obs. in Prosp. Alp. Pl. Aegypt.* 75, fig. (1638); syn, *fide* B.Verdcourt, *Fl. Trop. E. Africa*, Convolvulaceae: 125 (1963). Epithet from the Latin adjective *cairica* for Cairo in Egypt.

Glabrous twining perennial; roots tuberous. Leaves orbicular in outline, palmately 5–7-lobed, glabrous; lobes split to base except where basal lobes are again divided, narrowly ovate, entire, acuminate, c. 10 mm long, 4 mm wide; petiole 6–20 mm long. Inflorescence cymose, 1–3-flowered; peduncle c. 5 mm long; bracts minute, caducous; pedicels to 1 cm long. Sepals ovate, subequal, c. 7 mm long, mucronulate, glabrous; margin scarious. Corolla funnel-shaped, 5–5.5 cm long, glabrous, entirely purplish red or only centre purplish red, or entirely white. Stamens and style included; stigma at level of shorter stamens, biglobose. Fruit not seen, but capsule c. 10–12 mm long, 4-valved, glabrous, *fide* S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 478 (1953). Seeds 4 or less, c. 5–6 mm long, densely and shortly pubescent with longer hairs along edge.

Christmas Is. D.A.Powell noted that it was probably first introduced into gardens at South Point about 1960 and is now covering 120–160 hectares of 'mined-out' quarries. Found throughout tropical Africa, Asia, Malesia and eastern Mediterranean.

Ch.Is.: quarries, *D.A.Powell 430* (K); Drumsite area, near engineering office, *B.A.Mitchell 155* (CBG).

8. *Ipomoea hederifolia L., *Syst. Nat.* 10th edn, 925 (1759)

T: from the West Indies, illustration of *Ipomoea foliis cordatis* in C.Plumier, *Pl. Amer.* t. 93, fig. 2 (1756); lecto, *fide* B.Verdcourt, *Fl. Trop. E. Africa,* Convolvulaceae: 132 (1963). Epithet from the genus *Hedera* (Ivy) and the Latin *folius* (a leaf).

I. angulata Lam., *Tabl. Encycl.* 1: 464 (1793). T: Mauritius, *P.Commerson s.n.*; holo: P *n.v.*, *fide* B.Verdcourt, *loc. cit.*

Illustration: S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 482, fig. 54 (1953).

Low twining annual; branches sparsely pubescent. Leaves ovate, cordate at base, entire or 3-lobed, acuminate, glabrous; lamina to 4.5 cm long and 4 cm wide; petiole 1–4.5 cm long. Inflorescence a terminal raceme to 10 cm long, 1–4-flowered; bracts minute; pedicels 5–7 mm long in fruit and somewhat thickened. Sepals oblong, c. 2 mm long, with awn c. 2 mm long inserted just below obtuse apex, glabrous. Corolla salver-shaped, glabrous, bright scarlet; tube c. 2.5 cm long, slightly curved; lobes c. 8 mm long. Stamens and style exserted. Capsule c. 7 mm long, splitting longitudinally into 4 valves, exposing translucent dissepiment with thickened margins, glabrous. Seeds 4, trigonous, c. 4 mm long, pubescent, black.

Christmas Is. Found in one locality along cleared roadside, first collected there in 1963. A native of tropical America, now found throughout tropical regions of the world.

Ch.Is.: 2-mile [c. 3.1 km] post on railway from South Point, *A.Pearson & D.A.Powell 34* (K); near 2-mile [c. 3.1 km] post on railway from South Point, *D.A.Powell 156* (K).

9. *Ipomoea quamoclit L., *Sp. Pl.* 1: 159 (1753)

T: India, Herb. C.Linnaeus 219.1; possible syn: LINN. Epithet from the old generic name used by the Dutch botanist C.Clusius (1525–1609) for this species. From the Greek *kyamos* (kidney bean) and *klitos* (dwarf) as it resembles a smaller version of the kidney bean, in particular its climbing stems.

Glabrous twining annual. Leaves pinnatisect, with 6–18 pairs of linear leaflets; petiole 0–3 cm long. Leaflets to 2 cm long, c. 0.5 mm wide. Flowers 1 or 2; peduncle to 4 cm long, slender; bracts small; pedicels thickening in fruit, c. 0.5–2 cm long. Sepals ovate to oblong, somewhat unequal, glabrous; outer 3.5–4.5 mm long; inner 4.5–5 mm long; margin scarious; mucro c. 0.5 mm long. Corolla salver-shaped, to 3 cm long, glabrous, deep red. Stamens and style exserted. Capsule c. 6 mm long, splitting longitudinally into 4 valves exposing translucent dissepiment with thickened margins. Seeds 4, pubescent, black.

Christmas Is. D.A.Powell noted that cultivation has been attempted from naturalised populations but the plant does not persist for more than 1 or 2 seasons. Naturalised among marginal growth, but first collected in 1982. Found throughout tropical regions of the world; often cultivated in gardens and escaping from there into waste places.

Ch.Is.: road between Settlement and Drumsite, *D.A.Powell 558* (K).

10. Ipomoea mauritiana Jacq., *Collect.* 4: 216 (1791)

T: plant from Mauritius cultivated at Vienna; *n.v.*, probably no specimen made, *fide* B.Verdcourt, *Fl. Trop. E. Africa,* Convolvulaceae: 135 (1963). Named after Mauritius whence the type originated.

[*I. digitata auct. non* L.: C.W.Andrews, *Monogr. Christmas Is.* 183 (1900)]

Large perennial stem-twiner with tuberous roots; stems glabrous. Leaves orbicular, palmately 5–7-lobed, glabrous, gland-dotted below; lobes divided to middle or just below, acute, entire; lamina 7–15 cm long, 7–18 cm wide; petiole 2.5–12 cm long. Inflorescence cymose, corymb-like when many-flowered, or flowers solitary; peduncle 2.5–21 cm long, glabrous; bracts to 7 mm long, pubescent on back, caducous; pedicels 12–15 mm long. Sepals oblong, subequal or inner exceeding outer in fruit, 10–11 mm long, glabrous; margin scarious. Corolla funnel-shaped, 5–5.5 cm long, glabrous, pink or reddish purple, darker in throat (not known for Christmas Is. specimens). Stamens and style included. Fruit not seen, but capsule c. 12–14 mm long, 4-valved, glabrous, *fide* S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 483 (1953). Seeds 4, covered with long, silky, easily detached hairs, black.

Christmas Is. Recorded c. 1900 from Flying Fish Cove and common along the north-eastern shore terrace, growing over light marginal scrub; in 1984 recorded by B.A.Mitchell from a roadside in the Phosphate Hill area and regarded as common. Pantropical, sometimes cultivated but more often associated with beach vegetation.

Ch.Is.: no precise locality, *C.W.Andrews s.n.* (K, SING); Flying Fish Cove, *H.N.Ridley 149* (K); north-eastern shore terrace, *D.A.Powell 527* (K); Phosphate Hill area, *B.A.Mitchell 144* (CBG).

Under the misapplied name of *I. digitata*, S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 483 (1953), recognised 2 varieties separable on their leaf shape, var. *digitata* with palmately divided leaves and var. *eriosperma* with entire or shallowly lobed leaves. The Christmas Is. material belongs with the former.

11. Ipomoea macrantha Roem. & Schult., *Syst. Veg.* 4: 251 (1819)

Based on *I. longiflora* R.Br., *Prodr.* 484 (1810), *nom. illeg. non* Humb., Bonpl. & Kunth. ex Willd. (1809). T: Sweers Is., Gulf of Carpentaria, [Qld], *R.Brown Iter Austral. 2741*; holo: BM, *fide* C.R.Gunn, *Brittonia* 24: 150–168 (1972). Epithet from the Greek *macro* (large) and *anthos* (a flower).

Convolvulus tuba Schltdl., *Linnaea* 6: 735 (1831); *Ipomoea tuba* (Schltdl.) G.Don, *Gen. Hist.* 4: 271 (1837); S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 487 (1953). T: St. Thomas, Virgin Islands, West Indies, *C.A.Ehrenberg s.n.*; syn: ?HAL, *fide* B.Verdcourt, *Fl. Trop. E. Africa*, Convolvulaceae: 137 (1963).

[*I. grandiflora auct. non* (L.f.) Lam.: C.W.Andrews, *Monogr. Christmas Is.* 183 (1900)]

Illustration: C.R.Gunn, *Brittonia* 24: 159, fig. 3 (1972).

Glabrous perennial climber; stems somewhat woody and sometimes twining. Leaves broadly ovate to orbicular, cordate at base, entire, acuminate, glabrous but lower surface gland-dotted particularly about base; lamina 8–14 cm long, c. 11 cm wide; petiole 8–11 cm long, ?with 2 purple glands at join of blade (obscure in dry material). Flowers solitary; peduncle 10–12.5 cm long; bracts fugacious; pedicels c. 2 cm long, thickening in fruit. Sepals ovate, subequal, c. 2 cm long, obtuse or sometimes mucronulate. Corolla ±salver-shaped, glabrous, white turning yellow or white with greenish yellow bands, probably opening at night; tube c. 8.5 cm long; lobes c. 6 mm long. Stamens 2 longer and 3 shorter, included. Style included; stigma above stamens. Fruit not seen, but capsule 2–3 cm long, 4-valved, glabrous, *fide* S.J. van Ooststroom, *Fl. Males.* ser. I, 4: 487 (1953). Seeds 4, 10–12 mm long, densely and shortly pubescent with longer hairs on margin.

Christmas Is., Cocos (Keeling) Is., Ashmore Reef, Coral Sea Is. On Christmas Is. grows on sea cliffs of coralline limestone and basalt – 'draping the basalt sea cliff at Waterfall' according to D.A.Powell. On Cocos (Keeling) Is. grows in shrub communities and *Cocos* plantations in coralline sand. On Ashmore Reef grows in herbfield and shrub communities in coralline sand. On the Coral Sea Is. recorded from herbfield, shrub communities and low *Pisonia* forest on Herald and Magdelaine Cays and Coringa and Diamond Islands. A pantropical species usually found on beaches, but usually at the back of the beach rather than the front.

Ch.Is.: north coast, Apr. 1898, *C.W.Andrews* (BM, K); Waterfall, *D.A.Powell 363* (K); sea cliffs above Greta Beach, *B.A.Mitchell 121* (CBG). C.K.Is.: between North Lagoon and ocean beach, West Is., *I.R.Telford 9975 & C.Howard* (AD, CBG, K). A.R.: West Is., 23 Feb. 1984, *D.B.Carter* (CBG). C.S.Is.: Magdelaine Cays, SE Cay, 6 Oct. 1987, *T.Scotney & W.Jeffs* (CBG).

The flowers open at night and are visited by hawk moths on the Coral Sea Is. Seed dispersal is aided by the ability of its seeds to be dispersed by sea water, the presence of an air cavity within the seed rendering the seed buoyant (C.R.Gunn, *op. cit.* 161).

6. STICTOCARDIA

Stictocardia Hallier f., *Bot. Jahrb. Syst.* 18: 159 (1894); from the Greek *stictos* (dotted), and *kardia* (heart), referring to the black glands on the heart-shaped leaves of the type species.

Type: *S. tiliifolia* (Desr.) Hallier f.

Woody or herbaceous trailers or twiners. Leaves petiolate, entire, lower surface with black glands. Inflorescence a 1–many-flowered, pedunculate, axillary cyme; bracts small, caducous. Sepals 5, subequal, enlarging in fruit. Corolla large, funnel-shaped, with mid-petalline bands with black glands. Stamens 5; filaments pubescent at base; pollen spiny. Ovary 4-locular; ovules 1 per locule; style 1, simple; stigma biglobular. Fruit indehiscent, globular, enclosed by persistent sepals; pericarp splitting irregularly. Seeds 4, pubescent.

A genus of c. 9 species whose representatives are chiefly pantropical or found in Africa; 1 species native to Australia; 1 species on Christmas Is.

C.R.Gunn, Notes on *Stictocardia campanulata* (L.) Merrill and *S. jucunda* (Thw.) C.R.Gunn (Convolvulaceae), *Brittonia* 24: 169–176 (1972); D.F.Austin, D.A.Powell & D.H.Nicolson, *Stictocardia tiliifolia* (Convolvulaceae) re-evaluated, *Brittonia* 30: 195–198 (1978).

Stictocardia tiliifolia (Desr.) Hallier f., *Bot. Jahrb. Syst.* 18: 159 (1894), as '*tiliaefolia*'

Convolvulus tiliaefolia Desr. in J.B.A.P.Lamarck, *Encycl.* 3: 544 (1792). T: Isle de France [Mauritius], *P.Commerson*; holo: P, *fide* H.Heine, *Fl. Nouv. Caléd.* 13: 44 (1984). Epithet from the genus *Tilia* and the Latin *folium* (a leaf), in reference to the resemblance of the leaves to some species of that genus.

Ipomoea campanulata auct. non L.: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 206 (1906).

Illustration: C.R.Gunn, *op. cit.* 171, fig. 1.

Large, perennial, woody creeper with glabrescent stems. Leaves orbicular, cordate at base, subentire, acuminate, sparsely pubescent on both surfaces; lamina 4–11 cm long, 4.5–14 cm wide; petiole 3–5 cm long. Flowers usually single; peduncle 1–2.5 cm long; pedicels 1.5–2.5 cm long. Sepals orbicular, c. 1–1.5 cm long in flower, enlarging to 3–3.5 cm in fruit, black gland-dotted, subglabrous. Corolla 10–11 cm long, pink with darker throat. Stamens unequal, 2 long and 3 short, included. Stigma included. Fruit c. 2 cm diam., enclosed by enlarged sepals which are eventually reduced by weathering to a lacy network of vascular tissue. Seeds not seen.

Christmas Is. First collected by H.N.Ridley in 1904. A pantropical, littoral species frequently found on islands.

Ch.Is.: Cemetery Rd, *H.N.Ridley 150* (K); 1¾ mile [c. 2.8 km] peg, *D.A.Powell 103* (K); no precise locality, *D.A.Powell 232A* (K).

Some, but not all, seeds of *S. tiliifolia* are capable of dispersal by sea water because of an air cavity giving them buoyancy.

70. BORAGINACEAE

R.M.Barker (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R., C.S.Is.)

Herbs, shrubs or trees. Leaves alternate or spirally arranged, simple, entire or toothed, exstipulate. Inflorescence often a scorpioid or helicoid cyme, uncoiling as flowers open, or corymbose or paniculate, usually without bracts. Flowers usually bisexual, actinomorphic. Calyx 5-lobed, the lobes free or joined. Corolla 5-lobed, variously shaped, sometimes with

appendages in throat. Stamens 5, equal or unequal; anthers 2-locular. Ovary superior, 2-locular becoming 4-locular at maturity; style terminal or gynobasic, simple or 2- or 4-fid. Fruit a drupe or of 1, 2 or 4 nutlets. Endosperm present or absent.

A family of c. 100 genera and 2000 species found worldwide; c. 23 genera and c. 90 species in Australia; 5 genera (6 species) on Christmas Is.; 2 genera each with 1 species on Cocos (Keeling) Is., Ashmore Reef and the Coral Sea Is. Three of the genera treated here, *Cordia*, *Carmona* and *Ehretia*, are sometimes treated separately within the family Ehretiaceae.

I.M.Johnston, Studies in the Boraginaceae, Representatives of Three Subfamilies in Eastern Asia, *J. Arnold Arbor.* 32: 1–26, 99–122 (1951); I.M.Johnston, Boraginaceae, *Fl. Trinidad & Tobago* 2: 193–194 (1953); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Boraginaceae, *Fl. Java* 2: 457–464 (1965); H.Heine, Boraginaceae, *Fl. Nouv.-Caléd.* 7: 95–118 (1976).

1 Style 4-branched, each branch with a stigma — **CORDIOIDEAE 1. CORDIA**

1: Style simple or forked; stigmas 1 or 2

2 Style forked; stigmas small, not clearly differentiated into receptive and sterile tissue — **EHRETIOIDEAE**

3 Shrub; leaves toothed in upper half; style forked almost to base — **2. CARMONA**

3: Tree; leaves entire; style forked above middle — **3. EHRETIA**

2: Style simple; stigma conical, receptive only in a band about the base — **HELIOTROPIOIDEAE**

4 Herb; leaves petiolate, herbaceous, scabrid; flowers lilac in an unbranched elongated scorpioid cyme — **4. HELIOTROPIUM**

4: Tree; leaves sessile, fleshy, covered with a silver, velvety indumentum; flowers white, in a dichotomous, 1-sided cyme — **5. ARGUSIA**

1. CORDIA

Cordia L., *Sp. Pl.* 1: 190 (1753); *Gen. Pl.* 5th edn, 87 (1754); after Euricius Cordus 1486–1535, a German doctor and botanist.

Type: *C. myxa* L. or *C. sebestena* L.

Trees or shrubs, glabrous or hairy. Leaves alternate or spirally arranged, petiolate. Inflorescence a few-flowered terminal or axillary cyme. Flowers sometimes heterostylous and sometimes functionally male by reduction of style and stigma. Calyx frequently cup-shaped; lobes short. Corolla small or large, white, yellow, orange or red. Stamens exserted or included. Style terminal, divided twice into 2 to give 4 branches, each with a stigma; stigmas capitate or clavate. Fruit a drupe with fleshy mesocarp or with a corky mesocarp and completely enclosed by persistent calyx, 1–4-seeded.

A large genus of c. 250 species predominantly of the American tropics; 2 species on Christmas Is., 1 of these also on Cocos (Keeling) Is., Ashmore Reef and the Coral Sea Is.

Cordia subcordata belongs to section *Sebestenoides* which is possibly generically distinct from the rest of *Cordia* by its fruit with corky mesocarp included within the enlarged calyx (I.M.Johnston, *J. Arnold Abor.* 32: 2, 1951).

Tree to 15 m tall; flowers large, at least 3 cm long, golden yellow to pinkish orange; fruit dry, corky, completely enclosed by calyx — **1. C. subcordata**

Woody herb or shrub to 1 m; flowers small, c. 6 mm long, white; fruit fleshy red, apical portion exceeding calyx — **2. C. curassavica**

1. Cordia subcordata Lam., *Tabl. Encycl.* 1: 421 (1792)

T: 'Ex insulis Praliniis' [Port Praslin, Santa Isabel group, Solomon Islands, or on New Ireland, Papua New Guinea], *P.Commerson s.n.*; syn: P-JU, *fide* H.Heine, *Fl. Nouv.-Caléd.* 7: 105 (1976). Epithet from the Latin *sub-* (somewhat) and *cordatus* (cordate), in reference to the leaves.

Illustration: H.Heine, *Fl. Nouv.-Caléd.* 7: 107, t. 23 (1976).

Tree to 15 m tall, seldom upright; trunk dividing near base; branches sprawling; bark fissured. Leaves broadly ovate, obtuse and sometimes asymmetrical at base, entire to crenulate, obtuse to shortly acuminate, subglabrous except abaxial venation; lamina 4–19 cm long, 2.5–14 cm wide; petiole 1.5–10 cm long. Panicles terminal, dichotomously branched; flowers probably heterostylous. Calyx c. 16 mm long, glabrous outside, pubescent inside; lobes c. 2 mm long. Corolla funnel-shaped, pubescent outside, golden-yellow, fading to pinkish orange; tube 2.5–3 cm long; lobes 1–2.5 cm long. Stamens just exserted; filaments inserted in upper half of corolla tube, 3–8 mm long. Fruit enclosed by hardened, enlarged calyx, c. 2–2.5 cm diam., 1- or 2-seeded. *Gerong gang*, *Ironwood*.

Christmas Is., Cocos (Keeling) Is., Ashmore Reef, Coral Sea Is. On Christmas Is. occurs in low strand forest on coastal cliffs with *Argusia argentea*. On Cocos (Keeling) Is. grows in low forest with *Argusia argentea* and *Hibiscus tiliaceus*. On Ashmore Reef recorded from 3 cays in strand shrub communities on foredunes of coralline sand. On the Coral Sea Is. recorded only from Herald Cays where dominant in a shrub community. A common constituent of the strand vegetation of the coasts of the tropical Indian and Pacific Oceans including Australia.

Ch.Is.: near sea, *C.W.Andrews 45* (BM, K); Flying Fish Cove, *A.Pearson P90* (K); West White Beach, *B.A.Mitchell 28* (AD, CBG, K). C.K.Is.: Cocos Atoll, *H.St.John 26440* (K); top of lagoon beach, North Keeling Is., *D.G.Williams 54* (BISH, BRI, CBG, NSW). A.R.: East Is., Oct. 1983, *J.Hicks* (CANB). C.S.Is.: SE Cay, Magdelaine Cays, 6 Oct. 1987, *T.Scotney & W.Jeffs* (CBG).

The dark grained timber is keenly sought for making tables and bowls. The fruit is capable of dispersal by sea currents.

2. *Cordia curassavica (Jacq.) Roem. & Schult., *Syst. Veg.* 4: 461 (1819)

Varronia curassavica Jacq., *Enum. Syst. Pl.* 14 (1760). T: Curacao, 29 Mar. 1925, *E.Kilip & L.Smith 1067*; neo: NY, *fide* J.Gaviria, *Mitt. Bot. Staatssamml. München* 23: 224 (1987). Epithet from the locality of the type collection, Curacao or Caribbean Sea region.

Woody herb or shrub to 1 m tall, often with an odour of sage. Leaves lanceolate to ovate, attenuate and sometimes asymmetrical at base, dentate, acute, upper surface green, roughened with mineralised protuberances, lower surface pale, densely and softly pubescent; lamina 4–10 cm long, 1.5–6 cm wide; petiole c. 7.5 mm long. Spikes terminal or internodal; flowers not heterostylous. Calyx c. 3 mm long, granular or ±strigose outside; lobes c. 1 mm long. Corolla funnel-shaped, 4–6 mm long, white; lobes c. 2 mm long. Stamens just exserted; filaments inserted midway in corolla tube, 1–2 mm long. Fruit fleshy, red, just exceeding enlarged calyx; stone ovoid, 4–5 mm long.

Christmas Is. Introduced to the island. Native to tropical America, where it is a common weed.

Ch.Is.: without specific locality, *D.A.Powell 272* (K); central area work quarry, *R.Shivas 897* (PERTH).

Found near old gardens, with the two recent collections coming from naturalised populations.

2. CARMONA

Carmona Cav., *Icon. Pl.* 5: 22, t. 438 (1799); after Brunoni Salvatori Carmona, illustrator on the Swedish botanist Pehr Loefling's journey to Orinoco R. (S America).

Type: *C. heterophylla* Cav. = *C. retusa* (Vahl) Masam.

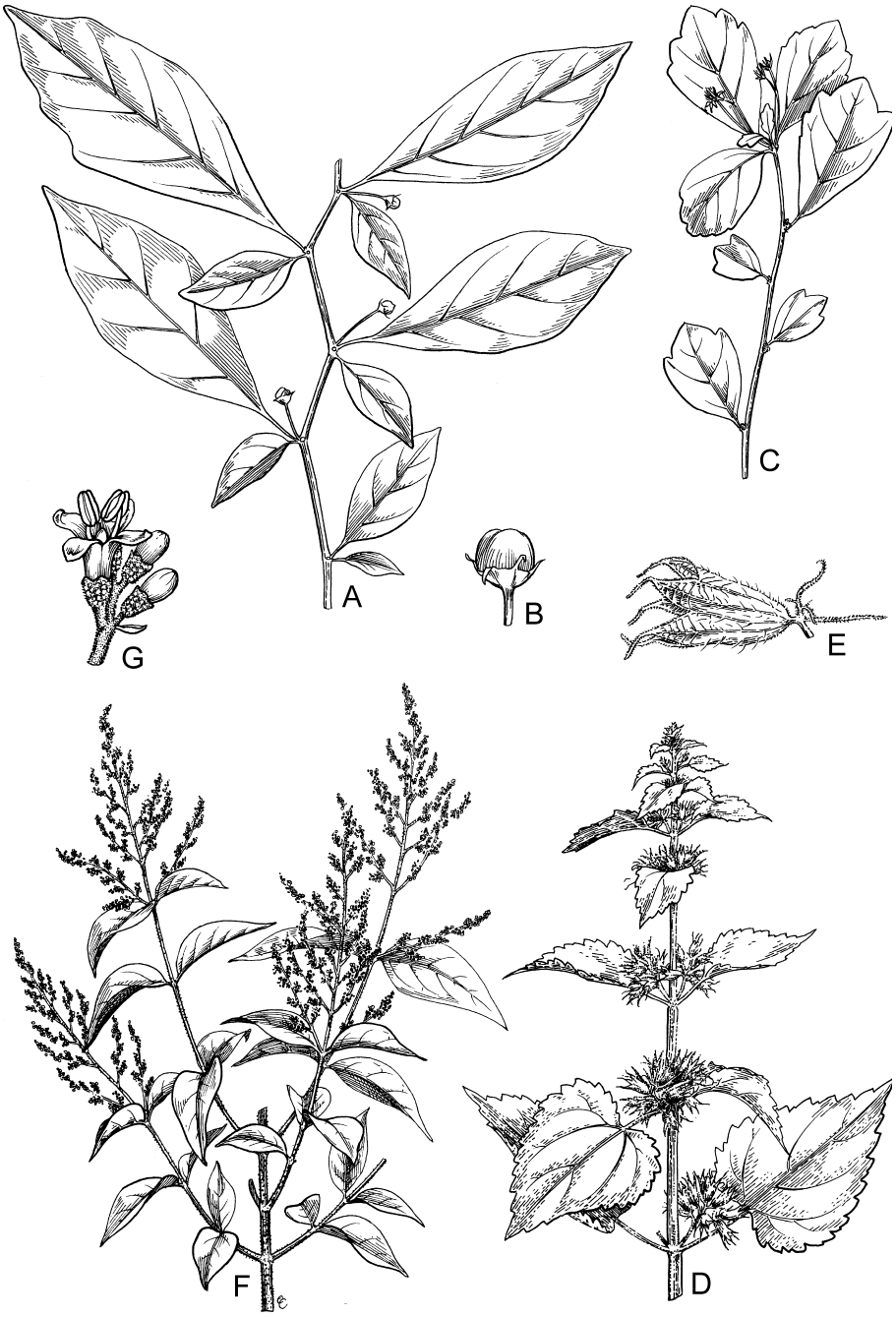

Figure 82. **A–B**, SOLANACEAE: *Lycianthes biflora*. **A**, fruiting branchlet X0.5 (D.Powell 164, K); **B**, fruit X1 (J.Lister, 30 Nov. 1888, K). **C**, BORAGINACEAE: *Carmona retusa*, flowering shoot X0.5 (J.Maclear *s.n.*, K). **D–E**, LAMIACEAE: *Anisomeles indica*. **D**, flowering shoot X0.5; **E**, calyx X2 (**D–E**, C.Andrews 18, K). **F–G**, OLEACEAE: *Ligustrum glomeratum*. **F**, flowering branchlet X0.3 (D.Powell 696, K); **G**, flowers X2 (D.Powell 4, K). Drawn by E.Catherine.

[*Ehretia auct. non* L.: Linnaeus *et auctt., p.p.* (only with respect to specimens in which the style is divided almost to the base and the endocarp does not split into pyrenes).]

Trees or shrubs, usually hispid. Leaves in clusters on very short branchlets, shortly petiolate. Flowers bisexual, 2–6 on a long peduncle arising from short branchlets. Calyx fused only at base. Corolla white. Stamens exserted. Ovary with terminal style divided almost to base into 2 arms; stigmas minute. Fruit a globose drupe, red or yellow, 4-seeded, not splitting into pyrenes.

A monotypic genus closely related to *Ehretia* and occurring from Asia to the Solomon Islands; occurs on Christmas Is.

I.M.Johnston, *Carmona*, *J. Arnold Arbor.* 32: 16–19 (1951).

Carmona retusa (Vahl) Masam., *Trans. Nat. Hist. Soc. Taiwan* 30: 61 (1940)

Cordia retusa Vahl, *Symb. Bot.* 2: 42 (1791). T: East Indies, *coll. unknown*. Specimen not in Vahl or Forsskål's herbaria at C; possibly to be based on Plukenet's figure in *Phytographia* (t. 31, fig. 1, 1691) or a specimen in his herbarium at BM. Epithet from the Latin *retusus* (blunt), in reference to the leaf apex.

Ehretia microphylla Lam., *Tabl. Encycl.* 1: 425 (1792); *Carmona microphylla* (Lam.) G.Don, *Gen. Hist.* 4: 391 (1837). T: East Indies, *P.Sonnerat*; ?P *n.v., fide* I.M.Johnston, *op. cit.* 17.

Ehretia buxifolia Roxb., *Pl. Coromandel* 1: 42, t. 57 (1796). T: illustration of W.Roxburgh, *Icon.* 199 (K) reproduced as t. 57 in *Pl. Coromandel* (1796).

Shrub c. 2 m high, with long, slender, straggling, subglabrous branches. Leaves variable (obovate on Christmas Is.), attenuate at base, 1–5-toothed on either side in upper half, strigose; lamina 1–5 cm long, 0.5–3 cm wide; petiole 1–5 mm long. Flowers usually 2; peduncle slender, 10–15 mm long; pedicel c. 1 mm long. Calyx 4–5 mm long, hispid, more densely so inside tube; lobes oblanceolate to linear. Corolla funnel-shaped, c. 5 mm long; tube c. 1 mm long; lobes spreading. Style 4–5 mm long. Drupe c. 6 mm diam.; colour not documented for Christmas Is. Fig. 82C.

Christmas Is. Very common in the undergrowth on all the terraces.

Ch.Is.: no precise locality, *J.P.Maclear s.n.* (K); Flying Fish Cove, *C.W.Andrews 24* (K); no precise locality, *C.W.Andrews 68* (BM, K); Rocky Point to North East Point, *H.N.Ridley 28* (K, SING); SE coastal terrace, below South Point, *B.A.Mitchell 199* (AD, CBG).

The leaves of this species vary greatly in texture, colour, size and margin, with those from Christmas Is. being larger, more toothed and not shining on the upper surface, making them unlike specimens from Java and India. I.M.Johnston, *op. cit.* 19, suggested that this variation is ecological in origin; this is supported by H.N.Ridley's observation (*J. Straits Branch Roy. Asiat. Soc.* 45: 205, 1906) that leaves of plants grown in the shade are much larger than those of dry, open places. Specimens from Christmas Is. frequently lack the circles of white, oblong secretions, visible as white dots, occurring at the base of the hairs of the upper leaf surface in Java.

3. EHRETIA

Ehretia P.Browne, *Civ. Nat. Hist. Jamaica* 168 (1756) *p.p.*, excluding specimens in which style is divided almost to the base and endocarp does not split into pyrenes; after Georg Dionysius Ehret, illustrator of numerous botanical works.

Type: *E. tinifolia* L.

Trees or shrubs, glabrous or hairy. Leaves alternate, usually petiolate. Inflorescence usually paniculate or corymbose, axillary or terminal, bracteate or not. Flowers bisexual. Calyx lobes joined at base. Corolla hairy outside or glabrous, white or yellow. Stamens exserted. Style terminal, divided above middle into 2 long arms; stigmas capitate or elongate. Fruit a globose drupe, splitting into 1- or 2-seeded pyrenes, usually yellow, orange or red.

A genus of c. 50 species occurring in Africa, Asia, Malesia and America; 6 species in

Australia; 1 species on Christmas Is. not in mainland Australia.

Ehretia javanica Blume, *Bijdr.* 842 (1826)

T: Java; *coll. unknown*; *n.v.* Named after the country of origin of the type.

Tree to c. 25 m high, deciduous; bark flaky, smooth. Leaves broadly elliptic to obovate, obtuse at base, entire, acuminate, glabrous; lamina 4–11 cm long, 3.5–7.5 cm wide; petiole 1–2 cm long. Inflorescence of many-flowered di- or trichotomously branched corymbs or panicles, ebracteate; peduncle 2–4 cm long. Calyx 1.5–2 mm long, glabrous; lobes ciliate. Corolla white to pink; tube c. 4–5 mm long, widening apically, shortly appressed-pubescent outside; lobes c. 2 mm long. Stamens ±unequal, inserted in apical half of tube; filaments c. 4–5 mm long, glabrous. Style 6–7 mm long including lobes; lobes 2–3 mm long. Drupe c. 3–7 mm diam., apparently breaking into 4 single-seeded pyrenes, yellow (H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 231, 1906).

Christmas Is. The species is a dominant part of the plateau forest vegetation which occurs in shallow soil (B.A.Mitchell, *Comm. For. Rev.* 53: 27, 1974). It extends from China and India to Malesia.

Ch.Is.: Flying Fish Cove, *H.N.Ridley 139* (BM, K); no precise locality, Apr. 1980, *D.A.Powell* (K: 2 sheets); SE coastal terrace, below South Point, *B.A.Mitchell 199* (CBG); Andrews Lookout, Phosphate Hill, *B.A.Mitchell 18* (CBG).

First collected by H.N.Ridley, *loc. cit.*, who was unable to identify it ('unidentified plant A'). Known by different names over its range (I.M.Johnston, *J. Arnold Arbor.* 32: 106, 1951). *Ehretia javanica* Blume is the earliest name. It has been suggested (B.Randell, in *annot.*) that this species may be better treated as *Carmona retusa* (Vahl) Masam.

4. HELIOTROPIUM

Heliotropium L., *Sp. Pl.* 1: 130 (1753); *Gen. Pl.* 5th edn, 63 (1754); from the Greek *helios* (the sun) and *trope* (turning), for plants believed to turn their heads to the sun.

Type: *H. europaeum* L.

Annual or perennial herbs or shrubs, usually scabrous or hairy. Leaves alternate, petiolate or sessile. Inflorescence a terminal, 1-sided scorpioid, spicate or raceme-like cymes. Flowers bisexual. Calyx lobes free or joined only at base. Corolla often hairy outside, white, yellow or purple. Stamens included; filaments very short. Style short or long, terminal, undivided; stigma subconical, only receptive in ring about base. Fruit dry, 2–4-lobed, eventually breaking into 2 or 4 nutlets.

There are c. 275 species of *Heliotropium* in tropical and temperate regions of the world; c. 30 species in Australia; 1 species on Christmas Is.

***Heliotropium indicum** L., *Sp. Pl.* 1: 130 (1753)

T: Ceylon, *P.Hermann*; *n.v.* Named after the region in which type material was collected.

Annual herb, c. 20–40 cm high, scabrous with long erect and short appressed hairs. Leaves ovate, abruptly attenuate at base, crenulate, acute; lamina 2–6 cm long, 1.5–4 cm wide; petiole c. 2–3 mm long, excluding 'winged' portion of 1–2 cm. Inflorescence spike-like, to 10 cm long, ebracteate, with flowers crowded in 2 rows. Calyx lobes linear, c. 2 mm long, acute. Corolla salver-shaped, pubescent outside, glabrous inside, lilac; tube c. 4 mm long; lobes 1 mm long, rounded. Stamens included, inserted just above stigma level. Ovary glabrous; stigma broadly conical. Fruit of 2 glabrous, conical, apically divergent lobes; lobes longitudinally ribbed, c. 3 mm high, eventually separating.

Christmas Is. Only recently recorded with a collection made in 1984 and recorded as several small patches. A pantropical weed, possibly originating in America.

Ch.Is.: alongside Waterfall Rd, *D.A.Powell 785* (K).

5. ARGUSIA

Argusia Boehm. in C.G.Ludwig, *Def. Gen. Pl.* 3rd edn, 507 (1760); the genus was first described by J.Amman (1739) who based his generic name on the locality, Argun R. in Manchuria, given by the collector of the type species, D.G.Messerschmid (*fide* I.M.Johnston, *J. Arnold Arbor.* 16: 162, 1935).

Type: *A. sibirica* (L.) Dandy

Messerschmidia L. ex Hebenstr., *Novi Comment. Acad. Sci. Imp. Petrop.* 8: 315, t. 11 (1763). T: *Tournefortia sibirica* L. *non M. sibirica* L.

Tournefortia L., *Sp. Pl.* 1: 140 (1753) *p.p.* only as to species with a fruit with corky mesocarp. T: *T. hirsutissima* L.

Usually trees or shrubs, often hairy. Leaves spirally arranged, petiolate or sessile. Inflorescence dichotomously branched, 1-sided, paniculate, or a loose corymbose cyme, ebracteate. Flowers bisexual. Calyx lobes fused at base. Corolla often hairy outside, white. Stamens just exserted; filaments short. Style very short or lacking, not divided; stigma receptive in a ring about base. Fruit ±globose, dry; mesocarp vesicular, corky, dividing in 2, each half with 2 seed-bearing cavities.

A genus of 3 or 4 species, all growing in saline conditions; 1 species on Christmas Is., Cocos (Keeling) Is., Ashmore Reef and the Coral Sea Is. The presence of the corky mesocarp not only adapts the species for water dispersal but also distinguishes them from *Tournefortia* (I.M.Johnston, *loc. cit.*), a genus in which they are still sometimes placed, e.g. J.S.Miller, *Ann. Missouri Bot. Gard.* 75: 505 (1988) and W.L.Wagner, D.R.Herbst & S.H.Sohmer, *Man. Fl. Pl. Hawai'i* (1990).

I.M.Johnston, The species of *Tournefortia* and *Messerschmidia* in the Old World, *J. Arnold Arbor.* 16: 145– (1935); I.M.Johnston, Studies in the Boraginaceae, XX. *Messerschmidia*, *J. Arnold Arbor.* 32: 118 (1951); J.E.Dandy, Notes on *Argusia* Boehmer, Boraginaceae, *J. Linn. Soc., Bot.* 65: 256 (1972).

Argusia argentea (L.f.) Heine, *Fl. Nouv.-Caléd.* 7: 109 (1976)

Tournefortia argentea L.f., *Suppl. Pl.* 133 (1782); *Messerschmidia argentea* (L.f.) I.M.Johnst., *J. Arnold Arbor.* 16: 164 (1935). T: Ceylon, *J.G.Koenig 1777*, Herb. C.Linnaeus 193.6 as *T. argentifolia*; syn: LINN, *fide* I.M.Johnston, *loc. cit.* Epithet from the Latin *argenteus* (silvery), in reference to the leaves.

Illustration: H.Heine, *op. cit.* 111, t. 24.

Tree to 6 m high; bark grey, deeply fissured; young branches and leaves densely silver-pubescent. Leaves subsessile by continuation of attenuate base, spathulate, thick, entire, usually obtuse; lamina 6–27 cm long, 2–8.5 cm wide. Inflorescence loose, panicle-like; flowers 2-ranked, sessile, initially crowded, fragrant; peduncle 4–10 cm long. Calyx lobes ±orbicular, c. 2 mm long, densely pubescent outside, glabrous inside, spreading in fruit. Corolla campanulate, white; tube c. 1–2 mm long, widened and thickened at base; lobes c. 2–3 mm long. Anther locules somewhat divergent at base. Ovary glabrous; stigma sessile, a thick disc surmounted by 2 subconical appendages, persistent in fruit. Fruit c. 3–4 mm diam., smooth, glabrous, brown. *Octopus Tree, Kayu Sirch.* Figs 4, 6, 52.

Christmas Is., Cocos (Keeling) Is., Ashmore Reef, Coral Sea Is. On Christmas Is. D.A.Powell recorded it as occurring only in the spray zone among *Scaevola taccada* and *Pemphis acidula* but it appears to occur around the whole island in strand forest with *Hibiscus tiliaceus* and *Cordia subcordata* at beach tops or on low sea cliffs. Common on Cocos (Keeling) Is. on both atolls in strand communities on ocean and lagoon beach tops with *Scaevola taccada*, *Calophyllum inophyllum* and *Cocos nucifera* in calcareous sand. On Ashmore Reef recorded on strand line of West Is., as scattered on Middle Is. and as one occurrence on East Is., by J.Hicks, ANPWS, *pers. comm.* On the Coral Sea Is. recorded for Herald Cays, Diamond Is., Coringa Is., Magdelaine Cays, Willis Is. and Cato Is., usually dominant in leeward shrub communities in coralline sand. A characteristic shore species in the Pacific and Indian Oceans including Australia.

Ch.Is.: Flying Fish Cove, 7 Oct. 1887, *J.J.Lister et al.* (K); Smith Point, *H.N.Ridley 27* (K, SING); Flying Fish Cove, *D.A.Powell 61* (K). C.K.Is.: c. 4 km NW of settlement, West Is., *I.R.Telford 9983 & C.Howard* (AD, CBG, K); lagoon beach, North Keeling Is., *I.R.Telford 10025 & C.Howard* (CBG, K). A.R.: material unavailable. C.S.Is.: Willis Is., 21 Dec. 1981, *A.Skeat & J.Henry* (CBG).

On Cocos (Keeling) Is. the timber, though soft, has been used for walls and floors for houses.

71. VERBENACEAE

R.M.Barker (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Trees or shrubs, erect or climbing, more rarely herbs, without cystoliths. Branchlets terete or obscurely 4-angled. Leaves usually decussate, simple or compound, often gland-dotted, exstipulate. Inflorescence often cymose. Flowers bisexual, terminal or axillary, solitary or clustered, bracteate. Calyx 5-lobed, or cupular and 5-toothed, sometimes 2-lipped. Corolla tubular at base; limb 4- or 5-lobed, usually 2-lipped. Stamens 2, with or without 2 small staminodes, or 4, or rarely (not on Christmas Is.) 5–8; anther locules 2, equally inserted. Disc lacking. Ovary superior, 2–8-locular; ovules 1 or 2 per locule; stigma 2-lobed. Fruit a drupe, dry or fleshy, seated upon or enclosed by persistent, often enlarged calyx. Seeds 1–8. Endosperm present or absent.

A tropical and subtropical family of c. 75 genera and 3000 species; in Australia 17 genera and 62 species; on Christmas Is. 5 genera (8 species); on Cocos (Keeling) Is. 5 genera (5 species).

J.C.Schauer, Verbenaceae in A.de Candolle, *Prodr.* 11: 522–700 (1847); H.J.Lam, *The Verbenaceae of the Malayan Archipelago* (1919); H.J.Lam & R.C.Bakhuizen van den Brink, Revision of the Verbenaceae of the Dutch East Indies and surrounding countries, *Bull. Jard. Bot. Buitenzorg* ser. 3, 3: 1–116 (1921); C.A.Backer & R.C.Bakhuizen van den Brink Jr, *Fl. Java* 2: 594–614 (1963); H.N.Moldenke, *A Fifth Summary of the Verbenaceae of the World as to valid taxa, geographic distribution, and synonymy* (1971); H.N. & A.L.Moldenke, Verbenaceae, *Revis. Handb. Fl. Ceylon* 4: 196–487 (1983); B.Verdcourt, *Fl. Trop. E. Africa*, Verbenaceae: 1–155 (1992).

KEY TO GENERA

1 Herbs: flowers in spikes

2 Stems ±erect; spikes terminal, elongate, more than 5 cm long (Ch.Is., C.K.Is.) **1. STACHYTARPHETA**

2: Stems prostrate; spikes axillary, short, less than 5 cm long (C.K.Is.) **2. PHYLA**

1: Shrubs or trees; flowers in cymes, frequently arranged into panicles

3 Plants with stellate hairs (especially on petiole and young branches); corolla actinomorphic, 4-lobed; anther connective with sessile glands **3. CALLICARPA**

3: Plants glabrous or with simple hairs; corolla 5-lobed, 2-lipped; anther connective lacking sessile glands

4 Corolla tube 2–3 cm long, narrow; stamens exserted more than 1 cm **4. CLERODENDRUM**

4: Corolla tube less than 1 cm long; stamens exserted less than 1 cm

5 Corolla tube with dense white hairs inside throat; leaves simple **5. PREMNA**

5: Corolla tube without dense hairs inside throat; leaves usually 3- or 4-foliolate, rarely simple **6. VITEX**

1. STACHYTARPHETA

Stachytarpheta J.Vahl, *Enum. Pl.* 1: 205 (1804), *nom. cons.*; from the Greek *stachus* (a spike) and *tarphus* (dense), referring to the typical inflorescence of the genus.

Type: *S. jamaicensis* (L.) J.Vahl

Robust herbs. Branches terete, often longitudinally ridged, without stellate hairs. Leaves decussate, simple, petiolate. Inflorescence a long, terminal spike, each flower within a concavity on the rachis and subtended by a single bract. Calyx tubular, 4-toothed, longer on outer side. Corolla fugacious, the top of the tube pubescent; lobes 5, spreading, subequal. Stamens 2, inserted in corolla tube, included; staminodes 2 or absent; anther locules 2. Ovary 2-locular; ovules 1 per locule; style slender; stigma expanded, discoid, just exserted. Drupe enclosed within persistent perianth, breaking into 2 cocci.

Sixty five species, mainly from tropical America; a few species naturalised in Malesia; 1 species naturalised on Christmas Is. and Cocos (Keeling) Is.

R.B.Fernandes, Notes sur les Verbenaceae I. Remarques sur quelques espèces de *Stachytarpheta* Vahl, *Bol. Soc. Brot.* 57: 87 (1984).

*Stachytarpheta jamaicensis (L.) J.Vahl, *Enum. Pl.* 1: 206 (1804)

Verbena jamaicensis L., *Sp. Pl.* 1: 19 (1753). T: Jamaica and Caribbean, Herb. C.Linnaeus; S, microfiche 7, photo 13, *fide* R.B.Fernandes, *loc. cit.* Named from Jamaica where the plant was known to be native.

[*S. indica auct. non* (L.) J.Vahl: C.W.Andrews, *Monogr. Christmas Is.* 184 (1900)]

Much-branched herb, to 1 m high; branches subglabrous, dark-brown below, green-ridged above. Leaves ovate, decurrent with petiole, serrate, acute, glabrous; lamina 4–6 cm long, 2–4 cm wide; midrib blotched with purple; petiole 0–5 cm long. Inflorescence to 30 cm long, only a few flowers open at any time; rachis finely pubescent; bracts ovate, 3.5–4 mm long including acuminate apex, 1.5 mm wide, with a wide hyaline margin in lower half, glabrous, shortly ciliate. Calyx 5–6 mm long. Corolla blue with white throat, or more rarely all white. Staminodes absent. Ovary glabrous; style c. 6 mm long, glabrous. Drupe c. 5 mm long, glabrous. Fig. 74.

Christmas Is., Cocos (Keeling) Is. Common in disturbed sites such as roadsides and around settlements on Christmas Is. where it was first collected by C.W.Andrews in 1897. On Cocos (Keeling) Is. common in disturbed areas in coralline sand. First collected there by H.O.Forbes in 1879. Native to tropical America, this species is now naturalised throughout Asia, Africa and Malesia.

Ch.Is.: settlement, Flying Fish Cove, *C.W.Andrews 29* (BM); South Point Rd, 13.7 km from South Point, *A.Pearson P56* (K); road leading down to Ross Hill Gardens, *D.A.Powell 418* (K). C.K.Is.: Keeling Is., 1879, *H.O.Forbes* (BM); near settlement, West Is., *I.R.Telford 9959 & C.Howard* (AD, CBG, K).

2. PHYLA

Phyla Lour., *Fl. Cochinch.* 63 (1790); from the Greek *phyle* (tribe or race), in reference to the flowers.

Type: *P. chinensis* Lour.

Perennial herbs; stems decumbent or prostrate. Leaves simple. Inflorescence an axillary, short, crowded spike. Calyx deeply 2-lipped. Corolla shortly tubular, 4-lobed. Stamens 4; anthers included. Ovary 2-locular; 1 ovule per locule; style short. Fruit enclosed by calyx, dry, ellipsoidal, compressed, breaking into 2 planoconvex 1-seeded nutlets.

A widespread tropical and warm temperate genus of 15 species; 1 widespread species native to northern and eastern mainland Australia, naturalised on Cocos (Keeling) Is.

***Phyla nodiflora** (L.) Greene, *Brittonia* 4: 48 (1889)

Verbena nodiflora L., *Sp. Pl.* 1: 20 (1753); *Lippia nodiflora* (L.) Michx., *Fl. Bor. Amer.* 2: 15 (1803). T: ?from Virginia; *n.v.* Epithet from the Latin *nodus* (a knot) and *flos* (a flower), in reference to the dense, knot-like spikes.

Stems prostrate, spreading to c. 1 m long, rooting at nodes. Leaves obovate, cuneate at base, entire, serrate towards apex; lamina 8–50 mm long; petiole 1–3 mm long, winged. Spike rachis 5–25 mm long; peduncle 15–75 mm long. Corolla tube c. 2 mm long; limb c. 2 mm diam., white ageing to lilac. Fruit c. 2 mm long.

Cocos (Keeling) Is. Introduced as a lawn plant and naturalised around the settlement area. Mainly pantropical, including northern and eastern Australia.

C.K.Is.: settlement, West Is., *I.R.Telford 9952 & C.Howard* (AD, CBG, K); settlement, West Is., *D.G.Williams 201 & Amat Noor* (CBG, PERTH).

3. CALLICARPA

Callicarpa L., *Sp. Pl.* 1: 111 (1753); *Gen. Pl.* 5th edn, 50 (1754); from the Greek *callos* (beauty) and *carpos* (fruit), in reference to the brightly coloured fruit of the type species.

Type: *C. americana* L.

Small trees or shrubs. Branches ±4-angled, usually floccose with stellate hairs. Leaves decussate, simple, petiolate. Inflorescence a pedunculate, open, dichotomous cyme in upper axil. Flowers actinomorphic, small. Calyx persistent, ±cup-shaped; rim truncate or with 4 small teeth. Corolla 4-lobed, fugacious. Stamens 4, exserted, ±equal, inserted on corolla tube; anthers longitudinally dehiscent. Ovary 4-locular; ovules 1 per locule; style slender, usually exserted; stigma capitate, obscurely 2-lobed. Drupe globose; endocarp consisting of 4 fused pyrenes.

A genus of c. 150 species distributed worldwide, the majority in America or Asia; 7 species in northern and north-eastern Australia; 1 species, possibly indigenous, on Christmas Is.

A.A.Munir, A taxonomic revision of the genus *Callicarpa* L. (Verbenaceae) in Australia, *J. Adelaide Bot. Gard.* 6: 5–39 (1982).

Callicarpa longifolia Lam., *Encycl.* 1: 563 (1785)

T: Malacca, *P.Sonnerat s.n.*; syn: P-LA *n.v., fide* A.A.Munir, *op. cit.* 12. Epithet from the Latin *longus* (long) and *folium* (a leaf).

C. longifolia var. *subglabrata* Schauer in A.de Candolle, *Prodr.* 11: 645 (1847). T: in India orient. e. gr. Prov. Silhet [Sylhet province, Bangladesh], *N.Wallich* Cat. No. 1829; syn: G-DC; Java, 1843, *H.Zollinger 156, 223, 349*; syn: G-DC.

C. longifolia Lam. var. *glabrescens* Ridl., as *longiflora, J. Straits Branch Roy. Asiat. Soc.* 45: 212 (1906). T: plateau, 1904, *H.N.Ridley 93*; syn: K, SING.

C. longifolia f. *floccosa* Schauer in A.de Candolle, *Prodr.* 11: 645 (1847). T: Prince of Wales Is., eastern India, *W.Roxburgh s.n.*; syn: G-DC; Singapore and Manila, 1839, *C.Gaudichaud-Beaupré s.n.*; syn: G-DC; Java, *C.P.Thunberg s.n.*; syn: G-DC.

Shrub or small tree 4–5 m high, stellate-hairy, glabrescent. Leaves elliptic, serrate, long-acuminate, gland-dotted below; hairs persisting on midrib and main veins; lamina 10–15.5 cm long, 3.5–7.5 cm wide; petiole 0.7–2.5 cm long. Bracts c. 1 mm long. Pedicels c. 1 mm long. Calyx entire or with irregular rim, glabrous apart from sparse glands sometimes mixed with sparse, stellate hairs. Corolla c. 2.5 mm long, white (elsewhere in Malesia pink or lavender); lobes obovate, 0.5–1 mm long, obtuse, glabrous or pubescent outside, sometimes with glands. Stamens: filaments glabrous, c. 1 mm long; anthers glandular laterally along

connective. Ovary glabrous apart from glands; style exserted, exceeding stamens. Drupe 1.5–2 mm diam., initially glandular, white at maturity.

Christmas Is. First collected by J.J.Lister in 1887 and recorded by H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 212 (1906), as common on the plateau, lowest cliffs and near Flying Fish Cove; D.A.Powell noted that it is a common understory tree of the high terraces, usually not seen in rainforest. A widespread and variable species occurring from eastern India to Australia.

Ch.Is.: summit, 6 Oct. 1887, *J.J.Lister* (K); east coast, shore cliff, *C.W.Andrews 39* (K); no precise locality, *C.W.Andrews s.n.* (K); plateau, *H.N.Ridley 93* (K, SING); plateau SW of Hanitch Hill, E of Grants Well, *B.A.Mitchell 88* (CBG).

H.N.Ridley annotated the Singapore herbarium material of this species as *Callicarpa longiflora* var. *glabrescens* and it has been segregated there as the holotype of this taxon. This name is also reproduced in his account of the botany of Christmas Is. (H.N.Ridley, *loc. cit.*). While *longiflora* is clearly a mistake for *longifolia* as he attributes the species to Lamarck and also refers to *C. longifolia* in the discussion, it is less clear whether he intended to publish a new variety. Three varieties have been distinguished in the past, chiefly on indumentum characteristics. There also appears to be a difference in flower colour, with the specimens from Java and Malaysia having pink or lavender flowers. Whether the infraspecific taxa already recognised are viable awaits a revision of the species throughout its range, although A.A.Munir, *J. Adelaide Bot. Gard.* 6: 16 (1982) indicated that varietal status was not justified.

4. CLERODENDRUM

Clerodendrum L., *Sp. Pl.* 2: 637 (1753); *Gen. Pl.* 5th edn, 285 (1754); from the Greek *kleros* (chance) and *dendron* (tree), usually thought to refer to its medicinal or magical properties.

Type: *C. infortunatum* L.

Erect or climbing shrubs. Branches obscurely 4-angled or terete, without stellate hairs. Leaves decussate, simple, petiolate. Inflorescence an axillary cyme, sometimes combined into a terminal panicle. Calyx cup-shaped and 5-toothed, or 5-lobed, persistent in fruit. Corolla 2-lipped by the oblique limb on a long slender tube; lobes 5, ±equal. Stamens 4, long-exserted, subdidynamous. Ovary 4-locular; style long, exserted; stigma 2-lobed. Drupe globose; exocarp dry or juicy; endocarp hard, breaking into 4 or fewer pyrenes.

A genus of c. 400 species distributed throughout the tropical and subtropical regions of the world. There are 10 species in Australia, most of them endemic; 2 species, of which at least 1 is a naturalised garden escape, on Christmas Is.; 1 species native on Cocos (Keeling) Is. *Clerodendrum indicum* (L.) Kuntze is cultivated as an ornamental on Home Is. on Cocos (Keeling) Is.

A.A.Munir, A taxonomic revision of the genus *Clerodendrum* L. (Verbenaceae) in Australia, *J. Adelaide Bot. Gard.* 11: 101–173 (1989).

Calyx divided almost to base into 5 equal lobes, these much larger than fruit and spreading under it; leaves serrate **1. C. calamitosum**

Calyx cup-shaped, shortly 5-toothed, smaller than fruit and not spreading under it; leaves entire **2. C. inerme**

1. *Clerodendrum calamitosum L., *Mant. Pl.* 1: 90 (1767)

T: Java, *J.Baster*, Herb. C.Linnaeus 810.4; possible syn: LINN, *fide* C.Jarvis, *pers. comm.* Epithet presumably from the Latin *calamitosus* (destructive) although there is no indication in the protologue of why it was applied to this species.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 522 (1973).

Upright woody shrub, 1–1.5 m high. Branches pubescent. Leaves ovate, serrate, sparsely

pubescent above and with sparse peltate scales, pubescent only on main veins below and gland-dotted; lamina 2–10 cm long, 1–6 cm wide; petiole 0.5–3 cm long, pubescent. Inflorescence an axillary, long-pedunculate cyme combined into a terminal panicle. Flowers white. Calyx lobes 5, split almost to base, lanceolate, ±equal, 9–10 mm long, somewhat enlarged and red in fruit, pubescent outside, glabrous and gland-dotted inside. Corolla white; tube 2.5–3 cm long, pubescent outside; lobes c. 8 mm long, pubescent outside, glabrous inside. Style glabrous, c. 4.5 cm long. Fruit c. 7–8 mm diam., black.

Christmas Is. The only collection is from the edge of the rainforest; probably a garden escape.

Ch.Is.: Flying Fish Cove, *D.A.Powell 2* (K).

Often cultivated in Malesia and established near settlements.

2. Clerodendrum inerme (L.) Gaertn., *Fruct. Sem. Pl.* 1: 271, t. 57 (1788)

Volkameria inermis L., *Sp. Pl.* 1: 637 (1753). T: Ceylon, *P.Hermann 231*; possible syn: BM, *fide* C.Jarvis, *pers. comm.*; Herb. C.Linnaeus 809.3; possible syn: LINN, *fide* H.N. & A.L.Moldenke, *Fl. Ceylon* 4: 447 (1983). Epithet is the Latin for unarmed or without spines.

Illustrations: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 523 (1973); A.A.Munir, *op. cit.* 111, fig. 1.

Small tree or woody creeper; branches appressed-pubescent. Leaves ovate, entire, subglabrous above, with sessile glands below; lamina 3–6.5 cm long, 1.5–3 cm wide; petiole 5–8 mm long, appressed-pubescent, mixed with flattened scales on underside. Inflorescence a long-peduncled cyme in upper axil. Calyx cup-shaped, 3.5–4 mm long, shortly 5-toothed, sparsely pubescent below, covered with sessile glands. Corolla white; tube 2.5 cm long, glandular outside; lobes 4.5 mm long, glandular outside, glabrous inside. Stamens and style glabrous, red; style 4.5 cm long. Fruit not seen from Christmas Is.; from Cocos (Keeling) Is. gland-dotted, c. 7.5 mm diam., black. Fig. 54.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. D.A.Powell recorded several trees on the edge of the limestone cliff near Greta Beach. On Cocos (Keeling) Is., recorded for 2 islands of the main atoll with *Scaevola taccada* in coralline sand and clinker. Native to tropical coasts in NE Indian and W Pacific Oceans from India and China to Australia and Polynesia.

Ch.Is.: close to Greta Beach, *D.A.Powell 289* (K); coastal terrace between Greta and Dolly Beaches, *B.A.Mitchell 135* (AD, CBG). C.K.Is.: Home Is., *H.St John 26435* (K); Possession Point, Horsburgh Is., *D.G.Williams 26* (CBG).

5. PREMNA

Premna L., *Mant. Pl.* 2: 154 (1771), *nom. cons.*; from the Greek *premnon* (stump of a tree), probably referring to the low-growing or stunted habit of much of this genus.

Type: *P. serratifolia* L.

Trees or shrubs. Branches ±terete, without stellate hairs. Leaves decussate, simple, petiolate. Inflorescence usually a pedunculate, terminal, much-branched, corymbose cyme, initially trichotomously and finally dichotomously branched. Flowers small, bracteate. Calyx campanulate, toothed or truncate, obscurely 2-lipped with 1 lip 2-toothed or entire, the other 3-toothed or entire, persistent. Corolla ±2-lipped from base, the upper lip usually entire, lower 3-lobed with the mid-lobe larger; tube with dense white hairs inside in upper half. Stamens 4, exserted, didynamous, inserted on top of corolla tube and alternating with lobes. Ovary 4-locular; ovules 1 per locule; style slender. Drupe small, succulent.

A genus of c. 200 species distributed worldwide; 7 species in Australia; 3 species on Christmas Is., 1 of which also on Cocos (Keeling) Is. The many collections from Christmas Is. can be referred to 3 presently recognised species but the differences between them are not clear-cut and they may be more worthy of infraspecific status. H.N. & A.L.Moldenke, *Revis. Handb. Fl. Ceylon* 4: 334 (1983) treated similar taxa of Ceylon as varieties of *P.*

obtusifolia R.Br.

A.A.Munir, A taxonomic revision of the genus *Premna* L. (Verbenaceae) in Australia, *J. Adelaide Bot. Gard.* 7: 1–44 (1984).

1 Older leaves densely pubescent (velvety to touch) on lower surface **1. P. odorata**

1: Older leaves glabrous, or pubescent only on midrib and main veins of lower surface

2 Stamens long-exserted; corolla lobes pubescent inside; ovary with glands at apex **2. P. lucidula**

2: Stamens just exserted; corolla lobes glabrous inside; ovary glabrous **3. P. serratifolia**

1. Premna odorata Blanco, *Fl. Filip.* 488 (1837)

T: Mt Makiling, Laguna Prov., the Philippines, 28 Feb. 1949, *J.Tadena PNH 9602*; neo: BRI 267491; isoneo: BM, PNH, *fide* A.A.Munir, *op. cit.* 35. Epithet from the Latin *odor* (a smell, odour), presumably in reference to the smell of the plant.

P. obtusifolia var. *velutina* Benth., *Fl. Austral.* 5: 59 (1870). T: Rockingham Bay, Qld, *J.Dallachy s.n.*; syn: BM, K, MEL 582180, *fide* A.A.Munir, *op. cit.* 35.

Illustration: A.A.Munir, *op. cit.* 36, fig. 8.

Tree, sometimes shrub-like; branchlets velvety-pubescent and with sessile glands. Leaves ovate, rounded or ±truncate at base, entire, obtuse to acuminate, velvety pubescent; lamina 4–12 cm long, 2.5–8 cm wide; petiole 0.5–4 cm long. Pedicels c. 0.5 mm long. Calyx ±entire with 2 tiny teeth or obscurely 2-lipped with 1 lip 2-toothed, the other more obscurely 3-toothed. Corolla colour not recorded for Christmas Is., pinkish or greenish white elsewhere; tube 2 mm long, sometimes pubescent, constricted at point of insertion of stamens; lobes c. 1 mm long, glabrous inside, sometimes pubescent outside. Stamens: filaments c. 1.5 mm long; anther locules divergent at base. Ovary glabrous. Fruit not seen.

Christmas Is. Grows on sea-cliffs. Found throughout Java, the Philippines, New Guinea and tropical Australia and probably also in India, China and Japan.

Ch.Is.: shore-terrace close to North East Point, *D.A.Powell 772* (K); high vertical cliffs overlooking southern coast line, *D.A.Powell 831* (K); sea cliffs between Dolly and Greta Beaches, *D.A.Powell 843* (K); Gannett Hill trig point, N end of Ross Hill Gardens, *B.A.Mitchell 193* (CBG).

Easily distinguished by its leaves which are velvety to the touch.

2. Premna lucidula Miq., *Fl. Ned. Ind.* 2: 898 (1858)

T: Java 'in Patjitan', *T.Horsfield s.n.*; syn: BM, K. Epithet from the Latin *lucidus* (shining, clear, transparent), a reference to the leaves.

P. flavescens var. *rubens* C.B.Clarke in J.D.Hooker, *Fl. Brit. Ind.* 4: 578 (1885). T: Java, *W.Griffith*, Kew Distrib. no. 6020; syn: K *n.v.*; Malacca, Herb. Ind. Orient, *J.D.Hooker & T.Thomson*; syn: K *n.v.*

Tree; branchlets ±glabrous except for indumentum and glands at nodes. Leaves of main canopy ovate, rounded at base, entire, acuminate, ±glabrous except for sessile glands when young; lamina 5–15 cm long, 4–10 cm wide; petiole 2.5–3.5 cm long; leaves of adventitious stems ovate, serrate. Pedicels 0.5–1 mm long. Calyx obscurely 2-lipped with 1 lip distinctly 2-lobed, the other obscurely 3-toothed. Corolla white; tube 2 mm long, glabrous; lobes 1.5 mm long, pubescent inside and sometimes outside. Stamens long-exserted, exceeding lobes, subdidynamous; filaments c. 2–3 mm long; anther locules divergent at base. Ovary glandular at apex; style c. 3.5 mm long, exceeding stamens. Drupe ±globose, acuminate, c. 4.5 mm long, slightly ribbed, black.

Christmas Is. Common on the high terraces. A Javan species.

Ch.Is.: first inland cliff near Flying Fish Cove, *C.W.Andrews 103* (K); Andrews lookout, *H.N.Ridley 92* (K, SING); North West Point, Feb. 1980, *D.A.Powell* (K); alongside railway, *D.A.Powell 771* (K); terrace, SE side of island, *D.A.Powell 839* (K).

Christmas Is. specimens agree with Javan material except a smaller flower size and

correspondingly smaller floral parts. Specimen *D.A.Powell 829* (K), while having some of the leaf indumentum characteristics of *P. odorata*, seems to approach more closely *P. lucidula* in floral characteristics.

3. Premna serratifolia L., *Mant. Pl.* 2: 253 (1771)

T: ?SE India, ?*Koenig*, Herb. C.Linnaeus 782.4; lecto: LINN *n.v., fide* D.H.Nicolson *et al., Interpretation of Van Rheede's Hortus Malabaricus* 263 (1988). Epithet from the Latin *serratus* (saw-edged) and *folium* (a leaf).

P. corymbosa Rottl. & Willd., *Ges. Naturf. Freunde Berlin Neue Schriften* 4: 188 (1803). T: between Tranquebar and Madras, [Fenpakkam], India, 2 Oct. 1799, *J.P.Rottler s.n.*; syn: K.

Illustration: A.A.Munir, *op. cit.* 16, fig. 2.

Trees, often stunted; branchlets glabrous, often with hairs and glands at nodes. Leaves ovate to oblong, rounded or truncate at base, entire, obtuse or acuminate, glabrous, the undersurface glandular; lamina 3–14.5 cm long, 1.5–10 cm wide; petiole 1–3.5 cm long. Pedicels 0.5 mm long. Calyx 2-lipped with 1 lip 2-toothed, the other obscurely 3-toothed. Corolla colour unknown; tube 1–2 mm long, usually glabrous outside, somewhat constricted at insertion of stamens; lobes glabrous. Stamens just exceeding tube, shorter than lobes; filaments c. 0.5 mm long; anther locules not divergent at base. Ovary glabrous; style exceeding stamens and corolla lobes. Drupe 3–4 mm diam., glabrous.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. the specimens are all from windswept locations. On Cocos (Keeling) Is. it grows in strand forest on islands of both atolls with *Calophyllum inophyllum*, *Guettarda speciosa* and *Pisonia grandis* and in regrowth in *Cocos* plantations in coralline sand. It is native throughout the northern Indian Ocean from east Africa, Madagascar and Aldabra, through Indo-china, Japan, Malesia, Australia and the Pacific.

Ch.Is.: North East Point, *D.A.Powell 161, 746* (K); southern most tip of island, *D.A.Powell 840* (K); Egeria Peninsula, S of Winifreds Beach carpark, *B.A.Mitchell 185* (AD, CBG). C.K.Is.: Home Is., *H.St.John 26407* (K); North Keeling Is., Apr. 1889, *H.B.Guppy per Murray s.n.* (K); Ujong Tanjong, West Is., *I.R.Telford 9996 & C.Howard* (AD, CBG, K).

A polymorphic species, very variable with respect to leaf and calyx characteristics. The H.B.Guppy collection from North Keeling Is. has much larger and more ovate leaves than the rest of the collections and is similar to those specimens previously referred to *P. obtusifolia* R.Br. The species has often been referred to as *P. corymbosa* Rottl. & Willd. For a discussion of the nomenclature and typification of the species see A.A.Munir, *op. cit.* 17–20.

6. VITEX

Vitex L., *Sp. Pl.* 638 ('938') (1753); *Gen. Pl.* 5th edn, 285 (1754); possibly from Latin *vita* (life) or *vitis* (vine), but the significance is obscure.

Type: *V. agnus-castus* L.

Trees or shrubs, erect or creeping. Leaves opposite, simple or 1–7-foliolate, petiolate, entire or toothed. Inflorescence an axillary cyme, usually combined into a terminal or axillary panicle or raceme. Calyx campanulate, shortly 5-toothed. Corolla with 2-lipped limb from a short base; upper lip 2-fid; lower lip 3-fid. Stamens 4, inserted near middle of corolla tube, exserted, didynamous. Ovary 2-locular. Drupe sessile, juicy or dry, seated in enlarged calyx.

A tropical and subtropical genus of c. 250 species of which 8 occur in Australia; 1 species naturalised on Christmas Is. and Cocos (Keeling) Is.

A.A.Munir, *J. Adelaide Bot. Gard* 10: 31–79 (1987)

***Vitex trifolia** L., *Sp. Pl.* 2: 638 (1753)

T: India, *Anon. s.n.* Herb. C.Linnaeus 811.7; lecto: LINN, *fide* B.Verdcourt, *Fl. Trop. E. Africa*, Verbenaceae: 52 (1992). Epithet from the Latin *tri-* (three) and *folium* (a leaf) in reference to the trifoliolate leaves.

Illustrations: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* pl. 521 (1973); A.A.Munir, *op. cit.* 73, fig. 9 (1987).

Aromatic shrub to 2 m; branches usually quadrangular. Leaves ovate, usually 3-foliolate, sometimes simple, discolorous, glabrous, dark green above, tomentose below; leaflets sessile, oblanceolate, entire, acute or shortly acuminate; middle leaflet larger, sometimes subsessile; lamina of simple leaves and middle leaflet to 6 cm long, 3 cm wide; lateral leaflets smaller; petiole 1–2.5 cm long. Panicle much-branched, narrow, terminal or axillary; branches slender, opposite, each branched dichotomously to 6 times, white-puberulent; bracts linear, c. 1 mm long; pedicel very short. Calyx 2–3 mm long, white-puberulent. Corolla c. 10 mm long, blue, densely white-puberulent outside except mid-lobe of lower lip, glabrous inside except hairy mid-lobe of lower lip. Filaments pubescent at base. Style exceeding stamens, glabrous. Drupe globose, c. 5 mm long, black.

Christmas Is., Cocos (Keeling) Is. D.A.Powell considered the plant introduced and established in pre-war gardens on Christmas Is. but it is no longer found in cultivation (*D.A.Powell 326*, K). On Cocos (Keeling) Is. occurs near the kampong, probably an occasional garden escape. A widespread species from India, China, Malesia and northern Australia.

Ch.Is.: Waterfall, *D.A.Powell 326* (K). C.K.Is.: Home Is., *I.R.Telford 10048 & C.Howard* (AD, CBG).

An extremely variable species within which a number of taxa have been recognised. The material from Christmas Is. is not adequate to say with certainty to which subspecific taxon it belongs but it probably represents var. *subtrisecta* (Kuntze) Moldenke. This taxon and the type variety are both native to the Malesian area and both are widely used medicinally (see H.N. & A.L.Moldenke, *Revis. Handb. Fl. Ceylon* 4: 378, 1983). Var. *subtrisecta* is, according to the Moldenkes, widely cultivated as a hedge plant whence it may become naturalised.

72. LAMIACEAE

R.M.Barker (Ch.Is.)

Herbs and subshrubs, usually aromatic. Branches usually 4-angled. Leaves opposite, or more rarely whorled, simple, entire or toothed, usually gland-dotted, exstipulate. Inflorescence a clustered cyme, or verticil, or flowers in pairs. Flowers bisexual, zygomorphic, mostly axillary. Calyx tubular or 2-lipped, 4–10-toothed, persistent. Corolla 2-lipped, 5-lobed; lobes usually unequal. Stamens 4, didynamous; anthers 2-locular, often confluent. Ovary superior, 2-carpellate; carpels 2-locular; ovules 1 per locule; style simple, terminal or gynobasic; stigma 2-fid, the lobes equal or not. Fruit of 4, dry, 1-seeded nutlets, usually with a basal scar of attachment, enclosed by persistent calyx. Seeds small; endosperm absent or sparse.

A family of c. 180 genera and 3000 species throughout the world, most highly developed in drier areas. On Christmas Is. 4 genera and 5 species which are mostly common tropical weeds. A fifth genus, *Plectranthus*, has also been collected from the island (*D.A.Powell 717*, K), but the notes on the collection do not suggest that it has become naturalised. The material (vegetative only) has been identified at Kew (K) as *P. zeylanicus* Benth.

J.I.Briquet, Labiatae, *Nat. Pflanzenfam.* 4(3a): 200 (1895); C.A.Backer & R.C.Bakhuizen van den Brink Jr, *Fl. Java* 2: 617 (1965); H.Keng, A revision of Malesian Labiatae, *Gard. Bull. Singapore* 24: 13–180 (1969); H.Keng, Labiatae, *Fl. Males.* ser. I, 8: 301–394 (1978).

1 Calyx 2-lipped, the upper lip broad, mucronate, lower lip 4-toothed; flowers in terminal raceme-like arrangement of verticils **4. OCIMUM**

1: Calyx tubular, ±equally 5–10-toothed; flowers in sessile or pedunculate axillary clusters or in dense, terminal heads

2 Calyx teeth 8–10; upper lip of corolla with a dense fringe of hairs **2. LEUCAS**

2: Calyx teeth 5; upper corolla lip lacking a dense fringe of hairs

3 Flowers in dense, long-pedunculate, axillary heads subtended by basal involucral bracts, white with purple dots on upper lip; lower lip sac-like at base **3. HYPTIS**

3: Flowers in sessile, axillary clusters without involucral bracts, purple or blue; lower lip not sac-like at base **1. ANISOMELES**

1. ANISOMELES

Anisomeles R.Br., *Prodr.* 503 (1810); possibly from the Greek *anisos* (unequal) and *melos* (limb), referring to the unequal lips of the corolla.

Type: not designated.

Robust aromatic herbs. Branches pubescent. Flowers clustered in upper axils. Bracts paired at base of pedicel. Calyx campanulate, 10-nerved, 5-toothed; teeth ±equal. Corolla tubular at base; upper lip short, erect, entire; lower lip longer, spreading, 3-lobed, the middle lobe usually notched. Stamens exserted, sub-didynamous, 1 pair with 2-locular anthers, the other with 1-locular anthers. Disc regular. Style 2-fid. Nutlets smooth, somewhat compressed, scarred at point of attachment.

A genus of c. 6 species from eastern Africa, Asia and Malesia to Australia; 1 species on Christmas Is., possibly native.

Anisomeles indica (L.) Kuntze, *Revis. Gen. Pl.* 2: 512 (1891)

Nepeta indica L., *Sp. Pl.* 1: 571 (1753). T: India, Herb. C.Linnaeus 726.28; syn: LINN *n.v.*, *fide* L.Cramer, *Revis. Handb. Fl. Ceylon* 3: 176 (1980). Named from the country of origin of the type material.

Anisomeles ovata R.Br. in W.T.Aiton, *Hortus Kew.* 2nd edn, 3: 364 (1811). T: cult. at Kew, *W.T.Aiton*; *n.v.*

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 531 (1973).

Herb to 2 m high. Branches 4-angled. Leaves ovate, truncate or rounded at base, serrate, acute, sparsely to densely pubescent on both surfaces; lamina 1.5–7 cm long, 1.7–4.5 cm wide; petiole slender, 1–4 cm long. Flowers 5–15 in each distinct whorl below, the whorls overlapping above. Bracts linear, c. 5 mm long, pubescent. Calyx 6–8 mm long, elongating to 10–11 mm in fruit. Corolla c. 15 mm long; upper lip white; lower lip purple to blue with a patch of long eglandular hairs. Filaments with sparse, fine, long hairs. Nutlets ±discoid, c. 2 mm diam., brown, shining. Seeds finely tuberculate. Fig. 82D–E.

Christmas Is. First collected in 1887 by J.J.Lister and recorded as common by H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 213 (1906) from Flying Fish Cove, Waterfall, Cemetery Rd and Phosphate Hill. A common and variable tropical species found throughout India, Asia, Malesia and Fiji.

Ch.Is.: no precise locality, 1887, *J.J.Lister s.n.* (K); shore platform, *C.W.Andrews 18* (K); shore cliff, Flying Fish Cove, *C.W.Andrews 34* (BM); Flying Fish Cove, *H.N.Ridley 36* (K); no precise locality, *D.A.Powell 330* (K).

2. LEUCAS

Leucas R.Br., *Prodr.* 504 (1810); from the Greek *leukos* (white), in reference to the flowers.

Type: *L. flaccida* R.Br.

Herbs or undershrubs. Branches usually pubescent. Flowers in dense axillary clusters in upper axils or in a terminal globose head. Bracts present. Calyx 8–10-nerved; mouth straight or oblique; teeth 8–10, equal or unequal. Corolla with slender tube, with or without a hairy ring inside, white; upper lip erect, entire, concave, usually fringed with dense, white hairs; lower lip larger than upper, spreading, 3-fid; middle lobe larger than laterals. Stamens covered by upper lip; anther locules confluent. Style unequally 2-lobed, the upper lobe smaller. Nutlets obovoid, 3-angled in cross-section, smooth.

A genus of c. 60 species from tropical and subtropical parts of Africa and Asia; 1 species in Australia; 2 species on Christmas Is.

J.K.Morton, Cytotaxonomic studies on the West African Labiatae, *J. Linn. Soc., Bot.* 58: 231 (1962).

Leaves lanceolate, subsessile, entire; flowers in terminal, globular heads; calyx mouth oblique; bracts 5–6 mm long, spine-tipped **1. L. zeylanica**

Leaves ovate, long-petiolate, serrate; flowers in axillary whorls; calyx mouth straight; bracts 2–3 mm long, not spine-tipped **2. L. flaccida**

1. Leucas zeylanica (L.) R.Br. in W.T.Aiton, *Hortus Kew.* 2nd edn, 3: 409 (1811)

Phlomis zeylanica L., *Sp. Pl.* 1: 586 (1753). T: India, *P.Hermann 227* vol. 1: 1 & vol. 4: 73; possible syn: BM *n.v.*, *fide* C.Jarvis, *pers. comm.* Named from Ceylon, earlier name for Sri Lanka.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 526 (1963).

Decumbent, much-branched herb, to 30 cm high. Branches glabrescent. Leaves lanceolate, attenuate at base, entire, upper surface hispid, lower surface with glands, pubescent on main veins; lamina 2.5–3.5 cm long, 0.4–0.7 cm wide; petiole very short. Flowers sessile, c. 20 in a dense, globular head; bracts spine-tipped, c. 5–6 mm long, ciliate. Calyx not prominently ribbed, c. 5 mm long elongating to 8 mm in fruit, hispid; mouth oblique; teeth 8, ±equal, c. 0.5 mm long. Corolla tube 6 mm long; upper lip 4 mm long; lower lip 8 mm long. Nutlets 2.5 mm long, c. 1 mm wide, brown.

Christmas Is. Only 1 recent collection. Found throughout southern and SE Asia and Malesia in waste places or as a weed of crops.

Ch.Is.: no precise locality, Aug. 1980, *D.A.Powell 172* (K).

2. Leucas flaccida R.Br., *Prodr.* 505 (1810)

T: Endeavour R., [Qld], 1770, *J.Banks & D.Solander*; syn: BM. Epithet from the Latin *flaccidus* (flaccid or weak), in reference to the stem.

L. mollissima Wall. ex Benth. in N.Wallich, *Pl. Asiat. Rar.* 1: 62 (1830). T: Nepal, 1821, *East India Company* (*N.Wallich* Cat. No. 2054a); syn: K.

L. javanica Benth., *Lab. Gen. Sp.* 3: 611 (1834). T: Bentham apparently based this species on C.L.Blume's description of a Javan species, *Phlomis chinensis*, from 'Burangrang et Tankuwan Paku'.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 528 (1963).

Erect herb to 1 m high. Branches densely pubescent. Leaves ovate, rounded at base, serrate, both surfaces (particularly lower) pubescent, glands not obvious; lamina 2–4 cm long, 1.5–2.5 cm wide; petiole slender, 12–15 cm long, rarely to 25 cm. Flowers in distinct axillary whorls in upper axils, 2–20 per whorl; pedicel 1–2 mm long. Bracts not spine-tipped, 2–3 mm long, tomentose. Calyx prominently 8–10-ribbed, 6–7 mm long, elongating to 7–9 mm in fruit, pubescent; mouth straight; teeth 8–10, ±equal, 1–2 mm long. Corolla tube c. 5 mm long; upper lip c. 3.5 mm long; lower lip c. 5 mm long. Nutlets c. 1 mm long,

black.

Christmas Is. Apparently first collected in 1890 by H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 312 (1906), from Flying Fish Cove and Cemetery Rd. Found throughout SE Asia and Malesia, extending to northern Australia.

Ch.Is.: shore above Cove, *C.W.Andrews 3* (K); shore platform, *C.W.Andrews 16* (BM *p.p.*); shore cliffs, *C.W.Andrews 124* (BM *p.p.*); no precise locality, July 1890, *H.N.Ridley* (BM, SING); Smith Point, *H.N.Ridley 53* (K).

3. HYPTIS

Hyptis Jacq., *Collect.* 1: 102 (1787), *nom. cons.*; from the Greek *hyptios* (resupinate) in reference to the limb of the corolla being turned on its back.

Type: *H. capitata* Jacq.

Robust herbs or undershrubs, often aromatic. Leaves gland-dotted. Flowers in densely spicate or capitate clusters, subtended by involucral bracts. Calyx tubular, 10-nerved; teeth 5, ±equal, acute. Corolla tubular at base; limb 2-lipped, upper lip 4-lobed, lower lip 1-lobed, this lobe longer and deflexed, usually saccate at base. Stamens exserted; anther locules confluent. Style 2-fid or entire. Nutlets ovoid, smooth or rugose.

A genus of c. 350 American species, 5 of these common tropical weeds in Malesia; 1 species on Christmas Is., possibly naturalised.

C.Epling, Revision del genero *Hyptis*, *Rev. Mus. La Plata* n. ser., 7: Bot. 153–497 (1949).

***Hyptis capitata** Jacq., *Icon. Pl. Rar.* 1: 11, t. 114 (?1787); *Collect.* 1: 102 (1787)

T: San Domingo, Herb. N.Jacquin; *n.v.* L.Cramer, *Revis. Handb. Fl. Ceylon* 3: 156 (1980) suggested that the plate is the type. Epithet from the Latin *capitatus* (having a knoblike head) in reference to the inflorescence.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 537 (1973); H.Keng, *Fl. Males.* ser. I, 8: 369, fig. 27d–f (1978).

Erect herb to 1.5 cm high. Branches 4-angled, longitudinally grooved, glabrous or sparsely pubescent. Leaves subsessile (on Christmas Is.), ovate to lanceolate, attenuate at base, crenate or serrate, sparsely pubescent, gland-dotted below; lamina 4–9.5 cm long, 0.8–4.5 cm wide. Flowers in dense, usually long-pedunculate, axillary heads; heads to 1 cm diam. in flower, increasing to 1.5–2.5 cm in fruit; peduncle usually 3–5 cm long; basal involucral bracts lanceolate, c. 5 mm long. Calyx (including teeth) c. 3 mm long, elongating to 7–9 mm in fruit, glandular outside. Corolla 4–6 mm long, white; upper lip violet-dotted; lower lip saccate at base. Stigma 2-lobed. Nutlet c. 1.3 mm long, pale brown with 2 small, paler swellings at base.

Christmas Is. Only 2 recent collections although B.A.Mitchell recorded the species as common. A pantropical weed native to America.

Ch.Is.: no precise locality, Sept. 1980, *D.A.Powell* (K); central plateau, *B.A.Mitchell 91* (CBG).

4. OCIMUM

Ocimum L., *Sp. Pl.* 2: 597 (1753); *Gen. Pl.* 5th edn, 259 (1754); from the Greek *okimon* for an aromatic herb.

Type: *O. basilicum* L.

Herbs or shrubs, aromatic. Leaves gland-dotted. Flowers pedicellate, 6–10 in each verticil, the verticils in a terminal or axillary, simple or branched raceme, and each one subtended by a pair of progressively smaller, leaf-like bracts. Calyx 2-lipped; upper lip large, broad; lower lip with 4–6 narrow teeth, equalling or exceeding upper lip. Corolla 2-lipped; upper

lip truncate, ±equally 4-fid; lower lip longer, entire. Stamens in 2 pairs, exserted; filaments free; anther locules confluent. Disc entire or 2–4-lobed. Style 2-fid. Nutlets smooth or roughened, often mucilaginous on wetting.

A predominantly African genus but occurring throughout the tropics and Malesia with c. 100–150 species; 1 species on Christmas Is., possibly naturalised.

J.K.Morton, Cytotaxonomic studies on the West African Labiatae, *J. Linn. Soc., Bot.* 58: 232 (1962).

***Ocimum americanum** L., *Cent. Pl.* 1: 15 (1755)

T: America, Herb. C.Linnaeus 749.9; possible syn: LINN *n.v., fide* J.K.Morton, *op. cit.* 234. Epithet from the name of the country of origin of the type.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 544 (1973).

Erect, branched, annual herb to 30 cm high. Branches 4-angled, longitudinally grooved, sparsely pubescent. Leaves lanceolate, cuneate at base, crenulate, both surfaces gland-dotted; lamina 3–6.5 cm long, 0.6–2.5 cm wide; petiole slender, 1–3 cm long. Verticils terminal, usually in a branched raceme-like inflorescence; pedicels c. 2 mm long, pubescent. Calyx 2 mm long, elongating to 3–4 mm in fruit, ciliate, glabrous or sparsely pubescent outside, usually with some sessile glands, densely villous inside in basal half; upper lip obovate, mucronate; lower lip 4-toothed, the 2 inner somewhat exceeding the laterals and upper lip. Corolla white. Stamens with glabrous filaments. Style purple. Nutlets narrowly ellipsoidal, c. 1 mm long, dark brown.

Christmas Is. An escape from cultivation, first collected in 1982 from alongside Waterfall Rd. Origin unknown; found in tropical Africa, SE Asia and Malesia.

Ch.Is.: alongside Waterfall Rd, *D.A.Powell 551* (K).

As both J.K.Morton, *op. cit.* 234 and C.A.Backer & R.C.Bakhuizen van den Brink Jr, *Fl. Java* 2: (1965) have commented, the species is not very distinct from *O. basilicum* L. (Basil) except in the smaller floral parts. J.K.Morton showed that in western Africa, at least, *O. basilicum* has a chromosome number of $2n = 48$ while *O. americanum* has $2n = 24$, but the two are apparently genetically isolated since they have not been crossed. *Ocimum basilicum* is used as a culinary herb, while *O. americanum* is often cultivated for its medicinal properties. Each species has a number of cultivars differing in their aromatic properties. *Ocimum basilicum* also occurs on the island but it is doubtful whether it has become naturalised.

73. CALLITRICHACEAE

A.E.Orchard (M.Is., H.Is.)

Aquatic or amphibious annual or perennial herbs. Stems slender, often rooting adventitiously at nodes. Leaves opposite, entire or lobed, exstipulate. Inflorescence of solitary, rarely paired, unisexual flowers borne in upper leaf axils, naked or sometimes with a pair of (usually) caducous bracteoles. Male flower consisting of a single stamen; female flower of a naked ovary of 2 carpels divided into 4 locules by false septa, usually flattened and more or less winged, with 2 subulate styles. Fruit separating into 4-seeded indehiscent mericarps.

A monogeneric family of c. 75 species, almost cosmopolitan but concentrated in temperate zones. About 10 species in Australia, 1 of which also on Macquarie and Heard Is.

G.Bentham, Halorageae, Anomalous Genera, *Fl. Austral.* 2: 491–492 (1864); T.F.Cheeseman, Halorageae, *Vasc. Fl. Macquarie Is.* 24 (1919); B.W.Taylor, Haloragaceae, *Fl. Veg.*

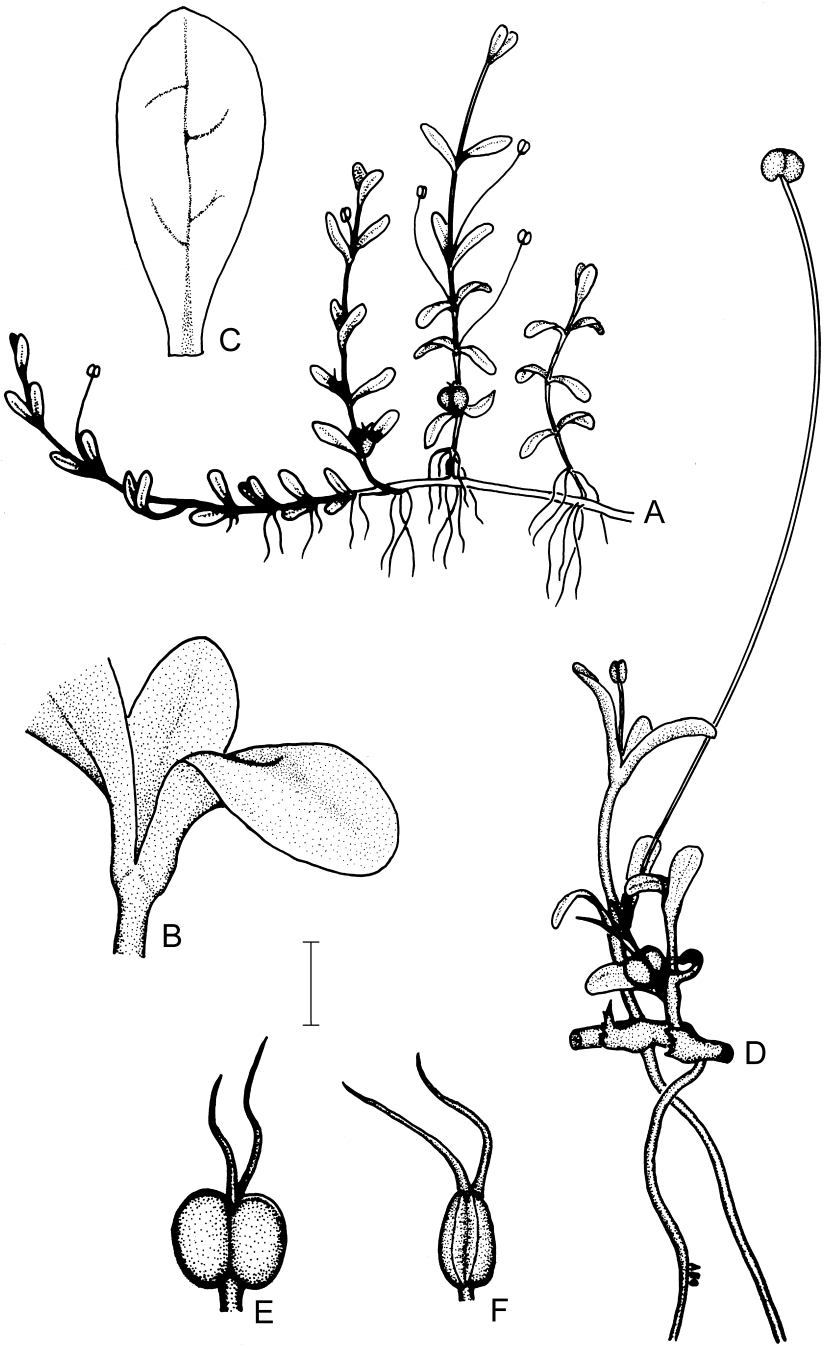

Figure 83. **A–F**, CALLITRICHACEAE: *Callitriche antarctica*. **A**, habit X2.5; **B**, young shoot showing leaf bases X11; **C**, leaf with venation X11; **D**, detail of two lateral branches with male and female flowers X6; **E**, fruit, face view X11; **F**, fruit, commissural view X11; (N.Laird, HO 86411, HO). Drawn by A.Orchard.

Soils Macquarie Is. 124–126 (1955); R.Mason, *Callitriche* in New Zealand and Australia, *Austral. J. Bot.* 7: 295–327 (1959); H.H.Allan, Callitrichaceae, *Fl. New Zealand* 1: 283–285 (1961); H.I.Aston, Callitrichaceae, *Aquat. Pl. Australia* 49–60 (1973); C.D.K.Cook, Callitrichaceae, *Water Pl. World* 171 (1974); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 34 (1984); C.J.Webb *et al.*, Callitrichaceae, *Fl. New Zealand* 4: 453–456 (1988).

CALLITRICHE

Callitriche L., *Sp. Pl.* 2: 969 (1753); *Gen. Pl.* 5th edn, 5 (1754); from the Greek *kallos* (beautiful) and *thrix, trikhos* (a hair), probably in reference to the crowded, delicate stems.

Type: *C. palustris* L.

Callitriche antarctica Engelm. ex Hegelm., *Verh. Bot. Vereins Prov. Brandenburg* 9: 20 (1867).

T: Antarctic Archipelago [Peninsula], *J.D.Hooker*; syn: *n.v.*; Kerguelen Is., May–July 1840, *J.D.Hooker*; isosyn: probably MEL *n.v.*; Campbell Is., Dec. 1840, *J.D.Hooker*; isosyn: probably MEL, NSW, both *n.v.* Epithet from the region of the syntype collections.

[*C. verna auct. non.* L.: J.D.Hooker, *Fl. Antarct.* 1: 11 (1844); *op. cit.* 2: 272 (1846)]

Illustrations: R.Mason, *op. cit.* fig. 6 & 6A; H.H.Allan, *op. cit.* fig. 13; H.I.Aston, *op. cit.* fig. 17.

Prostrate mat-forming herb; main stems freely branched, 0.3–0.4 mm diam., rooting at nodes; lateral stems erect, thinner, to 3 cm long. Leaves spathulate, connate at base, somewhat fleshy, with pellucid dots, midrib and 2 main lateral veins; lamina 3–5 (rarely to 7.5) mm long, 1–2.5 mm wide. Bracteoles absent or very early caducous. Male flower with filament 1.5 mm long, usually lengthening to 9–13 mm. Female flower on pedicel 0.2 mm long. Fruit orbicular in outline, slightly compressed, 0.8–1.3 mm long, 1–1.5 mm wide, without wings or keel, yellowish to dull brown; commissural groove open and very shallow. *n* = 20, D.M.Moore, *Bot. Not.* 113: 187 (1960). Fig. 83.

Macquarie Is., Heard Is., MacDonald Is. Widespread on both Heard and Macquarie Islands, locally dominant particularly in and around pools. Also found on Auckland, Campbell, Snares, Antipodes, Kerguelen, Marion, Crozet, Prince Edward and the Falkland Islands, South Georgia and the Patagonian/Fuegian region of S America. There is one early unconfirmed record from Tasmania (R.Mason, *op. cit.* 312). Flowers Sept.–Mar.

M.Is.: southern slopes of Wireless Hill, 20 Feb. 1949, *N.R.Laird* (AD, AK, CANB, CHR, HO, NLU, RSA); near Boiler Rocks, *D.Montgomery & G.Leaman 37* (HO); Green Gorge, *R.D.Seppelt 11908* (HO). H.Is.: Old ANARE Station, Atlas Cove, *G.R.Copson 105* (HO); Jacka Valley, *J.M.B.Smith 772* (HO).

This circumpolar species shows considerable variability. A collection from Macquarie Is. (*N.R.Laird s.n.*, HO86416) 'growing in 2ft [60 cm] of water' is more lax than terrestrial plants, with leaves 13 mm long, and 3.5 mm wide. Plants from Heard Is. are generally more robust than those from Macquarie Is., with thick stems and larger leaves. R.Mason, *op. cit.* 312, described the male flowers as being borne above the female ones but in specimens examined their distribution is random. D.M.Moore, *Vasc. Fl. Falkland Is.* (1968), described bracteoles on *C. antarctica* from the Falkland Is., while R.Mason described the flowers as 'ebracteate or [bracteoles] falling early', but there is no sign of bracteoles on the Macquarie Is. and Heard Is. plants.

74. PLANTAGINACEAE

P.S.Green (Ch.Is.)

Annual or perennial herbs, sometimes subshrubby. Leaves usually radical or less often cauline, opposite or alternate, simple, exstipulate, generally with sheathing base. Flowers small, actinomorphic, bisexual, rarely unisexual, in stalked, axillary, usually dense heads or spikes. Sepals 4, free or partially fused, persistent. Petals joined, scarious, 3- or 4-lobed, imbricate. Stamens 4, rarely fewer; filaments slender, usually long-exserted; anthers usually versatile. Ovary superior, 2–4-locular; ovules 1–many per locule, axile or basal. Fruit a circumscissile capsule, rarely indehiscent.

A family of 3 genera, 2 of them small, and about 260 species; 1 genus on Christmas Is. Widely distributed but mostly in the temperate regions.

R.Pilger in A.Engler, *Das Pflanzenreich* 102: 1–466 (1937).

PLANTAGO

Plantago L., *Sp. Pl.* 1: 112 (1753); *Gen. Pl.* 5th edn, 52 (1754); the Latin name for the type species, from *planta* (the sole of a foot) and the suffix *-ago* (indicating resemblance), in allusion to the flat leaves pressed against the ground.

Type: *P. major* L.

Annual or perennial herbs; stems usually simple, condensed to form a rootstock at or below ground level, sometimes branched, making plant subshrubby. Leaves usually all basal, crowded, sometimes cauline and opposite or alternate. Inflorescence spicate, cylindrical to globose; flowers bisexual, 4-merous. Sepals resembling the bract. Petals membranous, united below into a narrow tube, persistent on top of capsule. Stamens 4, united to corolla tube, usually exserted and versatile. Ovary 2-locular, sometimes becoming 4-locular by placental outgrowths; ovules 1–6, sometimes –8, in each locule; style filiform. Capsule with the lower portion persistent within the persistent calyx; seeds mucilaginous when wet.

A genus of about 250 species distributed in the temperate regions and on the mountains of the tropics; 1 species naturalised on Christmas Is.

B.G.Briggs *et al.*, *Fl. New South Wales* 181: 1–35 (1979).

***Plantago major** L., *Sp. Pl.* 1: 112 (1753)

T: Sweden, *coll. unknown*; lecto: LINN 144.1, *fide* B.Verdcourt, *Fl. Trop. E. Africa*, Plantaginaceae: 2 (1971); IDC microfiche 177/2.94. Epithet is the Latin for larger, probably in reference to the size of the plant relative to the other species of the genus described in the same work.

Illustrations: S.Ross-Craig, *Drawings Brit. Pl.* 25: 5 (1968); B.E.V.Parham & A.J.Healy, *Common Weeds in New Zealand* 129 (1976); C.Lamp & F.Collet, *Field Guide to Weeds in Australia* 188 (1979); H.R.Toelken, *Fl. S. Australia* 4th edn, 3: 1353, fig. 614H (1986); B.A.Auld & R.W.Medd, *Weeds* 201 (1987).

Short-lived perennial herb, glabrous or pubescent; rootstock stout; adventitious roots many. Leaves basal in rosette, ovate to broadly ovate or broadly elliptic, abruptly attenuate at base, entire, sinuate or irregularly bluntly toothed, 5–7-veined; lamina usually 10–20 cm long; petiole channelled, usually 1–20 cm long, broadened at base. Scapes to 80 cm tall. Spikes cylindrical, mostly 10–15 cm long, often open at base; bracts ovate-elliptic, 1.5–3 mm long, acute, keeled, brownish. Sepals broadly ovate, 1.5–2.5 mm long, keeled; margins membranous. Corolla tube c. equal to calyx; lobes ovate, c. 1.5 mm long, greenish or yellowish white. Stamens long-exserted; anthers ±globose, c. 1 mm long. Ovary 2-locular; style 4–5 mm long. Capsule broadly ellipsoidal, 4–5.5 mm long, 8–16-seeded; seeds c. 2 mm long, irregularly angular, brown.

Christmas Is. D.A.Powell in 1981 stated that it grew well at Drumsite among the Chinese labour quarters. A weedy species, native in Europe and northern and central Asia but now almost cosmopolitan.

Ch.Is.: no precise locality, *D.A.Powell 371A* (K).

75. OLEACEAE

P.S.Green (Ch.Is.)

Trees, shrubs or woody climbers. Leaves opposite or rarely alternate, simple or occasionally pinnately compound; stipules absent. Inflorescence cymose, dichasial, subumbellate or paniculate. Calyx small, 4-lobed or rarely absent. Corolla actinomorphic, usually 4-lobed (up to 10-lobed in *Jasminum*), sympetalous or rarely absent. Stamens 2, rarely 4, epipetalous. Ovary superior, 2-locular; ovules 2 per locule. Fruit a drupe, berry, capsule or samara. Endosperm present or absent.

A woody family containing c. 25 genera and 600 species distributed worldwide, with a concentration in eastern and SE Asia; 2 genera on Christmas Is.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Oleaceae, *Fl. Java* 2: 212–218 (1965).

KEY TO GENERA

Erect shrub to small tree; leaves glossy; flowers clustered in a pyramidal inflorescence; corolla tube 1–1.5 mm long **1. LIGUSTRUM**

Scrambling shrub; leaves dull; flowers solitary or 2 or 3 together; corolla tube c. 10 mm long **2. JASMINUM**

1. LIGUSTRUM

Ligustrum L., *Sp. Pl.* 1: 7 (1753); *Gen. Pl.* 5th edn, 8 (1754); the Roman name for a white-flowered shrub, probably *L. vulgare* L.

Type: *L. vulgare* L.

Shrubs or small trees. Leaves opposite or subopposite, simple, entire. Inflorescence terminal on branchlet tips, cymose or paniculate. Flowers usually scented, cream or white. Calyx campanulate, entire or with 4 shallow teeth. Corolla sympetalous; lobes 4, valvate or induplicate-valvate. Stamens 2, inserted within corolla tube. Ovary small, rounded; style terminal, elongate. Fruit a 1- or 2-seeded berry.

A genus of c. 40 species, found throughout most of the temperate and tropical Old World, except Africa and the coldest regions; 1 species on Christmas Is.

R.Kiew, The Oleaceae of Malesia, 1. The Genus *Ligustrum*, *Blumea* 24: 143–149 (1978).

Ligustrum glomeratum Blume, *Mus. Bot. Lugd.-Bat.* 1: 314 (1850)

T: Java, *C.L.Blume 945*; lecto: L, *fide* R.Kiew, *op. cit.* 148. Epithet from the Latin *glomerato* (to cluster), in allusion to the clustered flowers in this species.

Illustrations: S.H.Koorders & T.Valeton, *Atlas der Baumarten von Java* 4: t. 661 (1916); C.G.G.J. van Steenis, *Mountain Fl. Java* t. 30/8 (1972).

Shrub or small tree to 10 m tall, evergreen; young shoots hairy, lenticular. Leaves ovate-lanceolate to elliptic, rounded to cuneate-decurrent at base, acuminate, glossy above,

glabrous except on midrib below; lamina usually c. 6–8 cm long, c. 2.5–3 cm wide. Inflorescence 7–15 cm long, pyramidal, pubescent, many-flowered; flowers scented. Calyx 1 mm long, ±entire. Corolla tube 1–1.5 mm long; lobes 1 mm long, white or cream. Stamens exserted. Berry ellipsoidal, 5–8 mm long, fleshy, dark purplish-black, rare. Fig. 82F–G.

Christmas Is. Widespread in limestone areas. Occurs from southern Thailand to Java and from the Philippines to New Guinea.

Ch.Is.: no precise locality, *D.A.Powell 4* (K); no precise locality, *D.A.Powell 698* (K); track to Smithsons Bight, *B.A.Mitchell 33* (CBG, K); WSW of Wharton Hill, *B.A.Mitchell 216* (CBG, K).

This species is sometimes cultivated for its showy, scented inflorescences and is said to be grown as a hedge plant in Java.

2. JASMINUM

Jasminum L., *Sp. Pl.* 1: 7 (1753); *Gen. Pl.* 5th edn, 7 (1754); from the Persian name for this genus, *Yasmin*.

Type: *J. officinale* L.

Woody climbers or scramblers, rarely erect shrubs. Leaves opposite or rarely alternate, simple, trifoliolate or pinnate. Inflorescence few- to many-flowered, paniculate or subumbellate. Flowers heterostylous. Calyx with 5–9 inconspicuous to long filiform lobes. Corolla salver-shaped, white or rarely yellow (red in 1 species); lobes 5 or more, generally narrow, imbricate in bud. Stamens 2, within corolla tube. Fruit a paired berry, although often single by abortion, black or purplish black when ripe.

A genus of c. 200 species, found throughout the Old World tropics and warm temperate regions; 1 species on Christmas Is., introduced and persisting in old gardens; also cultivated on Cocos (Keeling) Is. Several species are cultivated for their fragrant flowers.

***Jasminum sambac** (L.) Aiton, *Hortus Kew.* 1: 8 (1789)

Nyctanthes sambac L., *Sp. Pl.* 1: 6 (1753). T: Herb. Hort. Cliff. 5, *Nyctanthes* 1; lecto: BM, *fide* R.A.Howard, *Fl. Lesser Antilles* 6: 83 (1989). Epithet derived from *zambac*, the Persian name for this species.

Illustrations: J.Sims, *Bot. Mag.* 43: t. 1785 (1815); E.A.Menninger, *Fl. Vines World* 244, t. 199 (1970); A.B.Graf, *Exotica* 4, 2: 1631, 1633 (1985); A.B.Graf, *Tropica* 3rd edn, 699 (1986).

Weak climber or scrambler. Leaves opposite, simple, broadly elliptic, broadly acute to rounded at base, obtuse or abruptly shortly acuminate, glabrous except for acarodomatia in the axils of the main nerves and midrib beneath; lamina c. 4–6 cm long, c. 3–4 cm wide; petiole articulate, pubescent. Inflorescence terminal on branchlet tips, pubescent to almost glabrous, 1–several-flowered. Flowers sweetly fragrant, usually double, white. Calyx 1.5–2 mm long, with 5–many filiform lobes. Corolla tube c. 10 mm long; lobes elliptic, 8 to many. Fruit not known in cultivated plants.

Christmas Is. It was carried to Christmas Is. by the Cocos Islanders and planted beside their houses. Now often persists even when the houses have disappeared. Presumably originated in India and has been cultivated in tropical Asia, especially China and India, for centuries.

Ch.Is.: Flying Fish Cove, cult., *H.N.Ridley 23* (K); no precise locality, *D.A.Powell 497* (K).

The flowers of this species are highly scented and are sometimes hidden in Malaysian women's hair or are strung into chaplets. They may also be soaked in water to be used for face washing. In China, the dried flowers are used to give their aroma to jasmine tea. The crushed leaves and flowers are reputed to arrest lactation if applied to the breasts.

76. SCROPHULARIACEAE

R.M.Barker (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Herbs or shrubs, free-living or semi-parasitic by haustoria. Leaves alternate, opposite or whorled, simple, exstipulate. Flowers solitary or in racemes or spikes, bisexual, subtended by a (sometimes leaf-like) bract and sometimes by a pair of bracteoles. Sepals 4 or 5, free or 3–5, fused, sometimes winged. Corolla tubular at base, 4- or 5-lobed; limb ±regular or 2-lipped. Stamens 4, didynamous or 2 with or without staminodes; filaments sometimes with appendages; anthers 1- or 2-locular. Ovary superior; locules 2, each with many ovules on an axile placenta; stigma entire or 2-lobed. Fruit a loculicidal, septicidal or septifragal capsule. Seeds many. Endosperm present.

A large family c. 220 genera and 3000 species, throughout the world; in Australia about 45 genera with c. 180 species; 2 genera (2 species), both possibly introduced, on Christmas Is.; 2 genera (2 species) on Cocos (Keeling) Is. The family does not possess any easily identifiable, unifying characteristics.

R. von Wettstein, Scrophulariaceae, *Nat. Pflanzenfam.* 4(3b): 39–107 (1891–1895); F.W.Pennell, The Scrophulariaceae of eastern temperate North America, *Acad. Nat. Sci. Philadelphia Monogr.* 1 (1935); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Scrophulariaceae, *Fl. Java* 2: 498 (1965).

KEY TO GENERA

1 Prostrate herb to 5 cm tall; leaves opposite (Ch.Is.) **1. LINDERNIA**

1: Erect herb to 60 cm tall; leaves alternate, opposite or whorled

2 Leaves opposite or in whorls of 3, ovate; flowers paired in axils (Ch.Is., C.K.Is.) **2. SCOPARIA**

2: Leaves opposite, becoming alternate upwards, linear; flowers solitary in axils (C.K.Is.) **3. STRIGA**

1. LINDERNIA

Lindernia All., *Melenges Philos. Math. Soc. Roy. Turin* (*Misc. Taur.*) 3: 178, t. 5, fig. 1 (1766); after F.B. von Lindern (1682–1755), a physician of Strasbourg and author of *Hortus Alsaticus*.

Type: *L. pyxidaria* L., *nom. illeg.* = *L. procumbens* (Krock.) Philcox

Herbs, often small. Leaves opposite, simple, entire or toothed. Flowers axillary or terminal, solitary, racemose or clustered, usually pedicellate, lacking bracteoles. Calyx 5-lobed, the lobes connivent for practically whole length, the join distinctly ribbed, sometimes minutely winged. Corolla tubular; limb 2-lipped; upper lip entire to 2-lobed, ±erect; lower lip 3-lobed. Stamens either 4 fertile, didynamous, or 2 fertile with 2 staminodes; longer filaments frequently with a basal appendage; anthers 2-locular, those of staminodal pair often cohering, divaricate. Ovary with slender style; stigma bilamellate. Capsule ovoid, 2-locular. Seeds many, alveolate.

A genus of c. 24 Malesian species with further species occurring in Africa and America; 1 species on Christmas Is.

D.Philcox, The Malesian species of *Lindernia*, *Kew Bull.* 22: 1–72 (1968).

Lindernia crustacea (L.) F.Muell., *Syst. Census Austral. Pl.* 97 (1883)

Capraria crustacea L., *Mant. Pl.* 1: 87 (1767). T: China, Herb. C.Linnaeus 785.3; lecto: LINN, *fide* D.Philcox, *Kew Bull.* 22: 17 (1968). Epithet from the Latin *crustaceus* (hard, thin and brittle), in reference to the capsule.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 583 (1973).

Procumbent herb to 5 cm tall, rooting at nodes; branches 4-angled, sulcate, glabrous. Leaves ovate, serrate, glabrous or sparsely and shortly pubescent on petiole, midrib and margins, gland-dotted; lamina 0.5–1.5 cm long, 0.3–1 cm wide; petiole 2–10 mm long. Flowers axillary, solitary; pedicels to 10 mm long, glabrous. Calyx 3–5 mm long, tubular for most of its length, free only at apex, distinctly ribbed; lobes acuminate, c. 0.5 mm long. Corolla 5–6 mm long, glabrous, blue to purple. Stamens 4, all fertile; filaments of longer pair c. 2 mm long, with a basal spur. Capsule ±globose, glabrous, 3–4 mm long, surrounded and exceeded by persistent calyx. Seed pale, 0.5 mm long.

Christmas Is. Occurs in areas of cultivation. Pantropical species of wetter, low-lying areas.

Ch.Is.: no precise locality, *D.A.Powell 342* (K).

2. SCOPARIA

Scoparia L., *Sp. Pl.* 1: 116 (1753); *Gen. Pl.* 5th edn, 52 (1754); from the Latin *scopa* (broom-like), in reference to the habit of the plant.

Type: *S. dulcis* L.

Much-branched herbs or shrubs. Leaves opposite or verticillate, entire or serrate, gland-dotted. Flowers axillary, long-pedicellate, lacking bracteoles. Calyx segments 4 or 5. Corolla ±rotate; segments 4, split almost to base, with many flexuose hairs in throat. Stamens 4, ±equal; anther locules 2, parallel or divaricate. Ovary with many ovules; style 1; stigma entire. Capsule loculicidally and septicidally 4-valved. Seeds many, longitudinally ribbed.

A genus of c. 20 tropical American species; 1 species naturalised on Christmas Is. and Cocos (Keeling) Is.

***Scoparia dulcis** L., *Sp. Pl.* 1: 116 (1753)

T: in 'Jamaica, Curassao'; *n.v.* Typification under review by R.Hampshire & C.Jarvis, *fide* C.Jarvis *pers. comm.* Epithet is the Latin for sweet or pleasant, presumably a reference to the odour of the plant.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 594 (1973).

Erect herb to 60 cm tall; branches 4-angled, glabrous. Leaves decussate or in whorls of 3, ovate, attenuate at base, serrate-dentate, glabrous; lamina to 3 cm long and 2.5 cm wide; petiole 5–10 mm long. Flowers paired in upper axils; pedicel 6–10 mm long, glabrous. Calyx lobes 4, 3-veined, ovate, 3 mm long, ciliate. Corolla segments white (pale purple with darker centre elsewhere), somewhat longer than calyx lobes. Ovary ovoid, glabrous; style 1–2 mm long, glabrous, persistent in fruit. Capsule ovoid, initially splitting loculicidally into 2, then septicidally to 4 valves. Seed c. 0.2 mm long.

Christmas Is., Cocos (Keeling) Is. A naturalised species occurring on roadsides throughout Christmas Is.; an early coloniser of the mined-out quarries. Grows as an occasional weed in disturbed areas in coralline sand on Cocos (Keeling) Is. Initially from tropical America, now commonly encountered throughout Malesia and also occurs in northern Australia.

Ch.Is.: Waterfall Rd, *A.Pearson P49* (K); no precise locality, *D.A.Powell 173* (K); no precise locality, *D.A.Powell 752* (K). C.K.Is.: near air terminal, West Is., *A.S.George 16240* (AD, CBG, K); c. 1 km N of settlement, West Is., *I.R.Telford 10084 & C.Howard* (AD, CBG).

3. STRIGA

Striga Lour., *Fl. Cochinch.* 17 (1790); from the Latin for a row of cut-down grain, used botanically to describe stiff hairs, as in many species of this genus.

Type: *S. lutea* Lour.

Annual, erect, hemiparasitic herbs. Leaves opposite, becoming spirally arranged upwards, usually sessile, ±linear. Flowers solitary, axillary, forming terminal spikes. Calyx tubular, 4- or 5-lobed or 4- or 5-fid, longitudinally ribbed. Corolla tubular, 2-lipped, the lower larger, 3-lobed. Stamens 4, included. Style slender or clavate, exserted. Fruit a 2-valved loculicidal capsule; valves entire. Seeds minute.

A genus of c. 40 species mainly of tropical Africa, Asia, also N Australia; 4 species in mainland Australia; 1 species on Cocos (Keeling) Is.

Striga angustifolia (D.Don) Saldanha, *Bull. Bot. Surv. India* 5: 70 (1963)

Buchnera angustifolia D.Don, *Prodr. Fl. Nepal* 91 (1825). T: Nepal, *N.Wallich*; *n.v.* Epithet from the Latin *angustus* (narrow), and *folium* (a leaf), referring to the linear leaves.

Buchnera asiatica L., *Sp. Pl.* 2: 630 (1753) *p.p.*, *nom. rej.*; *Striga asiatica* (L.) Kuntze, *Revis. Gen. Pl.* 466 (1891), *nom. illeg.* T: Ceylon [Sri Lanka], China, *n.v.*

Herb to 40 cm, most parts scabrid with tubercle-based hairs; stems simple or branched. Leaves linear, 10–25 mm long. Calyx 4- or 5-lobed, 7–15-ribbed, with 4 or 5 main ribs extending to the lobe apices, and 0–2 narrower ribs between. Corolla white or (not in our area) yellow, pink or red; tube c. 8 mm long; lower lip 3–5 mm long. Style thickened towards apex. Capsule ovoid, c. 4 mm long.

Cocos (Keeling) Is. Collected once, in ruderal herbfield with *Thuarea involuta* and *Euphorbia cyathophora* in coralline sand. Also India, Ceylon and Indonesia.

C.K.Is.: outside W boundary fence of Quarantine Station, West Is., *D.G.Williams 116* (AD, CBG, K).

Parasitic on the roots of grasses. Possibly a recent introduction.

77. ACANTHACEAE

R.M.Barker (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Herbs or shrubs, usually with cystoliths; branches 4- or 6-angled. Leaves decussate, those of each pair connected by a transverse ridge, simple, exstipulate. Flowers bisexual, terminal or axillary, solitary or clustered in spikes or panicles, usually subtended by a bract and 2 bracteoles. Calyx segments 4 or 5, equal or unequal. Corolla tubular at base; limb 5-lobed, ±regular or 2-lipped. Stamens 4, didynamous, or 2, with or without 2 staminodes; anther locules usually 2, equally inserted or superposed. Disc annular, nectar-producing. Ovary superior; locules 2, each with 1–8 superposed ovules; stigma 2-lobed. Fruit a loculicidal capsule, opening explosively, containing curved woody hooks subtending each seed base. Seeds 1–30, rarely more, usually compressed, often tuberculate, sometimes with mucilaginous hairs. Endosperm present or absent.

A tropical and subtropical family of c. 250 genera and 2500 species; 20–28 genera (depending on generic concepts) and 57 species in Australia; 7 genera and 11 species on Christmas Is.; 1 genus (1 species) on Cocos (Keeling) Is.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Acanthaceae, *Fl. Java* 2: 544 (1963); R.M.Barker, A taxonomic revision of Australian Acanthaceae, *J. Adelaide Bot. Gard.* 9: 1–286 (1986).

KEY TO GENERA

1 Calyx segments 4, in unequal pairs at right angles to each other, toothed or with cup-shaped glands; flowers with 4-lobed upper lip, entire lower lip **2. BARLERIA**

1: Calyx segments 5, equal, entire, without cup-shaped glands; flowers with 2- or 3-lobed upper and lower lip or almost regular

2 Stamens 4; corolla limb regular or almost so

3 Flowers soon withering; bracteoles large and leaf-like, enclosing corolla tube; capsule 8–14-seeded; seeds discoid, not tuberculate, with a rim of mucilaginous hairs when wet **1. RUELLIA**

3: Flowers long-lasting; bracteoles small, triangular, not enclosing corolla tube; capsule 2–4-seeded; seeds frequently angled about rim, tuberculate, lacking mucilaginous hairs **4. ASYSTASIA**

2: Stamens 2; corolla limb 2-lipped

4 Flowers in a leafy terminal panicle; anther locules equally inserted, fused at base by a membrane with long hairs; capsule elliptic in outline, seed-bearing throughout; seeds 4–7 per valve, dimpled, hardly compressed **3. ANDROGRAPHIS**

4: Flowers in a terminal spike or axillary cluster; anther locules superposed, not fused at base; capsule clavate, only the upper half seed-bearing, or discoid with short apical beak; seeds 1 or 2 per valve, glochidiate or tuberculate, compressed

5 Corolla tube not twisted through 180°, not enclosed by a pair of unequal bracts; flowers in a terminal spike, white with a purple-barred lower lip; stamens included under upper lip; lower anther locule with a basal appendage **7. JUSTICIA**

5: Corolla tube twisted through 180°, enclosed by a pair of unequal bracts; flowers not in a terminal spike, pink, sometimes with darker blotches of colour; stamens exserted; lower anther locule without a basal appendage

6 Bract pairs orbicular, spine-tipped, pressed together; floral clusters subtended by needle-like spines; capsule discoid with small apical beak **5. DICLIPTERA**

6: Bract pairs linear, not spine-tipped, not pressed together; floral clusters not subtended by spines; capsule clavate **6. PERISTROPHE**

1. RUELLIA

Ruellia L., *Sp. Pl.* 1: 634 (1753); *Gen. Pl.* 5th edn, 283 (1754); after J.Ruelle (1474–1537), physician and botanist to King Francis I of France.

Type: *R. tuberosa* L.

Dipteracanthus Nees in N.Wallich, *Pl. Asiat. Rar.* 3: 81 (1832). T: *D. prostratus* (Poir.) Nees

Herbs with linear cystoliths. Flowers single or paired in upper axils, subtended by a pair of large leafy or small bracteoles, chasmogamous or cleistogamous. Calyx segments 5, equal, linear. Corolla funnel-shaped, fugacious, longitudinally folded in throat. Stamens 4, each pair united at base, included; anthers with 2 locules inserted equally, without appendages; connective sometimes exceeding locules. Ovary with 6–16 ovules per locule; stigma unequally 2-lobed. Capsule clavate, seed-bearing only at apex, or compressed-cylindrical and seed-bearing throughout. Seed 6–30 per capsule, discoid, with mucilaginous hairs confined to rim or distributed all over.

In a broad sense a genus of c. 300 species found throughout the tropical and subtropical regions of the world; 1 species on Christmas Is. The genus is much in need of revision; sometimes split into segregate genera, of which *Dipteracanthus*, *Brunoniella* and *Ruellia s.*

str. occur in Australia. *Dipteracanthus*, to which the 1 Christmas Is. species belongs, is distinguished from the rest of the genus by its large leafy bracteoles, its clavate capsule and its seed with hairs confined to the rim.

Ruellia prostrata Poir., *Encycl.* 6: 349 (1804)

T: India, communicated by *M.Dupuis*; (possibly in J.B.A.P.Lamark's herb. in P) *n.v.* Epithet from the Latin *prostratus* (prostrate), in reference to the habit of the plant.

Dipteracanthus dejectus Nees in N.Wallich, *Pl. Asiat. Rar.* 3: 82 (1832); *R. prostrata* var. *dejecta* (Nees) C.B.Clarke in J.D.Hooker, *Fl. Brit. India* 4: 412 (1885). T: Tanjore province, [India], *R.Wight* Herb. propr. n. 32.; possible syn: K; Munghir, 11 May 1811, *F.H.Hamilton*; possible syn: K.

Sprawling herb 45–50 cm high, rooting at lower nodes. Leaves ovate, sparsely strigose; lamina 2–7 cm long, 1.5–4 cm wide; petiole slender, 5–20 mm long. Bracteoles large, leaf-like; blade to 9 mm long. Calyx 10 mm long. Corolla pubescent outside, 26–29 mm long, blue, violet or white. Stamens alternately short (4 mm) and long (7 mm); filaments glabrous; connective shortly prolonged. Ovary and style pubescent. Capsule clavate, 18–20 mm long, densely pubescent, with 4–7 seed-bearing hooks per valve. Seed c. 3 mm diam.; thickened rim mucilaginous-hairy on wetting. Fig. 84D–F.

Christmas Is. Very common as a roadside herb N of Waterfall. Possibly introduced, but the species is found in India, throughout Malesia, and possibly E Africa.

Ch.Is.: Waterfall to Settlement road, *D.A.Powell 743, 747, 750* (K); Flying Fish Cove, *H.N.Ridley 105* (K); Flying Fish Cove, *C.W.Andrews 96* (BM, K); along NE coast road to Waterfall, *R.Shivas 905* (PERTH); entrance to golf course, *R.Shivas 819* (PERTH).

2. BARLERIA

Barleria L., *Sp. Pl.* 1: 636 (1753); *Gen. Pl.* 5th edn, 283 (1754); after Jacques Barreleir (1606–1673), French collector and author.

Type: *B. cristata* L.

Erect or sprawling herbs or shrubs, sometimes spiny, with linear cystoliths. Leaves entire. Inflorescence an axillary cluster or terminal spike, each flower subtended by one bract and two bracteoles. Calyx segments 4, entire or toothed, sometimes spine-tipped; outer pair longer. Corolla tube narrow; lobes 5, equal; lowest lobe less fused to adjacent lobes giving 2-lipped appearance. Stamens 4, inserted at base of throat; 1 pair long-exserted, fertile; other pair included, fertile or sterile; staminode present or absent; anther locules 2, parallel. Ovules 1 or 2 per locule; style long; stigma entire. Capsule ovoid-acuminate, seed-bearing towards base; hooks prominent. Seeds 1 or 2, large, discoid.

A genus of c. 80 species, mostly of African and Asian tropics but with some in tropical America; 4 introduced species in Australia, 2 of these also introduced on Christmas Is.

Axillary spines absent; margin of calyx segments toothed; flowers blue-lilac or white	**1. B. cristata**
Axillary spines present; margin of calyx segments entire; flowers yellow	**2. B. lupulina**

1. *Barleria cristata L., *Sp. Pl.* 2: 636 (1753)

T: India, Herb. C.Linnaeus 805.11; syn: LINN. Epithet from the Latin *cristatus* (crested), possibly in reference to the toothed calyx segments.

Erect or sprawling woody shrub, strigose in young parts, unarmed. Leaves ovate, acuminate to acute; lamina 4–8 mm long, 1–3 mm wide; petiole 3–8 mm long. Flowers single or paired in axils of upper leaves. Bracts and bracteoles linear, 11–12 mm long, spine-tipped, sparsely glandular. Outer calyx segments ovate, 2 cm long, 7–12-toothed along one side, glandular- and eglandular-pubescent; inner segments narrowly ovate, 7 mm long, entire. Corolla 5.5–6 cm long, densely pubescent outside, blue-lilac to white. Longer stamen

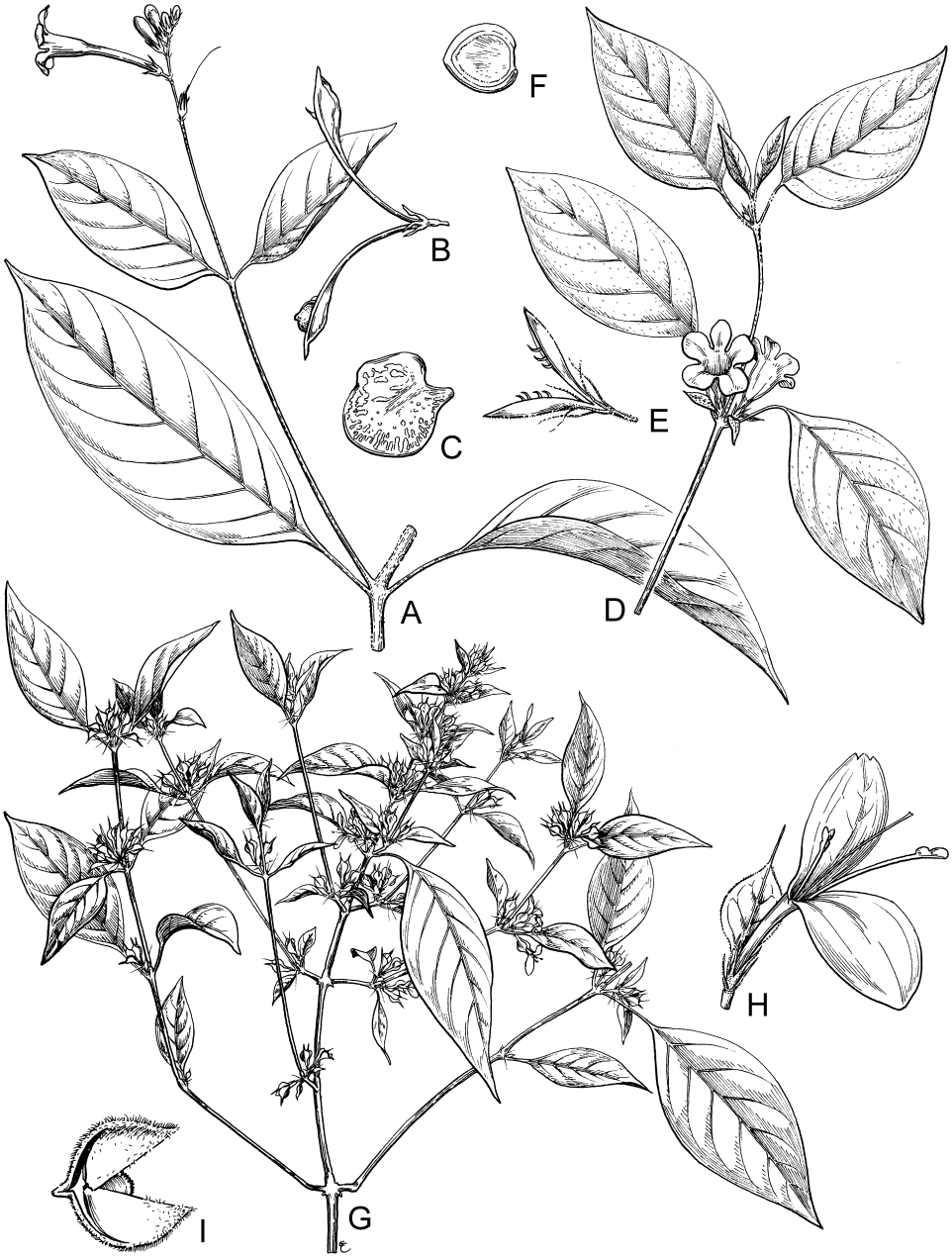

Figure 84. **A–I**, ACANTHACEAE. **A–C**, *Asystasia alba*. **A**, flowering shoot X0.5 (D.Powell 575, K); **B**, capsule X1; **C**, seed X3 (**B–C**, D.Powell 794, K). **D–F**, *Ruellia prostrata*. **D**, flowering shoot X0.5; **E**, capsule X1; **F**, seed X3 (**D–F**, D.Powell 333, K). **G–I**, *Dicliptera maclearii*. **G**, flowering stem X0.5; **H**, flower with one bract removed X2.5 (**G–H**, D.Powell 397, K); **I**, capsule containing a seed X5 (C.Andrews 22, K). Drawn by E.Catherine.

filaments 1.5–2.5 cm long, pubescent at base; shorter stamen filaments c. 5 mm long, pubescent throughout; staminode present. Ovary glabrous; style c. 4 cm long, glabrous. Capsules not seen.

Christmas Is. An escaped shrub growing well on margins of cleared areas. Native to India but commonly grown as hedge plants or for ornament in Malesia.

Ch.Is.: no precise locality, *D.A.Powell 505* (K).

Used as a hedge-plant following its introduction c. 1960 for this purpose.

2. *Barleria lupulina Lindl., *Bot. Reg.* 18: t. 1483 (1833)

T: Mauritius, *C.Telfair*; *n.v.* Epithet from the Latin *lupula* (a she-wolf), the specific epithet for the European hop, the flowers of which this species resembles.

Erect shrub; stems and leaves glabrous; spines 3 in lower axils, 2 deflexed c. 1–2 cm long, 1 shorter and upright. Leaves narrowly obovate, spine-tipped; lamina 3.5–9 cm long, 0.8–1.2 cm wide; petiole 2–3 mm long. Inflorescence a terminal spike with overlapping bracts; bracts broadly ovate, 15 mm long, shortly mucronate, green with purple upper half, very shortly pubescent all over, cup-shaped-glandular at base; bracteoles lanceolate, c. 5.5 mm long, sparsely glandular. Calyx segments spine-tipped, pubescent, lanceolate; outer 10 mm long; inner c. 8 mm long. Corolla yellow, finely eglandular pubescent outside; tube c. 3 cm long; lobes c. 1 cm long. Longer stamen filaments c. 2 cm long; shorter stamens fertile. Style c. 3 cm long, glabrous. Capsule not seen.

Christmas Is. Grows as an escape on roadsides. Possibly native to Mauritius, but often naturalised in tropical areas. A common ornamental house plant.

Ch.Is.: roadside, *D.A.Powell 405* (K).

Used by the Chinese as a poultice.

3. ANDROGRAPHIS

Andrographis Wall. ex Nees in N.Wallich, *Pl. Asiat. Rar.* 3: 77, 116 (1832); from the Greek *andros* (a man) and *graphis* (a pencil), in reference to the pencil-shaped anthers.

Type: *A. paniculata* (Burm.f.) Wall. ex Nees

Herbs or shrubs, with cystoliths. Leaves entire. Flowers in a terminal panicle, each subtended by a leaf-like bract and two small bracteoles. Calyx segments 5, equal. Corolla with a 2-lipped limb, the upper lip 3-lobed, the lower entire or notched. Stamens 2, usually exserted; filaments pubescent; anther locules 2, equally inserted, fused at base. Ovary with 4–7 ovules per locule; style exserted; stigma entire. Capsule elliptic in outline, compressed, seed-bearing throughout, each valve with 4–7 seeds. Seed glabrous, longitudinally grooved, dimpled, not compressed.

A genus of about 18 species occurring in India, China and Malesia. In Australia the occurrence of *A. paniculata* probably represents an introduction, as it may also on Christmas Is. Grown for its reputed medicinal properties.

***Andrographis paniculata** (Burm.f.) Wall. ex Nees in N.Wallich, *Pl. Asiat. Rar.* 3: 116 (1832)

Justicia paniculata Burm.f., *Fl. Indica* 9 (1768). T: 'in Malabaria et Zeylona' [India and Ceylon]; *n.v.* Epithet from the Latin *paniculatus* (paniculate), in reference to the inflorescence.

Herb to 1 m high; branches 4-angled, glabrous. Leaves ovate, glabrous, often gland-dotted; lamina 6–10 cm long, 1.5–2.5 cm wide, becoming smaller in young parts and intergrading with bracts. Bracts 1–2 mm long; bracteoles 0.8–1 mm long. Calyx segments 2–3 mm long, with glandular and eglandular indumentum. Corolla 5–6 mm long; upper lip recurved, white or pink with dark purple patches at base; lower lip decurved to tube, white. Stamens with

purple anther locules fused by a basal hairy membrane. Ovary shortly glandular; style pubescent at base. Capsule 14–17 mm long, sparsely glandular. Seeds ±rectangular, 18–20 mm long.

Christmas Is. Occurs in marginal growth on roadsides. Originally found in India, China and W Malesia, now probably pantropical.

Ch.Is.: Drumsite, *D.A.Powell 377* (K).

The leaves of this bitter plant are boiled by the Chinese to make a cooling medicine, but the species is apparently not cultivated.

4. ASYSTASIA

Asystasia Blume, *Bijdr.* 796 (1826); derivation obscure.

Type: uncertain, but possibly *A. nemorum* Nees or *A. blumei* Nees (see R.M.Barker, *J. Adelaide Bot. Gard.* 9: 133, 1986).

Erect or scandent herbs or shrubs, with rounded cystoliths; branches 4-angled. Flowers in terminal or axillary racemes, single or paired at each node; pedicels with small bract and 2 bracteoles at base. Calyx segments 5, equal, narrow. Corolla actinomorphic, narrow at base; lobes 5, spreading, imbricate in bud. Stamens 4, inserted in pairs at top of tube, included or just exserted, didynamous or equal. Anthers 2-locular; basal mucro present or absent; locules parallel, inserted equally. Ovules 2 per locule; style long; stigma thickened, bilobed. Capsule clavate, lacking seeds at base; seed-bearing hooks prominent. Seeds 2 or 4, large, compressed, almost triangular in outline, glabrous, tuberculate or smooth.

A genus of some 40–50 species in tropical India, Asia and Africa; 2 native and 1 naturalised species in Australia; 4 species on Christmas Is.

C.G.D.Nees in A.de Candolle, Acanthaceae, *Prodr.* 11: 163 (1847).

1 Flowers deep lilac with paler streaks into tube; corolla-tube and throat of similar length; connective exceeding anther locules, forked; bract and bracteoles c. 0.5 mm long — **3. A. sp.**

1: Flowers mainly white or yellow, sometimes with purple markings; corolla tube and throat of different lengths; connective not extended, or if so not forked; bract and bracteoles more than 0.5 mm long

2 Longer stamens exserted; corolla tube almost twice length of throat — **1. A. alba**

2: Longer stamens included in throat; corolla tube half length of throat

3 Flowers white with violet-blue patches on lower surface; semi-erect shrub; anther backs glabrous; longer filaments glandular-pubescent — **4. A.** cf. **chelonoides**

3: Flowers pale primrose to cream with maroon markings; sprawling creeper; anther backs glandular pubescent; longer filaments glabrous — **2. A. gangetica**

1. Asystasia alba Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 209 (1906)

T: lower terraces below Phosphate Hill and beyond Waterfall, Christmas Is., Oct. 1904, *H.N.Ridley 98*; syn: K, SING. Epithet from the Latin *albus* (white), in reference to the corolla.

[*A. coromandeliana* Nees, forma [unnamed] Baker in C.W.Andrews, *Monogr. Christmas Is.* 184 (1900)].

Erect woody herb, 50–75 cm high. Leaves ovate, acuminate or acute, pale green, usually bristly when young; lamina 3–14 cm long. Inflorescence 6–8 cm long; flowers single or rarely paired; bract and bracteoles c. 2 mm long; pedicels 1.5–3 mm long. Calyx lobes 5–7 mm long, sparsely eglandular-pubescent. Corolla white or violet, glandular-pubescent outside; tube 14–18 mm long; throat 8–10 mm long; lobes 4.5–7 mm long. Stamens: longer pair usually just exserted; anthers of shorter pair sometimes overlapping the longer; anther locules glabrous, without mucro. Ovary initially glabrous, becoming densely glandular; style sparsely pubescent at base, c. 2.2–2.8 cm long. Capsule usually 2-seeded, glabrous or

densely glandular-pubescent, c. 2.6 cm long. Seeds 4 mm long. Fig. 84A–C.

Christmas Is. Endemic. Found in cleared areas on the terraces up to c. 200 m.

Ch.Is.: top of 1st inland cliff, Steep Point, *C.W.Andrews 154* (BM, K); no precise locality, *D.A.Powell 742* (K); western shore terrace, c. 0.4 km S of North West Point, *D.A.Powell 758* (K); Toms Ridge, *D.A.Powell 794* (K); Waterfall, *H.N.Ridley 98* (K, SING).

Asystasia alba is a variable species and is part of a complex encompassing *A. australasica* and *A. oppositiflora* but differing from both by the single flowers at each axil. One collection (*D.A.Powell 165*, K) possibly represents a different taxon; it has violet flowers with longer corolla lobes, stamens included in throat with shorter pair of stamens not overlapping the longer, and a staminode present in one flower.

2.*Asystasia gangetica (L.) T.Anderson in G.H.K.Thwaites, *Enum. Pl. Zeyl.* 235 (1860)

Justicia gangetica L., *Amoen. Acad.* 4: 299 (1759). T: India, *coll. unknown*, Herb. C.Linnaeus 28.26, 28.27; syn: LINN. Epithet from the Latin for the Ganges R., India, where the species was first collected.

Woody sprawling creeper. Leaves ovate, acuminate, mostly glabrous; lamina c. 3.5 cm long. Inflorescence terminal or axillary, c. 6–10-flowered, 3–4 cm long; flowers solitary; bract and bracteoles c. 2 mm long; pedicels 0.5–1.5 mm long. Calyx 5–8 mm long, sparsely glandular. Corolla maroon in bud, densely glandular- or eglandular-pubescent, opening pale primrose, traced with maroon, fading to cream; tube 8 mm long; throat 15–20 mm long; lobes 12 mm long. Stamens included; pairs somewhat unequal; filaments 3–4 mm long; anther locules glandular-pubescent dorsally, with or without mucro. Ovary glandular- and eglandular-pubescent; style densely pubescent at base, 10–15 mm long. Capsule mainly eglandular-pubescent, 3.5 cm long, 4-seeded. Seeds 5 mm long, ±tuberculate.

Christmas Is. A garden escape. Recorded for Cocos (Keeling) Is. by H.Forbes, *A Naturalist's Wanderings in the Eastern Archipelago* (1885) and F.Wood-Jones, *Corals & Atolls* (1912) but not collected since and no specimens were located. A commonly cultivated and variable species of India, Africa and Malesia.

Ch.Is.: between a garden and the sea-cliff, c. 15 m from the sea at an elevation of c. 12 m, *D.A.Powell 760* (K).

3. *Asystasia sp.

Small woody plant. Leaves ovate, ±undulate, acute, sparsely pubescent; lamina c. 5 cm long. Inflorescence sometimes branched, usually axillary, usually 5- or 6-flowered, c. 3 cm long; flowers solitary; bract and bracteoles 0.5 mm long; pedicels 2 mm long. Calyx 3–5 mm long, eglandular-pubescent with occasional glandular hairs. Corolla lilac with lighter streaks into tube, glandular- and eglandular-pubescent outside; tube 13–17 mm long; throat 14 mm long; lobes 8 mm long. Stamens didynamous; anthers of longer pair overlapping shorter; anther locules included, lacking glandular hairs, without mucro; connective exceeding locules, forked. Ovary glandular-pubescent; style pubescent at base. Capsule and seeds not seen.

Christmas Is. A cultivated escape in marginal growth alongside the railway in the centre of the island.

Ch.Is.: alongside railway in central area, *D.A.Powell 740* (K).

No specific name has been found for this taxon, although the material is identical to a collection from the National Botanic Gardens, Lae, P.N.G., (*B.Verdcourt 5082*, K), implying that it is available for cultivation.

4. *Asystasia cf. chelonoides Nees in N.Wallich, *Pl. Asiat. Rar.* 3: 89 (1832)

T: Ceylon, *G.W.Walker s.n.*; syn: K. Epithet presumably from the resemblance to the North American *Chelone* (Scrophulariaceae), named from the Greek *chelo-ne* (a tortoise) and commonly called turtle-head.

Small semi-erect shrub. Leaves ovate to ±triangular; lamina 2.5–5.5 cm long. Inflorescence c. 10 cm long, 6–8-flowered; flowers solitary; bract and bracteoles 1 mm long; pedicels

sparsely glandular, 2 mm long. Calyx 4.5 mm long, glandular-pubescent in fused portion, otherwise eglandular-pubescent. Corolla white with violet-blue patches on lower surface, eglandular-pubescent outside; tube 3 mm long; throat 5.5–8 mm long; lobes 4 mm long. Stamens included; anthers of longer pair overlapping the shorter; longer filaments glandular; connective sometimes extended, truncate; anther locules lacking glandular hairs and mucro. Ovary eglandular-pubescent at apex; style pubescent at base, c. 7 mm long. Capsule mainly eglandular-pubescent, 4-seeded, 2–2.5 cm long. Seeds 4 mm long, tuberculate.

Christmas Is. Probably a garden escape.

Ch.Is.: from a clearing on the northern terraces leading up to Phosphate Hill, *D.A.Powell 787* (K).

Asystasia is much in need of revision throughout its range and it is often difficult to apply its names correctly. The Christmas Is. species seems to approach most closely *A. chelonoides* of India and Sri Lanka.

5. DICLIPTERA

Dicliptera Juss., *Ann. Mus. Natl. Hist. Nat.* 9: 267 (1807), *nom. cons.*; from Greek *diclis* (double folding) and *pteron* (a wing), in reference to the wing-like divisions of the capsule valves.

Type: *D. chinensis* (L.) Juss.

Erect or sprawling herbs with linear cystoliths. Flowers loosely or densely clustered in upper axils, subtended by a pair of appressed, unequal, often spine-tipped bracts; bracteoles 2, free, tiny. Calyx segments 5, acute. Corolla tube thin, twisted through 180°, widening into throat. Limb 2-lipped; upper lip shortly 3-lobed; lower lip entire or notched. Stamens 2, exserted; anther locules inserted at unequal levels, without appendages. Ovary with 2 ovules per locule; style exserted; stigma 2-lobed. Capsule compressed ovate, shortly beaked, splitting medially, the valves separating from placenta to raise the seeds; seed-bearing hooks broad, 1 or 2 per valve. Seed glochidiate or rarely smooth.

A genus of c. 150 species distributed throughout tropical and subtropical regions of the world; 1 endemic species on Christmas Is.; 1 species on Cocos (Keeling) Is.; and 5 or 6 species in Australia.

Flowers in some species may be cleistogamous. The genus is in need of revision, the only world-wide treatment being that of C.G.D.Nees von Esenbeck in 1847.

C.G.D.Nees von Esenbeck in A.de Candolle, *Prodr.* 11: 473–491 (1847); R.M.Barker, *J. Adelaide Bot. Gard.* 9: 174–191 (1986).

Bracts sparsely eglandular-hairy, sometimes ciliate with longer hairs (C.K.Is.) **1. D. ciliata**

Bracts glandular-hairy, not ciliate (Ch.Is.) **2. D. maclearii**

1. Dicliptera ciliata Decne., *Nouv. Ann. Mus. Hist. Nat., Paris* 3: 384 (1834)

T: Timor, *A.Guichenot s.n.*; syn: ?BM, ?K, MEL, P *all n.v., fide* R.M.Barker, *op. cit.* 178. Epithet from the Latin *ciliatus* (having hairs like an eyelash), in reference to the bracts.

Erect or decumbent herb to 50 cm, rooting at lower nodes; branches angled in young parts. Leaves broadly lanceolate to ovate, attenuate at base, shortly acuminate, sparsely pubescent, paler beneath; lamina 2–9 cm long, 1–7 cm wide; petiole 5–30 mm long. Bract pairs loosely to densely clustered in upper axils, usually 5–10, rarely 1 or 2 per axil; bracts broadly elliptic to ovate from an attenuate base, cuspidate, the larger 7–10 mm long excluding an apical spine 2–3 mm long, sparsely hairy with short eglandular hairs, sometimes ciliate with longer hairs. Cleistogamous flowers bud-like, c. 2 mm long. Capsule eglandular-hairy. Seed glochidiate on margins, c. 2 mm diam.

Cocos (Keeling) Is. Grows in forest under *Pisonia grandis* and in *Cocos* plantations in

coralline sand. Also on Timor and probably from Java to the Philippines.

C.K.Is.: North Keeling Is., *I.R.Telford 10036 & C.Howard* (AD, CBG, K); Horsburgh Is., *D.G.Williams 32* (CBG); West Is., *D.G.Williams 83* (CBG).

Tentatively referred to this species. Only cleistogamous flowers seen. Charles Darwin's collection of 1836 was cited by J.S.Henslow, *Ann. Nat. Hist.* 1: 344 (1838), as *Dicliptera burmanni* Nees var.? and by D.M.Porter, *J. Linn. Soc. Bot.* 93: 44 (1986), as *D. burmanni*. R.M.Barker, *op. cit.* 180–181, drew attention to the problems in applying the latter.

2. Dicliptera maclearii Hemsl., *J. Linn. Soc., Bot.* 25: 256 (1890)

T: above Flying Fish Cove, Christmas Is., 1887, *J.J.Lister et al. s.n.*; syn: FI, K. Epithet honouring J.P.Maclear, captain of the survey vessel *Flying Fish* which visited on Christmas Is. in 1886.

Erect herb to 1 m tall; branches angled in young parts, inconspicuously pubescent. Leaves lanceolate to ovate, acuminate or spine-tipped, sparsely pubescent on veins; lamina 2–7 cm long, 0.5–3 cm wide; petiole slender, to 7 mm long. Bract pairs densely clustered in upper axils, usually 6–8 per axil, sometimes fewer, subtended at base by needle-like spines 6–6.5 mm long; bracts broadly orbicular from attenuate base, the larger 5–7 mm long, excluding the apical spine 2 mm long, glandular-hairy. Corolla pink; tube c. 3.5 mm long; lobes c. 5.5 mm long. Staminal filaments sparsely pubescent. Capsule glandular- and eglandular-hairy. Seed glochidiate, at least on margins, c. 2 mm diam. Fig. 84G–I.

Christmas Is. Endemic. Apparently common on the lower terraces, at Flying Fish Cove, Waterfall and Cemetery Rd, and at North West Point.

Ch.Is.: Toms Ridge, *D.A.Powell 869* (K); shore platform, *C.W.Andrews 20* (BM); Phosphate Hill, *H.N.Ridley 35* (SING); North West Point, *D.A.Powell 397* (K).

This species comes closest to *D. ciliata* but differs from it in the lack of long, eglandular hairs and conspicuously glandular hairs on the external surface of the bracts.

6. PERISTROPHE

Peristrophe Nees in N.Wallich, *Pl. Asiat. Rar.* 3: 112 (1832); from the Greek *peri* (around) and *strophos* (a girdle), in reference to the involucre.

Type: none designated [see R.M.Barker, *J. Adelaide Bot. Gard.* 9: 192 (1986) for discussion]

Herbs with linear cystoliths. Flowers subtended by an involucre of 2 free, often unequal, bracts; involucres paired or cymose, terminal or axillary on a long peduncle, bibracteate at base of peduncle. Calyx segments 5. Corolla 2-lipped, resupinate, the apparent upper lip entire or emarginate, lower very shortly 3-lobed, often spotted. Stamens 2; anthers 2-locular, the locules superposed, lacking appendages. Ovary with 2 ovules per locule; stigma bilobed. Capsule clavate, lacking seeds at base; seed-bearing hooks prominent. Seeds 4, tuberculate, glabrous.

A genus of 15–20 species in Africa, India, Asia and Malesia; 1 species on Christmas Is.

*Peristrophe bivalvis (L.) Merr., *Interpr. Herb. Amboin.* 476 (1917)

Justicia bivalvis L., *Syst. Nat.* 10th edn, 2: 850 (1759). T: Herb. C.Linnaeus 28.25; lecto: LINN, *fide* J.R.I.Wood, D.Hillcoat & R.K.Brummit, *Kew Bull.* 38: 452 (1983). Epithet from the Latin *bi-* (two) and *valva* (a valve), in reference to the capsule.

Creeping or climbing herb; branches angled, grooved, moderately pubescent. Leaves ovate, truncate at base, subentire, acuminate, glabrous; lamina to 11 cm long, 5 cm wide; petiole to 3 cm long. Inflorescence of 1 or 2 peduncles per axil; peduncle supporting 1 or more bibracteate, pedicellate, bifoliate involucres; involucre enclosing c. 3 flowers; involucral bracts unequal, c. 20 and 17 mm long, sparsely pubescent. Corolla pink, pubescent outside; tube 2–3 cm long; lobes 1–1.5 cm long. Stamens long-exserted; filaments pubescent. Capsule pubescent, not present on Christmas Is. material.

Christmas Is. Doubtfully naturalised, although this species only occurs in the Malesian region.

Ch.Is.: Drumsite, possibly site of old Chinese garden, *D.A.Powell 367* (K).

7. JUSTICIA

Justicia L., *Sp. Pl.* 1: 15 (1753); *Gen. Pl.* 5th edn, 10 (1754); after J.Justice, a Scottish horticulturalist.

Type: *J. adhatoda* L.

Gendarussa Nees in N.Wallich, *Pl. Asiat. Rar.* 3: 103 (1832). T: *G. vulgaris* Nees

Herbs or shrubs, with linear cystoliths. Flowers in axillary clusters or terminal and spike-like, each subtended by a bract and two small bracteoles. Calyx segments 4 or 5, equal or sometimes with 5th segment a remnant. Corolla 2-lipped from a widening tube; upper lip notched, usually with a style channel; lower lip 3-lobed, marked with coloured bars; lobes imbricate in bud. Stamens 2; anthers 2-locular, the locules superposed, lower usually with basal appendage. Ovary with 2 ovules per cell; stigma slightly thickened. Capsule clavate, lacking seeds at base; seed-bearing hooks prominent. Seed 2 or 4, tuberculate, compressed, usually glabrous.

In the broad sense a genus of 400–600 species throughout the tropical and subtropical regions of the world; sometimes split into many segregate genera e.g. *Rostellularia* Rchb., *Rhaphidospora* Nees, as has been done for Australia by R.Barker, *J. Adelaide Bot. Gard.* 9: 1–286 (1986). V.Graham, Delimitation and Infra-generic classification of *Justicia* (Acanthaceae), *Kew Bull.* 43: 551–624 (1988) advocates a broader generic concept.

***Justicia gendarussa** Burm.f., *Fl. Indica* 10 (1768)

T: Malabar [SW India], Amboina and Java; syn: all *n.v.* Epithet derivation obscure, but possibly taken from a local name for this species.

Gendarussa vulgaris Nees in N.Wallich, *Pl. Asiat. Rar.* 3: 104 (1832). T: 4 sheets annotated by C.G.D.Nees von Esenbeck in Herb. W.J.Hooker and Herb. G.Bentham; possible syn: K.

Large shrub to 120 cm high; branches glabrous, angled in young parts, often purplish. Leaves elliptic, slightly sinuate, glabrous; lamina 7–10.5 cm long; petiole 3–6 mm long. Spike terminal, often with 2 or 3 flowers per axil at base; rachis finely pubescent, 6–10 cm long. Bracts and bracteoles tiny, triangular. Calyx lobes 5, equal, 4 mm long, shortly pubescent. Corolla white, barred with purple on lower lip, purple streaked in throat of lower lip; tube 6 mm long; throat 3.5 mm long; lobes c. 7 mm long. Stamens shorter than upper lip. Anther locules globose; lower with basal appendage. Ovary glabrous; style sparsely pubescent at base. Capsule glabrous, 1.7 cm long. Seed not seen.

Christmas Is. Probably introduced in cultivation by the Chinese, now naturalised at South Point. Native country unknown, possibly India. Cultivated throughout India and Malesia.

Ch.Is.: no precise locality, *D.A.Powell 536* (K); highest terrace, South Point, *D.A.Powell 793* (K).

78. BIGNONIACEAE

R.M.Barker (Ch.Is.)

Trees, shrubs or lianas, without cystoliths. Branches not angled. Leaves decussate, simple or compound, exstipulate. Flowers bisexual, large, in terminal or axillary racemes; bracts and bracteoles present. Calyx segments joined, cupular, spathaceous or lobed; lobes equal

or unequal. Corolla tubular at base; limb with 5 equal or unequal lobes usually 2-lipped. Stamens 5, rarely more, usually 4, didynamous with the 5th rudimentary, adnate to corolla tube at join of tube and throat; anther locules usually 2, rarely 1, basifixed, equally inserted, divergent. Disc usually annular. Ovary superior; locules 2, each with 2 or more rows of 3–many ovules; stigma usually 2-lobed. Fruit a 2-valved loculicidal or septicidal capsule. Seeds attached to dissepiment in 1 or more rows, usually winged each side. Endosperm sparse or absent.

A tropical and subtropical family, predominantly American, of c. 120 genera and 650 species; 5 genera with c. 11 species occur naturally in Australia; on Christmas Is. 1 genus naturalised. There are no native occurrences of the family. *Crescentia cujete* L. has been recorded by drift fruit while there are 2 cultivated species, *Spathodea campanulata* and *Tecoma stans*, the latter apparently naturalised.

C.G.G.J. van Steenis, Bignoniaceae, *Fl. Males.* ser. I, 8: 114–186 (1977).

Large tree; flowers orange-red; leaflets in 4–9 pairs, entire **†SPATHODEA**

Shrub; flowers yellow; leaflets in 1–3 pairs or sometimes 1-foliolate, serrate **TECOMA**

†*Spathodea campanulata* P.Beauv. (African Tulip Tree) is cultivated but apparently not naturalised on Christmas Is.

TECOMA

Tecoma Juss., *Gen.* 139 (1789); from the Mexican name *Tecomaxochitl* for these species, meaning unknown.

Type: *T. stans* (L.) Juss. ex Kunth

Shrubs or small trees. Leaves usually pinnate; leaflets toothed or serrate, glandular-punctate below. Flowers in terminal racemes, yellow, orange or scarlet, subtended by a tiny bracteole at base of pedicel. Calyx cupular, with 5 equal lobes. Corolla with short tube widening into longer throat; lobes equal or unequal. Stamens 4, didynamous, included or exserted; staminode present; anther locules widely diverging, sometimes pubescent. Ovary with small scales, with 2–4 rows of ovules in each locule. Capsule linear, compressed. Seeds with hyaline wing at each end.

A genus of c. 12 species from America, 1 from southern Africa. Widely cultivated in tropical and subtropical regions of the world as ornamentals. The only species on Christmas Is. is apparently naturalised.

A.L.Gentry, Bignoniaceae, Flora of Panama, *Ann. Missouri Bot. Gard.* 60: 958 (1973).

***Tecoma stans** (L.) Juss. ex Kunth in F.W.H.A. von Humboldt, A.J.A.Bonpland & C.S.Kunth, *Nov. Gen. Sp.* 3: 144 (1819)

Stenolobium stans (L.) Seem., *Ann. Mag. Nat. Hist.* 10: 30 (1862). T: America; *n.v.* Epithet is the Latin for standing upright.

Illustration: A.L.Gentry, *Ann. Missouri Bot. Gard.* 60: 958, fig. 38 (1973).

Shrub or small tree to 4 m. Leaves imparipinnate with 1 or 2 pairs of leaflets; leaflets almost sessile, lanceolate, cuneate at base, serrate, acuminate, subglabrous; lamina to 10 cm long, 3.5 cm wide; petiole to 8 cm long. Rachis up to 12 cm long, glabrous; pedicel c. 6 mm long. Calyx c. 6 mm long; lobes c. 1 mm high, shortly ciliate at apex. Corolla yellow; tube 0.8–1 cm long; throat 2.5–3 cm long; lobes 0.8–1 cm long, subglabrous. Stamens included; anther locules pubescent; connective extended. Capsule 7–21 cm long, 6–8 mm wide, lenticellate or not. Seeds c. 1 cm long, superposed along margins of septum.

Christmas Is. Apparently naturalised. Occurs from Florida to northern Argentina but widely cultivated in the tropics.

Ch.Is.: in landscaped part (Nursery), overlooking Settlement, 11 Aug. 1986, *R.Shivas 960* (PERTH); above

Dale No. 2, Waterfall, 14 Aug. 1983, *A.Stokes ANPWS 16* (CBG).

79. CAMPANULACEAE

I.R.H.Telford (C.K.Is.)

Herbs, rarely shrubs or trees. Leaves alternate or opposite, rarely whorled, simple, exstipulate. Inflorescence racemose, cymose or flowers solitary. Flowers actinomorphic or zygomorphic, usually bisexual. Calyx usually 5-lobed. Corolla tubular, cylindrical or campanulate, sometimes cleft on one side, usually 5-lobed. Stamens usually 5, alternating with corolla lobes, inserted on epigynous nectary disc or base of corolla; filaments free or partially connate; anthers 2-locular, dehiscing by longitudinal slits, connivent or connate. Ovary usually inferior or half-inferior; locules usually 2–5; placentation usually axile; ovules many, anatropous. Fruit usually a capsule, sometimes indehiscent. Seeds with endosperm.

A cosmopolitan family of c. 70 genera and c. 2000 species; 7 genera (of which 1 naturalised) and c. 70 species (2 naturalised) in Australia; 1 species naturalised on Cocos (Keeling) Is. Species of *Campanula* L. (bluebells), *Lobelia* L. and *Wahlenbergia* Schrad. ex Roth are cultivated as ornamentals.

R.McVaugh, A revision of *Laurentia* and allied genera in North America, *Bull. Torrey Bot. Club* 67: 778–798 (1940); R.Melville, Contributions to the Flora of Australia: VI. The pollination mechanism of *Isotoma axillaris* Lindl. and the generic status of *Isotoma* Lindl., *Kew Bull.* 14: 277–279 (1960); R.D.Meikle, Some notes on *Laurentia* Adanson (Campanulaceae), *Kew Bull.* 34: 373–374 (1979).

HIPPOBROMA

Hippobroma G.Don, *Gen. Hist.* 3: 698, 717 (1834); from the Greek *hippos* (a horse), and *bromos* (a poison), in reference to the toxic latex.

Type: *H. longiflora* (L.) G.Don

Erect to decumbent annual or biennial herbs. Leaves subsessile, lanceolate to oblanceolate, coarsely dentate to pinnately lobed. Flowers axillary, solitary. Hypanthium turbinate; rim conspicuous. Calyx lobes linear. Corolla trumpet-shaped; tube straight, entire; lobes subequal, lanceolate. Staminal column adnate to corolla tube for most of its length; anthers connate, with an undifferentiated apical tuft of hairs. Fruit a loculicidal capsule dehiscing by 2 apical valves. Seeds many, minute, ellipsoidal, minutely pitted-reticulate.

A monotypic genus, endemic in the West Indies but widely naturalised in the tropics, including Cocos (Keeling) Is. Previously included in *Laurentia* Adans. or *Isotoma* (R.Br.) Lindl. which was reduced to *Laurentia* sect. *Isotoma* (R.Br.) Wimmer, *Ann. Naturhist. Mus. Wien* 56: 336 (1948). Wimmer's sections of *Isotoma* are now usually treated at generic rank.

*Hippobroma longiflora (L.) G.Don, *Gen. Hist.* 3: 717 (1834)

Lobelia longiflora L., *Sp. Pl.* 2: 930 (1753); *Isotoma longiflora* (L.) C.Presl, *Prodr. Monogr. Lobel.* 42 (1836); *Laurentia longiflora* (L.) E.Wimm., *Publ. Field Mus. Nat. Hist., Bot.* ser. 13: 474 (1937). T: from the West Indies; *n.v.* Epithet from the Latin *longus* (long) and *flos* (a flower), in reference to the corolla tube.

Herb to 60 cm. Leaves sessile, lanceolate, coarsely and irregularly dentate to pinnatilobed, acute, pubescent; lamina 6–15 cm long. Pedicel to 2 cm long. Calyx tube 7–10 mm long; lobes linear, serrulate, 8–18 mm long. Corolla tube 7–10 cm long, greenish white; lobes narrowly lanceolate, 14–22 mm long, white. Staminal filaments united towards apex; anther

tube curved, c. 6 mm long. Capsule nodding, campanulate, beaked, 10–15 mm long. Seeds c. 0.5 mm long, brown.

Cocos (Keeling) Is. Recorded as a roadside weed in *Cocos* plantations in calcareous sand.

C.K.Is.: 1 km S of jetty, West Is., *D.G.Williams 24* (CBG, K).

The species is extremely poisonous with reports of the acrid milky sap causing blindness. *Hippobroma* differs from the Australasian species of *Isotoma* in the very long, narrow, straight corolla tube with subequal lobes and the undifferentiated tuft of hairs at the mouth of the anther tube. In *Isotoma*, long 'trigger' hairs are present.

80. GOODENIACEAE

I.R.H.Telford (Ch.Is., C.K.Is.)

Shrubs or herbs. Leaves usually alternate, rarely opposite, simple, exstipulate. Inflorescence an axillary or terminal cyme, or (not in our area) a raceme, head or panicle or flowers solitary. Flowers zygomorphic, bisexual. Calyx usually 5-lobed. Corolla shortly tubular, of 5 variously connate lobes; lobes usually digitately spreading, each with a thick central zone. Stamens 5, alternating with corolla lobes, free or inserted at base of corolla tube; anthers connivent or connate, dehiscing longitudinally. Ovary usually inferior, usually incompletely 2-locular, rarely 2- or 4-locular; placentation usually axile; ovules 1 to many per locule, usually erect, anatropous; style bearing a cupular indusium at apex around the small stigma. Fruit usually a 2-valved capsule, or drupaceous, 1–many seeded. Seeds with copious endosperm.

A family of 11 genera and c. 403 species, concentrated in Australia, but 1 genus (*Scaevola*) pantropical; 1 species on Christmas Is. and Cocos (Keeling) Is.

R.C.Carolin, M.T.M.Rajput & D.Morrison, Goodeniaceae, *Fl. Australia* 35: 4–334 (1992).

SCAEVOLA

Scaevola L., *Mant. Pl.* 2: 145 (1771), *nom. cons.*; from the Latin *scaevola* (a little hand), in reference to the shape of the corolla.

T: *S. plumierii* (L.) Vahl

Shrubs or perennial herbs. Leaves usually spirally arranged, rarely opposite. Inflorescence an axillary bracteate cyme or (not in our area) flowers solitary. Pedicels bearing 2 bracteoles. Calyx 5-lobed, adnate to ovary at base. Corolla cleft to base on adaxial side, 5-lobed; lobes ±equal, usually digitately spreading. Stamens inserted towards base of corolla. Ovary 1- or 2-locular; ovules 2, erect. Fruit drupaceous, 1- or 2-seeded.

A genus of c. 96 species, mainly Australian but also pantropical, particularly in littoral habitats; c. 71 species in Australia, of which 1 widespread tropical species is also on Christmas Is. and Cocos (Keeling) Is.

Scaevola taccada (Gaertn.) Roxb., *Hort. Bengal.* 15 (1814)

Lobelia taccada Gaertn., *Fruct. Sem. Pl.* 1: 119, t. 25, fig. 5 (1788). T: 'e collect. sem. hort. lugdb.'; holo: L *n.v., fide* C.Jeffrey, *Kew Bull.* 34: 543 (1980).

S. sericea Vahl, *Symb. Bot.* 2: 37 (1791). T: 'Habitat in Savage Island, Dn. *Prof. Fabricius*', coll. *G.Forster*; holo: C *n.v., fide* C.Jeffrey, *loc. cit.*

S. koenigii Vahl, *Symb. Bot.* 3: 36 (1794); *Lobelia sericea* var. *koenigii* (Vahl) Kuntze, *Revis. Gen. Pl.* 2: 377 (1891); *S. frutescens* var. *koenigii* (Vahl) Domin, *Biblioth. Bot.* 89: 646 (1929); *S. lobelia* L. ex Vriese, *Ned.*

Kruidk. Arch. 2: 20 (1850), *nom. illeg.* T: India, *J.G.Koenig*; holo: C *n.v., fide* C.Jeffrey, *loc. cit.*

S. frutescens K.Krause, *Pflanzenr.* 54: 125 (1912), *nom. illeg.* T: Niue Is., *G.Forster*; holo: C *n.v., fide* C.Jeffrey, *loc. cit.*

Illustrations: P.W.Leenhouts, *Fl. Males.* ser. I, 5: 340, fig. 3, 341, fig. 4 (1957); A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 136 (1985); T.Low, *Bush Medicine* 168 (1990).

Shrub or tree to 5 m; branchlets to 1 cm diam., glabrous except hair tufts in leaf axils. Leaves alternate, obovate, entire, obtuse, sometimes emarginate; lamina 9–23 cm long, tapering into petiole. Inflorescence to 8 cm long. Calyx tube cup-shaped to campanulate, 3–6 mm long, silky; lobes narrowly oblanceolate to linear, 3–5 mm long. Corolla 18–25 mm long, silky, greenish outside, white with pale brown hairs towards base inside; lobes obovate, 8–12 mm long. Fruit subglobose to obovoid, obscurely 5- or 10-ribbed, 8–13 mm long, white. *Cabbage Tree, Kayu Kankong*. Figs 3, 73.

Christmas Is., Cocos (Keeling) Is. Grows on coralline limestone cliff tops on Christmas Is. On Cocos (Keeling) Is. grows in strand shrub or forest communities with *Argusia argentea* in calcareous sand and coral rubble, and common in regrowth in *Cocos* plantations. Also widespread from Madagascar and tropical E Africa across the islands of the Indian Ocean, southern Asia, Malesia, tropical Australia and the islands of the Pacific Ocean to the Hawaiian Islands.

Ch.Is.: coastal terrace near Greta Beach, *B.A.Mitchell 7* (AD, CBG, K). C.K.Is.: SE of airstrip, West Is., (Pulo Panjang), 28 Apr. 1983, *A.S.George* (CBG, K); between North Lagoon and ocean beach, West Is., *I.R.Telford 9977 & C.Howard* (AD, CBG).

The corky seeds float and remain viable in seawater for a long time, aiding dispersal by ocean currents and allowing a wide littoral distribution, as reported by H.B.Guppy, *Plants, Seeds and Currents* 227–236 (1917).

81. RUBIACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R.)
A.E.Orchard (M.Is.)

Shrubs or trees, occasionally herbs or climbers. Leaves opposite and frequently decussate, or whorled, simple, entire, pinnately veined; stipules usually distinct and often persistent, interpetiolar, variously modified. Inflorescences cymose, variously combined and modified, or flowers solitary. Bracts usually present. Flowers actinomorphic, usually 4- or 5-merous, usually bisexual, sometimes heterostylous. Sepals connate, forming a tube, sometimes reduced or absent. Corolla often trumpet- to funnel-shaped, with a short to long tube and 4 or 5 (occasionally to 8) contorted, imbricate or valvate lobes. Stamens epipetalous, inserted within or towards apex of corolla tube. Disc often present. Ovary inferior, usually bilocular; ovules 1–many per locule; style slender, sometimes divided. Fruit usually a capsule, drupe or berry, occasionally connate into a syncarp (*Morinda*); seeds usually 2–many. Endosperm present or absent.

A large family of c. 500 genera and c. 6000 species, mainly tropical, with a few extensions into temperate and even arctic regions. Many shrubby species which occur beneath the tropical rainforest canopy belong to this family. There are 9 native or naturalised species in 7 genera on Christmas Is.; 4 genera (4 species) on Cocos (Keeling) Is.; 1 genus (1 species) on Ashmore Reef; 2 genera each with 1 species on Macquarie Is.

Members of this family can usually be recognised by their opposite, entire leaves, their interpetiolar stipules and their tubular flowers with an inferior ovary.

Many species are insect-pollinated, and frequently the flowers are white, sweetly

scented, nectariferous and open during the night, suggesting pollination by moths.

Coffee is the most important commercial crop in this family, mostly obtained from *Coffea arabica* L. The berries are first dried, and the pulp removed from the beans. The characteristic aroma is evident only after the beans have been roasted. Trial specimens of *Coffea liberica* Hiern are cultivated on Christmas Is., although with little success. It can be recognised by its large, opposite leaves, its small axillary clusters of white, scented flowers with a 6–9-lobed corolla, and its small, ellipsoidal, red to black berries containing 2 seeds.

The alkaloid quinine is obtained from the bark of several species of *Cinchona*, from S America. Java and India are large producers of this febrifuge, which is useful in the treatment of malaria.

Several genera contain species of ornamental value. The genus *Gardenia* contains several cultivated species with sweetly scented flowers. Ornamentals cultivated on Christmas Is. include *Mussaenda erythrophylla* Schumach. & Thonn., and *Ixora coccinea* L. (Flame of the Woods). The former is a shrub with bright yellow, star-shaped, 5-lobed, tubular flowers each subtended by a large, pink, rounded, felty, calyx lobe. The latter is a shrub with red, pink or orange, star-shaped, 4-lobed, tubular flowers in rounded heads 5–10 cm across.

G.Bentham, Rubiaceae, *Fl. Austral.* 3: 399–447 (1867); T.F.Cheeseman, Rubiaceae, *Vasc. Fl. Macquarie Is.* 28 (1919); B.W.Taylor, Rubiaceae, *Fl. Veg. Soils Macquarie Is.* 133–134 (1955); H.H.Allan, Rubiaceae, *Fl. New Zealand* 1: 559–593 (1961); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Rubiaceae, *Fl. Java* 2: 274–257 (1965); B.Verdcourt, *Fl. Trop. E. Africa*, Rubiaceae 1: 1–414 (1976); B.Verdcourt, Notes on Mascarene Rubiaceae, *Kew Bull.* 37: 521–574 (1983); C.J.Webb *et al.*, Rubiaceae, *Fl. New Zealand* 4: 1142–1150 (1988).

KEY TO TROPICAL GENERA

1 Climbing shrubs; leaves unpleasantly foetid when crushed; flowers c. 1 cm long, campanulate, cream with a purple throat, and purple hairs within; fruit a brittle-coated, glossy drupe, 4–6 mm diam., with 2 pyrenes **6. PAEDERIA**

1: Herbs, shrubs or trees; leaves not foetid; flowers and fruits not as above

2 Herbs

3 Flowers solitary or in lax, 2–6-flowered umbels; peduncles and pedicels long and slender; capsule with many seeds **1. OLDENLANDIA**

3: Inflorescences sessile, of dense clusters of sessile flowers and fruits; capsule with 2 seeds **7. SPERMACOCE**

2: Shrubs or trees

4 Stipules small, with 2 apical bristles; corolla lobes 4 **5. AMARACARPUS**

4: Stipules entire; corolla lobes 5–8

5 Branchlets 4-angled; stipules triangular to spathulate, connate and encircling stem; inflorescence of several flowers with the ovaries fused into a fleshy capitulum, replacing one leaf of each pair and appearing leaf-opposed; fruit a whitish, foetid, fleshy syncarp, c. 2–10 cm long **4. MORINDA**

5: Branchlets terete; stipules not as above; inflorescence of several free flowers, not appearing leaf-opposed; fruit a red berry or a whitish drupe, up to 2 cm diam.

6 Shrubs; leaves elliptic, narrow, ±glabrous, glossy; corolla tube c. 0.4–0.6 cm long; corolla lobes 5; fruit a red berry, 7–9 mm diam., with many seeds **2. AIDIA**

6: Trees; leaves broadly obovate to subcircular, softly pubescent on the veins beneath; corolla tube c. 1.5–3 cm long; corolla lobes 7–8; fruit a whitish drupe, c. 2 cm diam., thinly fleshy, with a large, 4–6-lobed, corky pyrene; seeds 4–9 **3. GUETTARDA**

KEY TO SUBANTARCTIC GENERA

Shrubs; leaves opposite **8. COPROSMA**

Perennial herbs; leaves in whorls of 4 **9. GALIUM**

1. OLDENLANDIA

Oldenlandia L., *Sp. Pl.* 1: 119 (1753); *Gen. Pl.* 5th edn, 55 (1754); after H.B.Oldenland, a Danish naturalist who worked in South Africa towards the end of the 17th century.

Type: *O. corymbosa* L.

Prostrate to erect herbs or subshrubs; stems often 4-angled. Leaves opposite; stipules sheathing, often adnate to petiole, often fimbriately lobed. Inflorescence axillary or terminal, lax to dense, or flowers solitary. Flowers pedicellate or sessile, often heterostylous, bisexual. Calyx lobes 4, small. Corolla small, funnel- or bell-shaped; tube usually short with hairy throat; lobes 4, ±spreading. Disc minute. Stamens 4, inserted in corolla tube or at its apex; anthers exserted or not. Ovary bilocular; locules with many ovules; style filiform, exserted or not; stigma bilobed. Fruit a 2-valved capsule, with persistent calyx lobes; seeds many.

A large genus of c. 150 species; 2 species, probably introduced, occur on Christmas Is. Sometimes included in *Hedyotis* L., which with this and several other related genera, form a complex group without a universally accepted taxonomic treatment. The nomenclature given here follows B.Verdcourt, *Fl. Trop. E. Africa,* Rubiaceae 1: 1–41 (1976).

C.E.B.Bremekamp, The African species of *Oldenlandia* L., *Verh. Kon. Ned. Akad. Wetensh., Afd. Natuurk.* ser. 2, 48: 1–297 (1952).

Plant suberect to prostrate; leaves narrowly elliptic to linear, c. 6–21 mm long; flowers mostly in pedunculate, umbellate clusters of 2–6, also solitary, often with several flowers and inflorescences from each axil **1. O. corymbosa**

Plant prostrate, mat-forming; leaves elliptic, c. 4–8 mm long; flowers solitary in leaf axils **2. O. pumila**

1. *Oldenlandia corymbosa L., *Sp. Pl.* 1: 119 (1753)

T: illustration of *Oldenlandia humilis hyssopifolia* in C.Plumier, *Nova Plantarum Americanum Genera* 42, t. 36 (1703). Epithet is a botanical term derived from the Latin *corymbus* (a bunch), used to describe a racemose inflorescence in which the lower flowers have longer pedicels, so that the inflorescence is dome-shaped.

Illustrations: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 651 (1973); B.Verdcourt, *Fl. Trop. E. Africa,* Rubiaceae 1: 27, fig. 41, no. 33 (1976).

Suberect to prostrate, lax, annual herb to c. 50 cm tall; stems glabrous. Leaves usually narrowly elliptic to linear, apiculate; margins often recurved, minutely rough-hairy; lamina 6–25 mm long; stipules c. 1 mm long, with 3–5 long, reddish bristles. Flowers usually in umbellate clusters of 2–8, sometimes solitary, often several flowers and inflorescences from axil; peduncle 2–17 mm long; pedicels c. 2–6 mm long, very slender. Calyx lobes narrowly triangular, c. 1 mm long, acute, minutely toothed. Corolla white or pale purple; tube c. 0.75 mm long; lobes ovate, obtuse, c. 1 mm long. Anthers in corolla throat. Capsule c. 1.5 mm long, bilobed, slightly bilaterally compressed; seeds many, brown.

Christmas Is., Cocos (Keeling) Is. A weed on roadsides and around habitation, and also as a colonising species in quarries on Christmas Is. On Cocos (Keeling) Is. grows in open areas

Figure 85. **A–F**, RUBIACEAE. **A–B**, *Aidia* aff. *racemosa*. **A**, flowering branchlet X0.5; **B**, flower X2 (**A–B**, D.Powell 34, K). **C–D**, *Amaracarpus pubescens*. **C**, flowering branchlet X0.5; **D**, flower X3 (**C–D**, D.Powell 332, K). **E–F**, *Oldenlandia pumila*. **E**, flowering plant X0.5; **F**, flower and pair of leaves X3 (**E–F**, D.Powell 556, K). Drawn by E.Catherine.

in coralline sand or coral rubble. A pantropical weed of waste and disturbed ground and cultivated land. Probably only native in America, Africa and SE Asia; also naturalised in northern Australia.

Ch.Is.: trackside near sea, Settlement area, *D.J. & B.P.Du Puy CI102* (CBG, K). C.K.Is.: SE of airstrip, West Is., *A.S.George 16322* (CBG, K); E verge of airstrip, West Is., *D.G.Williams 84* (CBG, DNA); at main jetty, Home Is., *D.G.Williams 178* (CBG, PERTH).

2. ***Oldenlandia pumila** (L.f.) DC., *Prodr.* 4: 425 (1835)

Hedyotis pumila L.f., *Suppl. Pl.* 1: 119 (1781). T: Tranquebar, India, *J.G.Koenig*; holo: not located. Epithet from the Latin *pumilio* (a dwarf), indicating the short, prostrate growth habit of this species.

Illustration: B.Verdcourt, *Fl. Trop. E. Africa*, Rubiaceae 1: 271, fig. 41, no. 32 (1976).

Prostrate, mat-forming, annual herb; stems minutely rough-hairy on angles. Leaves elliptic, acute; margins minutely hairy; lamina c. 4–8 mm long; stipules c. 1 mm long, with 3–5 long bristles. Flowers solitary, axillary; pedicels 4–8 mm long, slender. Calyx lobes triangular, c. 1 mm long; acute, minutely toothed. Corolla white; tube c. 1 mm long; lobes ovate, obtuse, c. 1 mm long. Anthers in corolla throat. Capsule obovoid, c. 2 mm long, slightly bilaterally compressed; seeds many, minute, brown. Fig. 85E–F.

Christmas Is. On grassy roadsides in the north-east of the island. An Asian species, native to India, Indo-China and western Malesia. It also occurs in Africa and the West Indies as an introduced weed.

Ch.Is.: Drumsite, *D.A.Powell 556* (K).

2. AIDIA

Aidia Lour., *Fl. Cochinch.* 143 (1790); from the Greek *aidios* (eternal, everlasting), noting the durability of the wood.

Type: *A. cochinchinensis* Lour.

Small trees, shrubs, climbers or stranglers. Leaves opposite, usually with some leaves reduced; stipules small, entire. Inflorescence cymose, axillary, at alternate nodes along branchlets, with subtending leaf usually reduced, sometimes appearing leaf-opposed, or from leafless nodes. Flowers usually 5-merous, sessile or pedicellate. Calyx tube short, weakly lobed. Corolla ±trumpet-shaped; tube distinct, hairy inside at apex within; lobes imbricate. Disc glabrous. Stamens inserted near apex of corolla tube; anthers exserted. Ovary bilocular, with many ovules; style prominently exserted; stigma bilobed, the lobes sometimes cohering. Fruit a small, spherical berry, with many angular seeds.

An inadequately known genus of c. 50 species, distributed from the tropics of Africa and SE Asia, through Malesia to Australia (Qld); 1 shrubby species occurs on Christmas Is.

K.M.Wong, The genera of Peninsular Malaysian Rubiaceae formerly confused with *Randia*, *Malayan Nat. J.* 38: 1–57 (1984); D.D.Tirvengadum & C.Sastre, Étude taxonomique et systèmes de ramification chez *Aidia* et genres asiatiques affins, *Adansonia* 3: 257–296 (1986).

Aidia aff. **racemosa** (Cav.) Tirveng., *Nordic J. Bot.* 3: 455 (1983)

Stylocoryna racemosa Cav., *Icon.* 4: 16, t. 368 (1797). T: Manila, Philippines, *L.Née s.n.*; lecto: MA *n.v.*, *fide* D.D.Tirvengadum & C.Sastre, *op. cit.* 262. Epithet is an inaccurate description of the inflorescence of this species, which is usually branched and cymose.

Randia densiflora var. *laxior* Baker f. in C.W.Andrews, *Monogr. Christmas Is.* 179 (1900). T: Christmas Is., 1898, *C.W.Andrews s.n.*; holo: K.

[*A. cochinchinensis auct. non* Lour.: K.M.Wong, *Malayan Nat. J.* 38: 10–16 (1984), *p.p.*]

Shrub to c. 4 m tall. Leaves elliptic, acute at base, shortly acuminate, ±glabrous,

subcoriaceous, glossy; lamina usually 10–18 cm long; petiole 5–17 mm long; stipules triangular, acuminate. Inflorescences usually from alternate nodes along branchlets, in axils of reduced leaves, 1.5–10 cm long, cymose, rather lax, much-branched, the terminal divisions cincinnoid; peduncle 7–17 mm long; pedicels 3–8 mm long. Flowers scented. Calyx tube c. 1 mm long, weakly 5-toothed, persistent in fruit. Corolla trumpet-shaped, white becoming pale yellow; tube 4–6 mm long, pilose at apex inside; lobes 5, narrowly oblong, 8–10 mm long, spreading. Anthers 5, linear, exserted. Stigma narrowly fusiform. Berry 7–9 mm diam., red. *Wild Coffee*. Figs 77, 85A–B.

Christmas Is. Occurs all over the island as an important constituent of the shrub layer along overgrown tracks and drill lines in the taller forests. It is especially common on the lower and shore terraces, where it can form thickets beneath the more open canopy.

Ch.Is.: no precise locality, *J.P.Maclear s.n.* (K); no precise locality, *H.N.Ridley 37* (K); Ross Hill garden area, *D.A.Powell 34* (K); track to Dolly Beach, *A.Pearson P69* (K); in rainforest along walk to West White Beach, *R.Shivas 922* (PERTH); central plateau, *R.Shivas 801* (PERTH).

H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 197 (1906) recorded that the stems of this species make good walking sticks. Plants can often be detected by the strongly perfumed flowers.

The taxonomy of *Aidia* is not resolved. The specimens from Christmas Is. were placed in *A. cochinchinensis* Lour. by K.M.Wong, *loc. cit.* However, in a recent taxonomic study by D.D.Tirvengadum & C.Sastre (*Adansonia* 3: 257–296, 1986), a key is given to three species, 'previously confused with *A. cochinchinensis*'. The specimen from Christmas Is. can be identified as *A. racemosa* (Cav.) Tirveng. *Aidia racemosa* is from the Philippines. The distribution maps of the three species treated by D.D.Tirvengadum & C.Sastre do not include Borneo, Java or Christmas Is., and no indication is given of the correct names for the *A. cochinchinensis* sensu Wong in those regions. Furthermore, *Randia densiflora* var. *laxior* Baker f. is absent from the synonymy listed. An examination of the available material of Kew has not allowed the Christmas Is. specimens to be placed in one of the 15 species listed but not keyed out by Tirvengadum & Sastre. The taxon represented on Christmas Is. is closely related to *A. racemosa*, and may be conspecific with it. It is therefore named accordingly here, pending a full revision of the genus. F.R.Fosberg (*pers. comm.*) suggests that this complex should be included in *A. cochinchinensis* Lour. *s. lat.*

3. GUETTARDA

Guettarda L., *Sp. Pl.* 2: 991 (1753); *Gen. Pl.* 5th edn, 428 (1754); after J.E.Guttard (1715–1786), who supported the work of Linnaeus.

Type: *G. speciosa* L.

Trees or shrubs. Leaves opposite; stipules large, entire. Inflorescence axillary, cymose, with cincinnoid branches; peduncle long. Flowers 4–9-merous, sessile, heterostylous. Calyx tube short, weakly lobed, circumscissile. Corolla trumpet-shaped; tube distinct, often long; lobes imbricate. Disc slightly lobed, nectariferous. Stamens inserted near apex of corolla tube; anthers sessile, linear. Ovary 4–9-locular; locules uniovular; style filiform; stigma capitate. Fruit drupaceous, with circular apical scar; pyrene with 4–9 cavities opening by pores, each with 1 seed.

A mainly New World genus of c. 50 species; 1 species widespread around the coast of SE Asia and Australia and also on Christmas Is., Cocos (Keeling) Is. and Ashmore Reef.

Guettarda speciosa L., *Sp. Pl.* 2: 991 (1953)

T: Java or India, Herb. C.Linnaeus 1121.1; syn: LINN. Epithet from the Latin *speciosus* (beautiful, splendid, imposing), in reference to the large, white, scented flowers.

Illustration: A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 188, 279 (1985).

Tree or shrub 3–15 m tall. Leaves broadly obovate to circular, rounded to shallowly cordate

at base, rounded or obtuse, very shortly acuminate, softly pubescent especially on veins beneath; lamina c. 8–30 cm long; petiole 2.5–5 cm long; stipules large, ovate. Inflorescence a capitulum with peduncle c. 2–15 cm long; rachis branches to 3 cm long. Flowers highly fragrant. Calyx tube campanulate, truncate or sinuate at apex, 3–5 mm long, caducous. Corolla trumpet-shaped, white; tube 1.5–3 cm long, velvety-pubescent, pilose within; lobes usually 7 or 8, obovate, 10–14 mm long, spreading. Anthers 7 or 8, sessile in corolla tube. Drupe c. 2 cm diam., thinly fleshy, fibrous, whitish; pyrene large, corky; cavities 4–6. Fig. 76.

Christmas Is., Cocos (Keeling) Is., Ashmore Reef. On Christmas Is. common on the shore terrace, often near the sea cliffs, and on the higher terraces, especially on the northern and western sides of the island. On Cocos (Keeling) Is. common in *Cocos* plantations in coralline sand on the main atoll. Rare on Ashmore Reef, where a single plant has been recorded. A widely distributed seashore tree, occurring from eastern Africa and SE Asia through Malesia to Australia (Qld) and the Pacific islands.

Ch.Is.: along NE coast road to Waterfall, *R.Shivas 875* (PERTH); shore terrace, Rocky Point, *A.Pearson & D.A.Powell P81* (K). C.K.Is.: between North Lagoon and ocean beach, West Is., *I.R.Telford 9976 & C.Howard* (AD, CBG, K); near N end of airstrip, West Is., *A.S.George 16262* (BR, CBG, K, P). A.R.: Middle Is., *D.B.Carter* 9 (CBG); Middle Is., *K.F.Kenneally 6361* (PERTH).

The strongly fragrant, night-opening, white flowers are probably moth-pollinated, although D.A.Powell noted that the flowers are visited by the small White-Eye birds (*Zosterops*) in the early morning. The white fruit is often seen on the forest floor, and is eaten and dispersed on Christmas Is. by the red crabs (*Gecarcoidea natalis (Pocock)*). The corky, lobed pyrene, often with some fibrous material still attached, is common among the flotsam on Christmas and Cocos (Keeling) Is. indicating the normal method of dispersal for this species. The timber is reputed to be durable and has been used in house construction on Cocos (Keeling) Is.

4. MORINDA

Morinda L., *Sp. Pl.* 1: 176 (1753); *Gen. Pl.* 5th edn, 81 (1754); from the Latin *morus* (mulberry), and *Indicus* (Indian), as the compound fruit somewhat resembles a mulberry.

T: *M. royoc* L.

Trees or erect to scandent shrubs. Leaves opposite, with pubescent acarodomatia in the abaxial axils of main veins; stipules large, entire. Inflorescence axillary or replacing one of a leaf pair, pedunculate; ovaries fused into a fleshy capitulum. Flowers usually 5-merous, sessile, densely crowded, heterostylous. Calyx tube short, usually truncate. Corolla trumpet-shaped; tube distinct; lobes keeled inside, valvate. Disc annular, glabrous. Stamens inserted in corolla tube; filaments short. Ovary 2–4-locular; locules uniovular; style bilobed. Fruit a drupe with a single pyrene; aggregated fruits of inflorescence form a fleshy syncarp.

A pantropical genus containing c. 80 species, 6 of which occur in Australia; 1 species on Christmas Is. and Cocos (Keeling) Is. Several species yield a red dye from the bark of their roots, which resembles the dye madder obtained from *Rubia tinctorium* L.

Morinda citrifolia L., *Sp. Pl.* 1: 176 (1753)

T: illustrations in Herb. P.Hermann vol. 5, fol. 16, 336, no. 82; syn: BM; Herb. C.Linnaeus 236.1; syn: LINN. Epithet from *Citrus*, a genus of plants in the Rutaceae (including oranges, lemons etc.), and the Latin *folium* (a leaf), the glossy leaves of this species somewhat resembling those of a species of *Citrus*.

Illustrations: A.B.Graf, *Tropica* 862, 870 (1978); A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 189 (1985).

Tree or shrub to c. 10 m tall; branchlets 4-angled. Leaves elliptic, acute at base, acute to obtuse and mucronate, pubescent only in abaxial vein axils, glossy; lamina c. 8–30 cm long; petiole 0.6–2 cm long; stipules triangular to spathulate, connate, encircling stem. Capitulum replacing one of a leaf pair, appearing leaf-opposed, 0.5–2.5 cm diam., irregularly

subspherical; peduncle c. 2–4 cm long. Calyx a narrow, usually entire, rim, sometimes expanded into a spathulate lobe to 2.5 cm long. Corolla trumpet-shaped, white; tube c. 9 mm long, pilose within; lobes 5, elliptic, c. 5 mm long, acute, spreading. Anthers 5, exserted or enclosed. Syncarp irregularly elliptic, c. 2–10 cm long, fleshy, whitish, foetid. *Cheese Fruit, Mengkudu*. Fig. 72.

Christmas Is., Cocos (Keeling) Is. Common on Christmas Is. on the coastal terrace of North East Point, and on other terraces and occasionally on the plateau. On Cocos (Keeling) Is., common in *Cocos* plantations in coralline sand on the main atoll. A widespread species distributed from SE Asia, through Malesia to the Pacific islands and northern Australia (N.T., Qld); also on the islands of the Caribbean.

Ch.Is.: Flying Fish Cove, *C.W.Andrews 78* (K); Waterfall Rd, near Chinese cemetery, *A.Pearson P75* (K); eastern side of Smith Point, shore terrace, *D.J. & B.P.Du Puy CI98* (CBG, K). C.K.Is.: SE of airstrip, West Is., 28 Apr. 1983, *A.S.George s.n.* (BR, CBG, K); between North Lagoon and Ocean Beach, West Is., *I.R.Telford 9967 & C.Howard* (CBG, K).

This species is cultivated in Java for its root bark, which yields a permanent red dye used in the batik industry. Bark has been exported to Java from Cocos (Keeling) Is. in the past. It is also used as a dye plant on the Pacific islands and to some extent throughout Malesia. The root bark must be boiled in dilute acid to yield the dye. The fruit has been used medicinally in Malesia for urino-genital complaints, and although edible has an unpleasant odour and flavour.

5. AMARACARPUS

Amaracarpus Blume, *Bijdr.* 954 (1827); from the Greek *amara* (a canal) and *karpos* (a fruit), describing the lightly channelled dorsal surface of the pyrenes.

Type: *A. pubescens* Blume

Shrubs. Leaves opposite, often in 1 plane; stipules with apical bristles. Flower solitary, terminal on greatly reduced lateral shoots, appearing sessile in leaf axils, 4-merous, subtended by several bracts, stipules and reduced leaves. Calyx tube obconical, deeply lobed; lobes unequal. Corolla funnel-shaped; tube distinct; lobes valvate. Disc hemispherical, large, glabrous. Stamens inserted near corolla tube apex; anthers subsessile. Ovary bilocular; ovules 1 per locule; style shortly bilobed. Fruit drupaceous, with 2 pyrenes.

A genus of c. 40 species, distributed from the Seychelles through Indo-China and Malesia to New Guinea and the Pacific islands (Polynesia); 1 species on Christmas Is. There is a large concentration of species in New Guinea.

Amaracarpus pubescens Blume, *Bijdr.* 954–955 (1827)

T: Java, *C.L.Blume*; holo: ?L *n.v.* Epithet is the Latin for pubescent, in reference to the shortly hairy twigs and the veins on the underside of the leaf.

Saprosma nativitatis Baker f. in C.W.Andrews, *Monogr. Christmas Is.* 180 (1900). T: Christmas Is., 1898, *C.W.Andrews s.n.*; holo: K.

Small shrub 0.5–2 m tall; branchlets shortly hairy. Leaves in one plane or appearing whorled on short, lateral shoots, elliptic, acute at base and apex, sparsely pubescent, especially on abaxial veins; lamina 1.5–7 cm long; petiole c. 2–5 mm long; stipules ovate, 2–5 mm long, with 2 apical bristles. Flowers solitary, inconspicuous, apparently axillary, sessile among crowded leaves, stipules and bracts of the short lateral shoots. Calyx lobes triangular, c. 0.5–2 mm long, sometimes acuminate, unequal, persistent in fruit. Corolla white; tube c. 5 mm long, slightly flared, hairy at apex inside; lobes c. 3 mm long, obtuse, not fully spreading. Anthers oblong, shortly exserted. Drupe subspherical, c. 5 mm diam., red; pyrenes 2. Fig. 85C–D.

Christmas Is. Forms part of the low, often sparse shrub layer in the tall primary rainforest in deep soil. The most widespread species in the genus, distributed from the Nicobar Islands

and Indo-China through Malesia and the Philippines to New Guinea.

Ch.Is.: no precise locality, *C.W.Andrews s.n.* (K); plateau, *H.N.Ridley 33* (K); low understorey of rainforest, *D.A.Powell 332 & 332A* (K).

6. PAEDERIA

Paederia L., *Mant. Pl.* 1: 7, 52 (1767), *nom. cons.*; from the Latin *paedor* (filth), as the bruised plant emits an unpleasant odour.

Type: *P. foetida* L.

Climbing shrubs; stems twining. Leaves opposite or in whorls of 3, foetid when crushed; stipules entire. Inflorescence axillary, much-branched. Flowers 5-merous, pedicellate. Calyx tube short, weakly toothed. Corolla funnel-shaped; tube distinct, hairy within; lobes valvate. Disc small, glabrous. Stamens short, inserted in corolla tube; anthers not exserted. Ovary bilocular; ovule 1 per locule; stigmas 2, filiform, twisted. Fruit drupaceous, with a brittle exterior; pyrenes 2.

A genus of c. 50 climbing shrubs distributed throughout the tropics; 1 species locally naturalised on Christmas Is.

*Paederia foetida L., *Mant. Pl.* 1: 52 (1767)

T: India, Herb. C.Linnaeus 294.1, 294.2 & 294.3; syn: LINN; illustration in G.E.Rumphius, *Herb. Amboin.* 5: t. 160 (1741); syn, *fide* B.Verdcourt, *Kew Bull.* 37: 543–544 (1983). Epithet from the Latin *foetidus* (stinking), as the crushed leaves emit an unpleasant odour.

Illustrations: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 664 (1973).

Climbing shrub to 4 m tall. Leaves ovate to oblong, rounded to cordate at base, shortly acuminate, pubescent, foetid; lamina c. 3–8 cm long; petiole c. 1–3 cm long; stipules triangular. Inflorescences axillary in both axils of each leaf pair, also terminal, c. 5–15 cm long, lax, often with reduced leaves. Calyx tube c. 1 mm long, 5-toothed. Corolla campanulate, cream with purple throat; tube 8–10 mm long, purple-hairy within, white-floccose outside; lobes c. 2 mm long, flared, with margins tightly undulate. Anthers at various levels in corolla tube. Drupe spherical, 4–6 mm diam., brittle, with persistent calyx and domed disc, orange-yellow becoming black, glossy; pyrenes 2. *Daun Kentut*.

Christmas Is. Occasionally occurs as a naturalised plant on the island and has recently been recorded from the vicinity of the disused picture theatre. A widespread, Old World species probably occurring from India, China and Japan through Indo-China to Malesia, and naturalised elsewhere (Mascarenes, N America, Hawaii).

Ch.Is.: close to disused dwelling, Grants Well, *D.A.Powell 360* (K); waste ground, Drumsite, *D.A.Powell 538* (K); in secondary growth beside disused cinema, Drumsite, *D.J. & B.P.Du Puy CI13* (CBG, K).

This species is treated here in the broad sense. It has frequently been confused with a second species, with larger and slighty compressed fruit, and it is therefore difficult to give precise distributions for the two. The use of *P. foetida* L. for the small-fruited species follows the tentative conclusions drawn by B.Verdcourt, *Kew Bull.* 37: 543 (1983), pending a more comprehensive revision of the complex.

The crushed leaves of this species are unpleasantly foetid due to the presence of paederoside (an iridoid glycoside). They also contain at least two alkaloids. The plant is an ancient widely-used Malaysian, Indonesian and Chinese medicine, chiefly used to treat intestinal complaints. The leaves may be pounded and infused in water, or cooked with other food to disguise the odour.

7. SPERMACOCE

Spermacoce L., *Sp. Pl.* 1: 102 (1753); *Gen. Pl.* 5th edn, 44 (1754); from the Greek *sperma* (seed) and *akoke* (a point), due to either the elongated seed shape or the calyx teeth which persist on the apex of the capsule.

Type: *S. tenuior* L.

Prostrate to erect herbs or subshrubs; stems often 4-angled. Leaves opposite or appearing whorled; stipules sheathing, adnate to petiole, lobed, fimbriate. Inflorescence an axillary or terminal, dense cluster of several flowers, often subspherical. Flowers sessile, not heterostylous. Calyx tube usually 2- or 4-lobed. Corolla trumpet- or funnel-shaped; tube often slender; lobes usually 4, spreading, valvate. Disc minute. Stamens 4, inserted in corolla tube or at its apex; anthers usually exserted. Ovary bilocular; ovules 1 per locule; style filiform, usually exserted; stigma bilobed. Fruit a 2-valved, septate capsule, sometimes indehiscent; seeds 2, longitudinally grooved.

A large genus of c. 100–150 species distributed worldwide, but with greatest diversity in the New World; 2 species on Christmas Is., 1 of which also on Cocos (Keeling) Is. This genus is sometimes considered to be inadequately distinct from *Borreria* G.Mey, but is maintained here as a distinct genus following B.Verdcourt, *Fl. Trop. E. Africa*, Rubiaceae 1: 341 (1976).

Erect to ascending herb; stems obtusely 4-angled; flowers small; corolla lobes c. 1.3 mm long; calyx 4-lobed; capsule c. 3 mm long, with 4 apical, persistent calyx lobes **1. S. assurgens**

Prostrate to ascending herb; stems 4-angled, each angle with a narrow, hairy wing; flowers minute; corolla lobes c. 0.35 mm long; calyx 2-lobed; capsule c. 1 mm long, with 2 apical, persistent calyx lobes **2. S. mauritiana**

1. *Spermacoce assurgens Ruiz & Pav., *Fl. Peru.* 1: 60, t. 92 (1798)

T: Peru, *H.Ruíz Lopez & J.A.Pavón*; syn: L *n.v.*; illustration in L.Plukenet, *Phytographia* t. 136. 4 (1692); syn, *fide* B.Verdcourt, *Kew Bull.* 37: 547 (1983). Epithet from the Latin *assurgere* (to rise), descriptive of the erect or ascending growth habit of this species.

Illustrations: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 674 (1973), as *Borreria laevis*; B.Verdcourt, *Fl. Trop. E. Africa*, Rubiaceae 1: 342, fig. 50, no. 14 (1976), as *S. laevis*.

Erect to ascending annual herb 10–50 cm tall; stems branching mainly from base, obtusely angled. Leaves elliptic, cuneate at base, acute; margins and abaxial veins minutely rough-hairy, often stained dark purple; lamina c. 2–4 cm long; stipules 2–3 mm long, loosely sheathing, minutely fimbriate. Inflorescence a small, sessile, axillary cluster of small flowers and fruits. Calyx tube funnel-shaped, c. 2 mm long, persistent; apex narrowly 4-lobed. Corolla small, white; tube 1.2 mm long, funnel-shaped; lobes 4, 1.3 mm long, acute, spreading. Anthers exserted. Capsule ellipsoidal, c. 3 mm long, dry; seeds 2, wrinkled, chestnut brown.

Christmas Is., Cocos (Keeling) Is. A very common weedy species throughout Christmas Is., in disturbed land, quarries, roadsides and grassy areas around habitation. On Cocos (Keeling) Is., common in *Cocos* plantations and grassed areas in coralline sand. A widespread, tropical weed, probably originating in the New World.

Ch.Is.: no precise locality, *D.A.Powell 319* (K); central plateau, *R.Shivas 806* (PERTH); roadside near Central Workshops, *B.A.Mitchell 95* (CBG, K). C.K.Is.: c. 1 km N of settlement, West Is., *I.R.Telford 9968 & C.Howard* (CBG, K, PERTH); N end of airstrip verge, West Is., *D.G.Williams 14* (CBG, MBA).

This taxon has been widely known as *S. laevis* Lam. (*Borreria laevis* (Lam.) Griseb.), but the type specimen of this name has recently been found to refer to another taxon and the name *S. assurgens* Ruiz & Pav. must be used instead; see B.Verdcourt, *Kew Bull.* 37: 546 (1983).

2. Spermacoce mauritiana Gideon, *Kew Bull.* 37: 547 (1983)

T: Mauritius, *F.W.Sieber, Fl. Maurit. 2,* no. 144; holo: G; iso: probably P *n.v.* Epithet derived from the type being collected from the island of Mauritius, Indian Ocean.

Illustrations: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 671 (1973), as *Borreria ocymoides*; B.Verdcourt, *Fl. Trop. E. Africa,* Rubiaceae 1: 342, fig. 50, no. 19 (1976), as *S. ocymoides*.

Ascending or decumbent, mat-forming, annual herb, c. 5–15 cm tall; stems much-branched, 4-angled, each angle with a narrow, hairy wing. Leaves elliptic, obtuse but finally tapering into petiole at base, obtuse to acute; margins minutely rough-hairy; lamina c. 2–3.5 cm long; stipules c. 3 mm long, loosely sheathing, minutely fimbriate. Inflorescence a small, sessile, axillary cluster of few minute flowers. Calyx tube cup-shaped, c. 0.5 mm long, narrowly 2-lobed, persistent. Corolla minute, white; tube bell-shaped, 0.3 mm long; lobes 4, c. 0.35 mm long, erect with recurved apices. Anthers ±enclosed. Capsule obloid, c. 1 mm long, compressed, bilobed, dry; seeds 2, finely wrinkled, brown.

Christmas Is. This ruderal species is uncommon on the island, occurring along shaded tracks on the plateau, in tall, primary rainforest. Pantropical.

Ch.Is.: middle of a bush track, Jacks Hill, *D.A.Powell 709* (K).

This species is frequently included in *S. ocymoides* Burm.f., but F.R.Fosberg has concluded that it is in fact a species complex, and that separate taxa can be identified, mainly through characters of the seed; see B.Verdcourt, *op. cit.* 547.

8. COPROSMA

Coprosma J.R.Forst. & G.Forst., *Char. Gen. Pl.* 137 (1776); from the Greek *kopros* (dung) and *osme* (a smell), in reference to the disagreeable smell of the crushed leaves and stems of some species.

Type: *C. foetidissima* J.R.Forst. & G.Forst.

Shrubs or small trees, dioecious. Leaves simple and decussate with connate interpetiolar stipules, rarely in whorls of 3. Inflorescence of clusters, cymes, or flowers solitary. Flowers usually unisexual, rarely bisexual. Calyx teeth 4 or 5, usually small, often absent in female flowers. Corolla tubular; lobes valvate. Stamens inserted near base of corolla tube. Styles 2–4. Fruit a 2- or 4-seeded succulent drupe.

A genus of over 90 species. The main centre of diversity is in New Zealand with a secondary centre in Hawaii. It also extends to Borneo, Java, New Guinea, mainland Australia, Tasmania and islands of the Pacific; 1 species extends (as a distinct subspecies) from Australia and New Zealand to the adjacent subantarctic islands.

W.R.B.Oliver, The Genus *Coprosma*, *Bernice P. Bishop Mus. Bull.* 132: 1–207 (1935); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 39 (1984).

Coprosma perpusilla Colenso, *Trans. New Zealand Inst.* 22: 466 (1890)

subsp. **subantarctica** Orchard, *Brunonia* 9: 133–134 (1987)

T: Douglas Point, Macquarie Is., 8 Jan. 1982, *R.D.Seppelt 12442*; holo: HO: iso: MEL. Epithets from the Latin *per-* (very) and *pusillus* (very small), in reference to the habit; and *subantarctica* referring to the distribution.

C. repens Hook.f., *Fl. Antarct.* 1: 22–23 (1844). T: Campbell Is., Dec. 1840, *J.D.Hooker 1595*; lecto: K, *fide* A.E.Orchard, *op. cit.* 133; Auckland Is., Nov. –Dec. 1840, *J.D.Hooker*; syn: K.

[*C. pumila auct. non* Hook.f.: W.R.B.Oliver, *Bernice P. Bishop Mus. Bull.* 132: 33–34 (1935) *p.p.*, subantarctic specimens only.]

Illustrations: B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* pl. 31 (1955), as *C. repens*; A.L.Poole & N.M.Adams, *Trees & Shrubs New Zealand* 185 (1963), as *C. pumila*; A.E.Orchard, *op. cit.* 131, fig. 7.

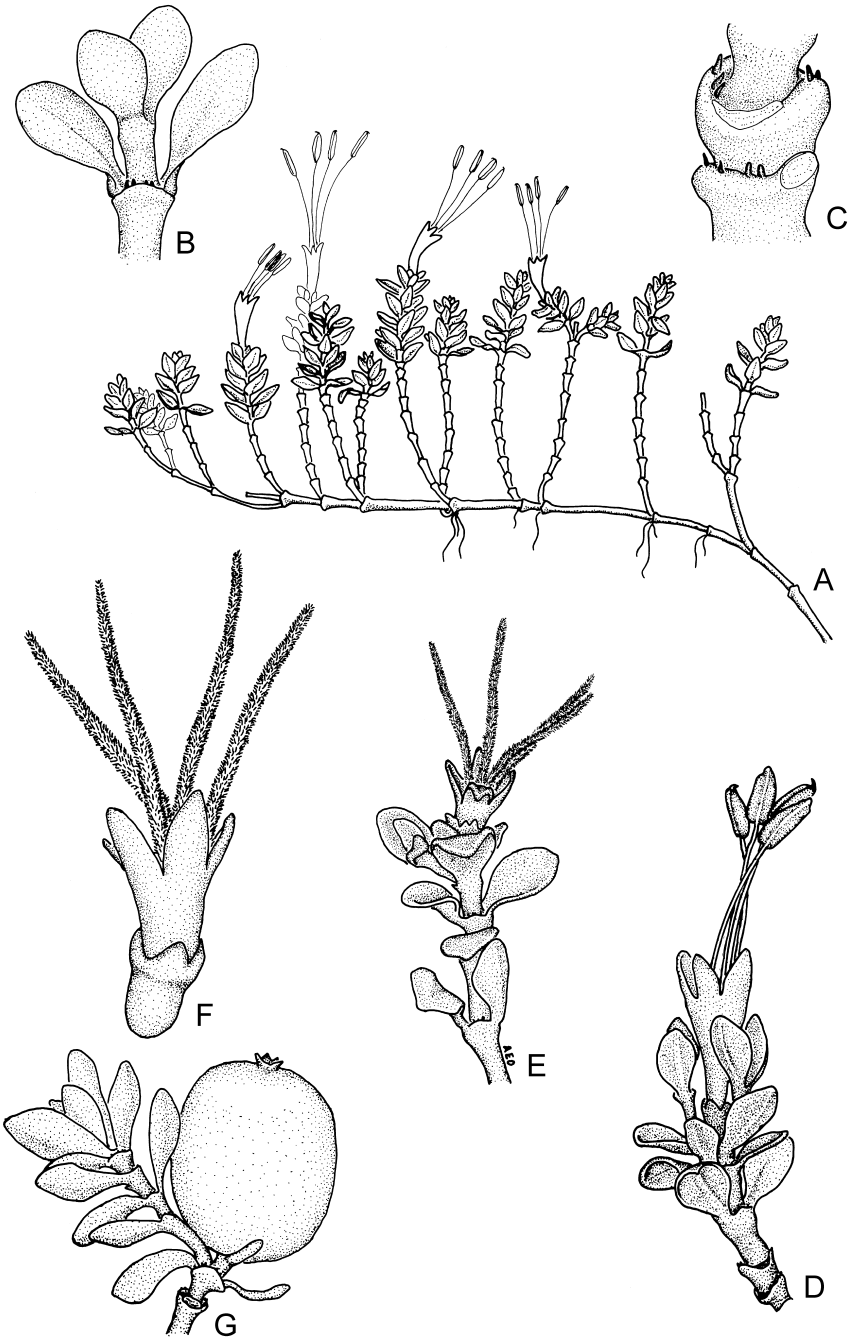

Figure 86. **A–G**, RUBIACEAE: *Coprosma perpusilla* subsp. *subantarctica*. **A**, habit of branch removed from mat X1.75; **B**, young shoot showing stipule characters X6; **C**, portion of old branch with leaves abscissed X22; **D**, shoot with male flower X2.75 (**A–D** D.Leaman & G.Montgomery 18, HO); **E**, shoot with female flower X2.75; **F**, female flower X6 (**E–F**, R.Seppelt 12189, HO); **G**, fruit X2.75 (G.Montgomery & D.Leaman 26, HO). Drawn by A.Orchard.

Prostrate, mat-forming subshrubs; stems rooting at nodes. Leaves crowded, usually lanceolate to oblanceolate or ovate to obovate, usually 4.5–7 mm long (including short petiole), thick, fleshy, bright glossy green, glabrous; abscission zone of petal well-developed; stipules ±rounded, flat or somewhat flared, with up to 7 denticles, occasionally more, glabrous or slightly bearded on margin, hairs never concealing denticles. Flowers solitary, terminal on erect branchlets, unisexual. Male flowers: calyx cupular; stamens 4; female flowers: calyx cupular; styles 3 or 4. Fruits ovoid, globular or depressed-globular, to 11 mm long (usually 4–6 mm), yellow-orange to orange-red, opaque to semi-translucent; pyrenes 3 or 4. *2n* = c. 154, D.M.Moore, *Bot. Not.* 113: 187 (1969). Fig. 86A–G.

Macquarie Is. Formerly widespread in a range of habitats, now more restricted, especially to the raised beach terraces of the west coast, and in the north in *Pleurophyllum* communities, due to rabbit grazing (G.R.Copson, *loc. cit.*). Confined to Macquarie, Auckland, Campbell and Antipodes Islands. Flowers Dec.–Apr.; fruits c. Jan. and persisting for most of the year.

M.Is.: N of Scoble Lake, *R.Filson & P.Atkinson 6343* (MEL); Nuggets Ck, 26 Feb. 1949, *N.R.Laird* (HO); small ridge to NW of Green Gorge, 20 Nov. 1979, *P.M.Selkirk* (NSW); Handspike Corner, *R.D.Seppelt 12189* (HO); Half Moon Bay, 11 Jan. 1951, *B.W.Taylor* (NSW).

Subspecies *subantarctica* differs from subsp. *perpusilla* of mainland Australia, Tasmania and New Zealand in having a well-defined abscission zone at the base of the petiole, and in its broader stipules with more denticles and little or no beard.

9. GALIUM

Galium L., *Sp. Pl.* 1: 105 (1753); *Gen. Pl.* 5th edn, 105 (1754); from the Greek *gala* (milk) alluding to the Greco-Roman use of *Galium verum* to curdle milk.

Type: *G. mollugo* L.

Annual or perennial herbs; stems slender, slightly woody at base, usually 4-angled above. Leaves and stipules similar in size and shape, in whorls of 4–12. Inflorescence a panicle, sometimes reduced to a few-flowered cyme, or flowers solitary in axils of upper leaves, or terminal. Flowers bisexual. Calyx absent or reduced to a ridge. Corolla rotate with a very short tube; lobes 3–5 (usually 4). Stamens 4. Ovary 2-locular; ovule 1 per locule. Styles 2, connate towards base. Fruit dry, splitting at maturity into 2 mericarps, glabrous or with various hairs or bristles.

An almost cosmopolitan genus of 300–400 species with its greatest diversity in temperate and montane tropical regions. One species on Macquarie Is.

D.J.McGillivray, A revison of *Galium* (Rubiaceae) in Australia and New Zealand, *Telopea* 2: 355–377 (1983).

Galium antarcticum Hook.f., *Fl. Antarct.* 1: 303 (1846)

T: Good Success Bay, Tierra del Fuego, *J.Banks & D.Solander*; syn: *n.v.*; Staten Is., *Dr Eights*; syn: *n.v.*; Hermit Is., *J.D.Hooker*; syn: *n.v.*; Falkland Is., *J.S.C.D.D'Urville*; syn: *n.v.*; White Bay, Kerguelen Is., *Dr Robertson*; syn: *n.v.* Epithet from the region of the syntype collections.

Illustration: A.Chastain, La Flore et la Végétation des Iles de Kerguelen, *Mém. Mus. Natl. Hist. Nat. (Paris)* ser. B, Bot. 11: t. 24 (1958).

Weak, perennial herb 4–5 cm tall; main stems prostrate, rooting at nodes, leafless; young stems erect, sparsely branched, leafy, glabrous. Leaves and stipules similar, in whorls of 4, obovate to spathulate, blunt, often minutely notched, 3–4.5 mm long, thick, fleshy, glabrous, green tinged purple. Flowers solitary in upper axils; pedicels 0.8–1.2 mm long. Calyx absent. Corolla pinkish buff; tube 0.3 mm long; lobes 3 or 4, 1.3 mm long. Stamens 3, sometimes 4, 0.5–0.7 mm long. Styles 2, free to base, 0.5–0.6 mm long, yellowish; stigmas capitate. Ovary 0.8 mm long, dark green, glabrous. Fruit not seen.

Macquarie Is. Known from only a single collection from a vegetated bank at the edge of a

lake, in an *Agrostis*/*Luzula*/*Acaena magellanica* association. Extends from S America (Chile and western Argentina S of 48°S lat.) to the Falkland Islands, South Georgia, Crozet, Kerguelen and Macquarie Islands. Flowers Jan.

M.Is.: NW side of Skua Lake, *R.D.Seppelt 12568* (AD, HO, MEL).

82. ASTERACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., C.S.Is.)
A.E.Orchard (M.Is.)

Mostly herbs or shrubs, sometimes climbing; sap sometimes milky. Leaves alternate or opposite, simple or lobed, often toothed or variously dissected, usually pinnately veined; stipules absent. Flowers (florets) crowded on a circular receptacle in few- to many-flowered heads (capitula), each resembling a single flower, sometimes subtended by bracts, enclosed by an involucre of bracts. Florets sometimes all with a tubular, usually 5-toothed corolla, or all with corolla zygomorphically extended into a 1–5-lobed, often brightly coloured ligule, or sometimes the central (disc) florets tubular and bisexual and the marginal (ray) florets ligulate and female or sterile. Stamens 5, epipetalous; anthers connate into a ring. Stigma and style often hairy; stigma bilobed, recurved. Ovary inferior, unilocular, uniovular. Fruit (achene) dry, indehiscent, usually with an apical pappus derived from the modified calyx; pappus of hairs, bristles, awns, scales or a scarious rim. Endosperm sparse or absent.

A huge, cosmopolitan family containing more than 1100 genera, with up to 20,000 species. This family has greatest diversity and importance in seasonal temperate and subtropical regions, especially in rather open habitats. There are c. 200 genera native to Australia; 18 genera (19 species) occur on Christmas Is.; 7 genera (7 species) occur on Cocos (Keeling) Is.; 1 genus (1 species) occurs on the Coral (Sea) Is.; 2 genera (2 species) occur on Macquarie Is.

Many species are annuals or biennials, capable of colonising disturbed land, and some are highly successful weedy species. The success of this family is also due to its ability to produce a wide range of secondary chemicals that effectively discourage many predators. A large proportion of the 18 species on Christmas Is. are pantropical and subtropical weedy species, which have been introduced during this century and have become established following clearance of the forest habitats for mining, roads, settlements and cultivation. Two notable exceptions to this are the native, forest-dwelling species *Blumea lanceolaria* (Roxb.) Druce, and the coastal species *Melanthera biflora* (L.) Wild.

The Asteraceae is alternatively known as the Compositae. It can be divided into two major groups, the *Lactuceae* (*Liguliflorae*) characterised by all florets having a ligulate corolla and by the presence of milky sap, and the *Asteroideae* (*Tubuliflorae*), characterised by the presence of non-ligulate disc florets and usually the absence of milky sap.

Species from many genera are cultivated as ornamentals including *Dahlia* Thunb., *Tagetes* L. (Marigolds) and *Chrysanthemum* L.; as food plants including *Lactuca* L. (Lettuce), *Helianthus* L. (Jerusalem Artichoke, Sunflower), *Cynara* L. (Cardoon, Globe Artichoke); or for their secondary products such as *Helianthus* L. (Sunflower Oil), *Carthamus* L. (Safflower Oil, dyes), *Tanacetum* L. (Pyrethrum insecticides). *Lactuca indica* L. is cultivated as a leaf vegetable on Christmas Is., principally used in soups (*D.A.Powell 573*, K).

Cross-pollination is usually ensured in individual florets by unisexuality, or by a protandrous sequence of development. The anthers are connate in a ring, ripen first, and dehisce inwards. The style lobes are appressed at this stage, then grow through the anther ring and the stylar hairs brush out the pollen. When the style is clear of the anther ring, the

lobes separate, recurve, and expose the inner stigmatic surface which is then receptive to pollen from other flowers.

The pappus is important in the dispersal of the achenes. In many cases it consists of fine hairs that assist wind-dispersal. In other cases the hairs are replaced by awns, bristles or scales that are sometimes barbed or toothed, efficiently attaching the achenes to fur, feathers or clothing.

The systematic arrangement followed here is that of C.Jeffrey, *Compositae Newsletter* 7: 6 (1978).

G.Bentham, Compositae, *Fl. Austral.* 3: 447–680 (1867); T.F.Cheeseman, Compositae, *Vasc. Fl. Macquarie Is.* 28–30 (1919); B.W.Taylor, Compositae, *Fl. Veg. Soils Macquarie Is.* 134–138 (1955); H.H.Allan, Compositae, *Fl. New Zealand* 1: 593–764 (1961); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Asteraceae, *Fl. Java* 2: 362–437 (1965); A.J.C.Grierson in M.D.Dassanayake & F.R.Fosberg (eds), Compositae, *Fl. Ceylon* 1: 111–278 (1980).

KEY TO TROPICAL GENERA

1 Leaves usually opposite

2 Slender, climbing herb to c. 4 m tall; leaves triangular or ovate, often cordate; capitula small, with 4 florets, white, in corymbose inflorescences — **4. MIKANIA**

2: Herb or shrub, not climbing; leaves, capitula and inflorescences not as above

3 Leaves usually 3–5-foliolate; stems 4-angled; achenes linear, 5–8 mm long, black, with apical awns — **16. BIDENS**

3: Leaves simple, toothed or lobed; stems terete, sometimes ribbed; achenes 2–5 mm long, not as above

4 Capitula ±sessile in leaf axils — **15. SYNEDRELLA**

4: Capitula distinctly stalked, axillary or terminal

5 Pappus a whorl of fine, feathery hairs; capitulum solitary, on very long, erect stalks, with 5 or 6 conspicuous, cream or creamy yellow, 2- or 3-toothed ray florets — **17. TRIDAX**

5: Pappus represented by a scarious rim, scales or awns, or absent; capitula several, in branched inflorescences, or if solitary not as above

6 Capitula with a marginal whorl of conspicuous, bright yellow, ligulate ray florets

7 Leaves ovate; capitula terminal, 1–3 on long stalks, sometimes combined into lax, branched inflorescences; plant erect, straggling; among coastal vegetation — **12. MELANTHERA**

7: Leaves mostly 3-lobed; capitulum solitary in leaf axils; plant creeping; on cultivated land — **11. WEDELIA**

6: Capitula without ligulate ray florets, or the ray florets very small, inconspicuous; florets all white, cream or violet

8 Leaves narrowly elliptic, sessile; ray florets minute, white (Ch.Is.) — **10. ECLIPTA**

8: Leaves triangular-ovate, petiolate; ray florets absent

9 Heads solitary or paired, axillary or terminal; involucral bracts leaf-like (C.K.Is., Ch.Is.) — **14. ELEUTHERANTHERA**

9: Heads in corymbose inflorescences; involucral bracts linear or narrowly lanceolate, not leaf-like

10 Annual herb; florets ±length of involucral bracts (C.K.Is., Ch.Is.) **3. AGERATUM**

10: Shrub; florets shorter than involucral bracts (C.K.Is.) **†EUPATORIUM**

1: Leaves alternate

11 Leaves lobed (palmate, lyrate, runcinate, laciniate, lobulate)

12 Leaves usually palmately 3–5-lobed, large, c. 6–25 cm diam.; capitulum large, solitary, bright yellow, with a single marginal whorl of ray florets, each 35–55 mm long **13. TITHONIA**

12: Leaves pinnately lobed (lyrate, runcinate, laciniate, lobulate); capitula much smaller, few to many in clusters or compound inflorescences

13 Leaves deeply laciniate with narrow, acute lobes, aromatic, dark green above, whitish beneath; capitula mostly sessile; pappus absent **18. ARTEMISIA**

13: Leaves not as above; capitula stalked; achenes with a distinct pappus of hairs

14 Leaves many, linear, upper leaves entire, lower leaves serrate to lobulate; capitula small; involucre 3.5–4 mm long **7. CONYZA**

14: Leaves not as above; capitula larger; involucre c. 9–12 mm long

15 All florets distinctly ligulate, yellow; achenes compressed; sap milky **1. SONCHUS**

15: All florets tubular, achenes not compressed; sap not milky

16 Involucral bracts 15–20; florets brick red (Ch.Is.) **20. CRASSOCEPHALUM**

16: Involucral bracts 7–10; florets pink to purple (C.K.Is.) **21. EMILIA**

11: Leaves not lobed, ±entire to strongly toothed

17 Branched shrubs

18 Leaves c. 2.5–6 cm long, obovate, sparsely and minutely pubescent **9. PLUCHEA**

18: Leaves c. 5–20 cm long, narrowly elliptic, covered in a whitish, felty indumentum **8. BLUMEA**

17: Erect herbs, often unbranched except the terminal inflorescence

19 Unbranched herb 0.7–2 m tall; leaves c. 10–30 cm long, narrowly obovate, strongly serrate with unequal teeth, dark green glossy; inflorescence erect, unbranched, with clusters of 1–4 capitula from the axils of leafy bracts **8. BLUMEA**

19: Herbs less than 0.8 m tall, usually much shorter; leaves less than 10 cm long, not as above; inflorescence usually branched, or capitula in a terminal cluster

20 Leaves linear to narrowly spathulate or narrowly elliptic

21 Basal leaves deeply toothed, upper leaves narrower and entire; capitula cream **7. CONYZA**

21: Leaves ±entire, or very shallowly toothed towards apex; capitula violet **5. ASTER**

20: Leaves broad, ovate to rhomboid or elliptic

22 Capitula violet; involucre c. 4 mm long; bracts free, somewhat spreading, in several successively shorter whorls **2. VERNONIA**

22: Capitula brick red; involucre 10–12 mm long; inner bracts coherent at their margins to near the apex, forming a cylinder **20. CRASSOCEPHALUM**

†*Eupatorium inulifolium* Kunth has been cultivated at the settlement on West Is., Cocos (Keeling) Is., and is possibly naturalised there.

KEY TO SUBANTARCTIC GENERA

Stout herbs with entire leaves	**6. PLEUROPHYLLUM**
Prostrate creeping herbs with tripinnate leaves	**19. COTULA**

1. SONCHUS

Sonchus L., *Sp. Pl.* 2: 793 (1753); *Gen. Pl.* 5th edn, 347 (1754); from the ancient Greek name *sonchos*, and the Latin *sonchus*, originally used to refer to a thistle-like plant, and gradually further defined to its present usage for this genus.

Type: *S. oleraceus* L.

Annual, biennial or perennial herbs, or subshrubs; sap milky. Leaves alternate, entire, toothed or lobed, sometimes spiny; lower leaves tending to form a rosette; petiole winged; stem leaves usually sessile, auriculate. Capitula usually clustered on a long stalk in a terminal, branched inflorescence; involucre ±campanulate; bracts in several whorls, the outer whorls smaller; receptacle minutely tuberculate. Florets all ligulate; corolla narrowly tubular, expanding into strap-shaped ligule, 5-toothed, yellow. Achene narrowly obovoid, compressed, usually 3-ribbed on each surface, sometimes tuberculate; pappus a whorl of slender, persistent hairs and coarser, caducous hairs.

A genus of c. 50 species, distributed throughout Europe, Africa, the Atlantic islands and Asia. Many in subg. *Sonchus* are weedy species, able to colonise disturbed ground; several are common weeds of agriculture. A few species now have cosmopolitan distributions, occupying a very wide range of climates; 1 of these occurs on Christmas Is.

L.Boulos, The genus *Sonchus*, a general systematic treatment, *Bot. Not.* 113: 400–420 (1960); L.Boulos, Révision Systématique du genre *Sonchus* L. s.l., 4. Sous-genre 1. *Sonchus*, *Bot. Not.* 126: 155–196 (1973).

***Sonchus oleraceus** L., *Sp. Pl.* 2: 794 (1753), *emend* A.Gouan, *Hort. Reg. Monsp.* 407 (1762)

T: Herb. C.Linnaeus 949.6; lecto: LINN, *fide* L.Boulos, *Bot. Not.* 126: 155 (1973). Epithet from the Latin *olus* (vegetables, greens), as this species can be used as a green vegetable.

Erect herb, sparsely branched c. 15–70 cm tall; stems hollow. Leaves c. 4–15 cm long, mostly runcinate with narrow, acute lobes; lower leaves attenuate; stem leaves auriculate, irregularly mucronate-dentate, glabrous, glaucous beneath. Capitula yellow, in terminal clusters of c. 2–10, often combined into a lax, branched inflorescence; involucre campanulate, c. 9 mm long; bracts narrowly oblong, with membranous margins, sparsely glandular, the outer bracts successively shorter. Corolla filiform at base, 8–12 mm long; ligule c. 1 mm wide, minutely toothed, pale yellow, whitish beneath. Achene narrowly obovoid, c. 3 mm long, compressed, 3-ribbed on each surface, minutely tuberculate, brown; pappus hairs c. 6 mm long, silky, white. *Sow Thistle*.

Christmas Is. An introduced weed occurring most frequently as a pioneer species on land cleared for mining, but also on mined areas with some soil remaining, on roadsides, and in gardens. Recorded for Cocos (Keeling) Is. by H.Forbes, *A Naturalists Wanderings in the Eastern Archipelago* 43 (1885), and reported as persisting as a weed of cultivated and disturbed areas but no modern collections have been located. A cosmopolitan weed, originally native to Europe, Africa and Asia, and probably introduced in grain seed to America and Australia, and now widely distributed there.

Ch.Is.: areas cleared for mining, *D.A.Powell 392* (K); quarried areas, *D.A.Powell 528* (K); Murray Hill area, Toms Ridge mine site, *B.A.Mitchell 149* (CBG, K); old mine site, 0.5 km N of airport, *R.Shivas 936* (PERTH); South Point, recently mined field S of Wharton Hill, *D.J. & B.P.Du Puy CI78* (CBG, K).

One of Europe's most common agricultural weeds and is common throughout its range on

cultivated land, roadsides, waste ground and in disturbed forest. This is a very variable species, able to grow in a very wide range of climates, soil types and altitudes, making it an extremely successful weed. It is thought to be of hybrid origin and has an amphidiploid genetic complement (a tetraploid, with 2 sets of chromosomes from each parental species) perhaps responsible for this high degree of vigour and plasticity.

The leaves may be eaten cooked as a vegetable, or in salads. It is used medicinally as a mild diuretic and to correct digestive disorders.

2. VERNONIA

Vernonia Schreb., *Gen. Pl.* 8th edn, 2: 541 (1791), *nom. cons.*; named after the 17th century, English bryologist and plant collector William Vernon (fl. 1688–1711).

Type: *V. noveboracensis* (L.) Willd.

Mostly herbs, sometimes shrubs or trees. Leaves alternate, usually petiolate, entire to dentate, often glandular beneath. Capitula small, with 1–many florets, usually in a branched inflorescence; involucre campanulate; bracts in several whorls, the outer whorl shorter; receptacle honeycombed. Florets all tubular; corolla 5-lobed, violet, pink or white. Achene terete to angular, sometimes pubescent; pappus hairs ciliate, usually in 2 whorls, the outer whorl much shorter.

A very large genus with c. 900 species, distributed throughout the warmer parts of the world; 1 widespread species occurs on Christmas Is. and Cocos (Keeling) Is. Many are weedy or colonising species.

J.T.Koster, The Compositae of the Malay Archipelago (*Vernonia*), *Blumea* 1: 380–403 (1935).

***Vernonia cinerea** (L.) Less., *Linnaea* 4: 291 (1829)

Conyza cinerea L., *Sp. Pl.* 2: 862 (1753). T: herb *C.Linnaeus 993.19* & *993.20*; syn: LINN; Herb. P.Hermann, vols 1, 3, folios 6, 16, no. 419; syn: BM. Epithet derived from the Latin *cinereus* (ash-grey), in reference to the fine, whitish indumentum on the leaves and stems.

Illustration: F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 169 (1980).

Slender herb to c. 50 cm tall. Leaves usually ovate to rhomboidal, sinuous to serrate, acute, pubescent especially on the veins beneath, minutely gland-dotted, decurrent on the c. 0.5–1.5 cm long petiole; lamina c. 1–5 cm long; upper leaves narrower and shortly petiolate or sessile. Capitula in a lax, terminal, branched inflorescence; involucre c. 4 mm long; bracts in several successively shorter whorls, linear-elliptic, acute, often purple-tinged. Florets exceeding involucre. Corolla 3.5–4 mm long, usually violet, rarely pink or white. Achene 1.5–2 mm long, weakly angular, white-hairy; pappus hairs c. 4 mm long, the outer whorl minute.

Christmas Is., Cocos (Keeling) Is. Common on Christmas Is., especially around Drumsite and Settlement, along roads and railways, and sparsely as a colonising herb on old mined areas. On Cocos (Keeling) Is. grows as a common weed around settlements, disturbed and open areas in coralline sand. A pantropical weed growing in open, disturbed sites, especially around habitation or on cultivated land.

Ch.Is.: central plateau, along railway line near Camp 4, *B.A.Mitchell 125* (CBG, K); entrance to golf course, *R.Shivas 838* (PERTH). C.K.Is.: settlement, West Is., *I.R.Telford 9960 & C.Howard* (CBG, K); Quarantine Station, West Is., *D.G.Williams 125* (CBG, PERTH); SE of airstrip, West Is., *A.S.George 16230* (CBG, K).

This species is used in the Malay Peninsula as a poultice for headaches and to treat ringworm. Young plants may be used as a rather bitter vegetable.

The violet corollas and achenes with a ring of pappus hairs closely resemble *Aster subulatus* Michx. from which it can be distinguished by its broad, ovate to rhomboid leaves, the *Aster* having linear-spathulate leaves.

3. AGERATUM

Ageratum L., *Sp. Pl.* 2: 839 (1753); *Gen. Pl.* 5th edn, 277 (1754); from the Greek *a-* (not, without) and *geras* (old age), as the flowers often retain their colouring for a long time.

Type: *A. conyzoides* L.

Erect herbs or subshrubs. Leaves mostly opposite, especially towards base of plant, ovate, toothed except towards base, 3-veined at base or pinnately veined, often glandular and hairy; petiole distinct. Capitula clustered in heads in a branched inflorescence; involucre campanulate; bracts in several whorls, all ±similar in size, narrow, acute, with prominent veins; receptacle convex, honeycombed. Florets all tubular; corolla 5-lobed, often blue or white. Achene oblong, 5-angled, pale at base; pappus of 5 scarious, acuminate, ciliate scales.

A genus of 60 species from tropical America, with several now introduced throughout the tropics; 1 species naturalised on Christmas Is. Mostly weedy species, adventive in disturbed sites. There are many cultivars of *A. houstonianum* Mill. and *A. conyzoides* which are widely cultivated as summer-flowering annuals.

J.T.Koster, The Compositae of the Malay Archipelago (*Ageratum*), *Blumea* 1: 484–491 (1935).

***Ageratum conyzoides** L., *Sp. Pl.* 2: 839 (1753)

T: illustration of *Eupatorium humile africanum...*, in P.Hermann, *Paradisus Batarus* t. 161 (1698). Epithet from the resemblance of this species to some species of *Conyza* Less. (Asteraceae).

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 702 (1973).

Suberect, annual herb, c. 10–50 cm tall, rooting along decumbent shoots; stems hairy. Leaves opposite, triangular-ovate, obtuse to truncate at base, serrate except at base, acute, sparsely hairy, minutely glandular beneath, foetid, 3-veined from base; lamina c. 2.5–7 cm long; petiole c. 0.5–3.5 cm long. Capitula in a terminal, branched inflorescence, clustered into small corymbs; involucre 4–5 mm long; bracts linear-elliptic, sparsely hairy, whitish or purple-stained at apex. Corolla c. 2 mm long, narrow, white or violet, exceeded by style. Achene c. 2 mm long, sharply angled, black with white base; pappus scales narrowly ovate, c. 3 mm long, long-acuminate, scarious, with minute marginal bristles. *Goatweed*.

Christmas Is. Already present by 1900 when C.W.Andrews, *Monogr. Christmas Is.* 180 (1900), recorded it as common on the shore cliff. H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 200 (1906), recorded that it had spread to cultivated ground around Flying Fish Cove. It is now common all over the island, spreading principally along roads and tracks, but also colonising cleared areas and mining sites with sufficient soil remaining. A common, pantropical weedy species, native to the New World.

Ch.Is.: dumps of reject material, Quarry L.B. 7, *D.A.Powell 513* (K); plateau, SW of Hanitch Hill, near drill line 378, *B.A.Mitchell 40* (CBG, K); cleared rainforest at Grants Well, *R.Shivas 810* (PERTH); track at Waterfall, *R.Shivas 913* (PERTH); old mine site N of airport, *R.Shivas 939* (PERTH).

The fruit is dispersed by the bristly pappus scales clinging to clothing or perhaps to birds' feathers. The leaves are used in Malesia to poultice wounds, boils and skin irritations, and a decoction of the leaves is used against stomach-ache, dysentery and fever.

4. MIKANIA

Mikania Willd., *Sp. Pl.* 3: 1742 (1803), *nom. cons.*; named after J.G.Mikan (1743–1814), a Czech botanist and founder of the botanical garden in Prague.

Type: *M. scandens* (L.) Willd., *typ. cons.*

Climbing herbs or shrubs. Leaves opposite, triangular to ovate, rarely palmate, 3-veined from base, glandular; petiole slender. Capitula small, 4-flowered, in a terminal or axillary,

stalked, simple or branched inflorescence; involucre narrowly cylindrical; bracts 4, sometimes with an extra, reduced bract, concave; receptacle small. Florets all tubular; corolla funnel-shaped, 5-lobed, white to pink. Achene narrowly oblong; pappus hairs in a single whorl.

A genus of c. 240 mainly New World species, with a few widely naturalised elsewhere; 1 species naturalised on Christmas Is. The palmate-leaved *M. ternata* B.L.Rob., with purple-hairy stems and undersurface of the leaves, is an attractive, cultivated species.

B.L.Robinson, *Mikania scandens* and its near relatives, *Contr. Gray Herb.* n.s., 6 (104): 55–71 (1934).

***Mikania micrantha** Kunth in F.W.H.A. von Humboldt, A.J.A.Bonpland & C.S.Kunth, *Nov. Gen. Sp.* 4: 134 (1820)

T: South America, *F.W.H.A.Humboldt & A.J.A.Bonpland*; holo: probably P *n.v.* Epithet from the Greek *mikros* (small) and *anthos* (a flower), in reference to the smaller flowers of this species.

Climbing herb to c. 4 m tall; stems ribbed, often sparsely hairy. Leaves triangular to ovate, sagittate, cordate or truncate at base, weakly to strongly dentate, shortly acuminate, subglabrous, minutely glandular beneath; lamina c. 2–12 cm long; petiole c. 1–9 cm long. Capitula sweetly scented, in long-stalked, branched, corymbose inflorescences; involucre c. 3.5 mm long; bracts usually 4, subequal, narrowly oblong-elliptic, mucronate, thinly pubescent, concave, green. Florets exceeding involucre. Corolla c. 2.5 mm long, creamy white. Lobes spreading. Anthers brown. Stigmas filiform, cream. Achene to 2 mm long, dark brown, glandular; pappus hairs c. 3 mm long, minutely barbed, white. *Mile-a-minute*. Figs 60, 87A–B.

Christmas Is. It is spreading along a short section of road in the central plateau region and has also been collected in the Nursery area overlooking Settlement. Native of tropical and subtropical Central and South America, introduced and naturalised as a weed elsewhere in the tropics.

Ch.Is.: central area, *D.A.Powell 159* (K); roadside near central workshops, *B.A.Mitchell* (CBG, K); nursery, *R.Shivas 959* (PERTH); roadside, 100 m N of railway above Central Area Workshop, *D.J. & B.P.Du Puy CI60* (CBG, K).

The florets and capitula are smaller than in *M. cordata* (Burm.) B.L.Rob., a closely related species also found in Malesia. Both species are probably used in Malesia to treat skin irritations and wounds. The twining stems and leaves form a dense mat, smothering secondary growth.

5. ASTER

Aster L., *Sp. Pl.* 2: 872 (1753); *Gen. Pl.* 5th edn, 373 (1754); the Greek word for star, descriptive of the appearance given to the capitula by the usually radiating ligules of the ray florets.

Type: *A. amellus* L.

Perennial or occasionally annual or biennial herbs; roots often somewhat thickened. Leaves spirally arranged, simple, usually narrow, often attenuate and decurrent on petiole at base, entire or slightly toothed. Capitula 1–many, in simple or branched inflorescences; involucre campanulate to funnel-shaped; bracts in several series, the outer bracts reduced; receptacle flat, honeycombed. Disc florets with tubular, 5-lobed corollas, enclosed by a marginal ring of ray florets usually with radiating ligules (not on Christmas Is.), mostly blue, purple or white. Achene compressed, oblong, glandular, somewhat hairy; pappus hairs rather stiff, in 1 or 2 whorls, the outer whorl often reduced.

A large genus of probably c. 500 species, with greatest diversity in N America, but with a very wide distribution also including Central & South America, south-eastern Africa, Europe and Asia; 1 weedy annual occurs on Christmas Is. Several species and their selected

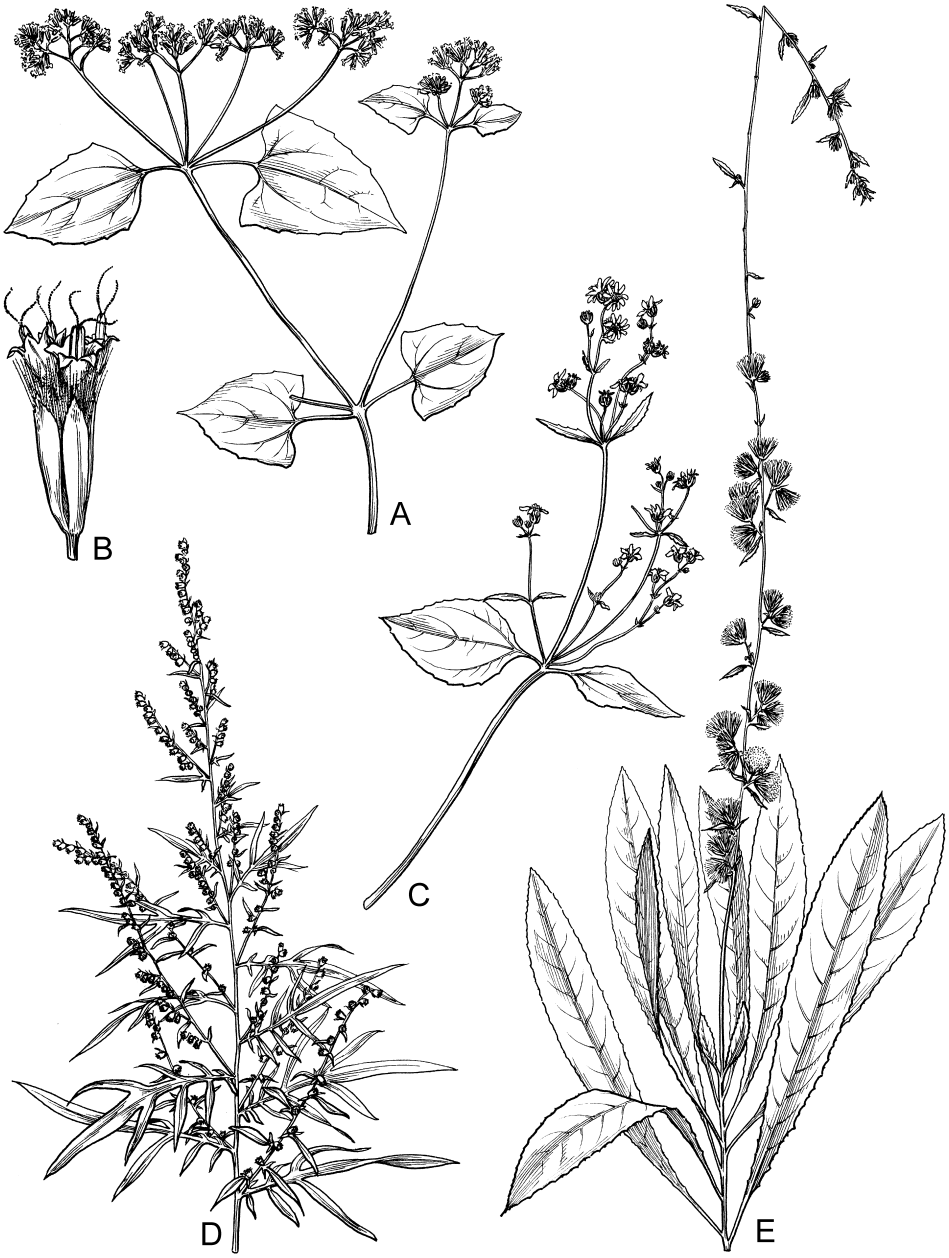

Figure 87. **A–E**, ASTERACEAE. **A–B**, *Mikania micrantha*. **A**, flowering shoot X0.3; **B**, capitulum with four florets X5 (**A–B**, D. & B.Du Puy CI60, K). **C**, *Melanthera biflora*, flowering shoot X0.3 (D.Powell 325, K). **D**, *Artemisia vulgaris*, flowering shoot X0.3 (D.Powell 162, K). **E**, *Blumea lanceolaria*, flowering shoot X0.3 (D.Powell 235, K). Drawn by E.Catherine.

cultivars are grown as perennial garden ornamentals, including *A. novae-anglicae* L. and *A. novi-belgii* L.

W.Lippert, The Compositae of the Flora Zambesiaca area (*Aster* L.), *Kirkia* 12: 10–14 (1980); A.G.Jones, A classification of the New World species of *Aster* (Asteraceae), *Brittonia* 32: 230–239 (1980).

***Aster subulatus** Michx., *Fl. Bor.-Amer.* 2: 111 (1803)

T: N America, *A.Michaux s.n.*; iso: P, microfiche seen. Epithet from the Latin *subulatus* (awl-shaped), in reference to the involucral bracts.

Slender, erect, annual herb, 25–100 cm tall. Leaves linear, spathulate, oblong-attenuate and finally ±sheathing at base, very shallowly toothed towards apex, glabrous; lamina c. 3–9 cm long. Capitula small, in an erect, lax, much-branched inflorescence; involucre c. 5 mm long, funnel-shaped; bracts in c. 3 successively smaller series, somewhat spreading, linear-elliptic, mucronate, green, sometimes purplish at apex with scarious margin. Corolla inconspicuous, c. 3 mm long, narrowly tubular, violet-tipped, exceeded by pappus hairs; disc florets few, with minutely 5-lobed corolla; ray florets with ligule c. 1 mm long. Achene c. 2 mm long, slender, 5-ribbed, minutely pubescent; pappus hairs c. 5 mm long, in 1 whorl.

Christmas Is. Common weed species on roadsides, in disused quarries and other disturbed sites. Native to the New World, now widely naturalised elsewhere in tropical to warm-temperate regions, including Australia.

Ch.Is.: airport road, Phosphate Hill, *D.A.Powell 504* (K): roadside weed, *D.A.Powell 847* (K); roadside, Central Area Work Quarry, *R.Shivas 986B* (PERTH); old mine site, 0.5 km N of airport, *R.Shivas 943* (PERTH).

Aster subulatus is treated here in the broad sense. It is a variable species and can flower and fruit when very small. P.Bosserdet, *Taxon* 19: 244–250 (1970), split *A. subulatus* into two species, both based on specimens in the herbarium of A.Michaux, the species on Christmas Is. being included in *A. ensifer* Bosser. This split has not been followed by later authors and the broader definition of *A. subulatus* is followed here. The species has also been widely known as *A. squamatus* (Spreng.) Hieron.

6. PLEUROPHYLLUM

Pleurophyllum Hook.f., *Fl. Antarct.* 1: 30 (1844); from the Greek *pleuron* (a rib) and *phyllon* (a leaf), referring to the stout parallel nerves of the leaves

Type: not designated.

Stout perennial herbs with fibrous roots. Leaves large, entire, rosette-forming and cauline. Inflorescence multi-headed, racemose. Capitula large; bracts in 2 or 3 rows, herbaceous; receptacle flat, slightly pitted. Ray florets pistillate; disc florets hermaphrodite. Pappus of stiff, scabrous, barbellate hairs. Achenes strigose.

A genus of 3 species confined to the Australian and New Zealand subantarctic islands; 1 species on Macquarie Is.

G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 40 (1984).

Pleurophyllum hookeri Buchan., *Trans. New Zealand Inst.* 16: 395 (1884)

T: hills around Perseverance Harbour, Campbell Island, *coll. unknown*; *n.v.* Epithet commemorates J.D.Hooker.

Illustrations: T.Kirk, *Trans. New Zealand Inst.* 23: 435, t. 40 (1891), as *P. hookerianum*; B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* pls 6, 11, 12, 13, 32, pp 43, 56, 57, 58, 137 (1955); T.Flannery & T.Rodd, *Australia's Wilderness Heritage* 2: 358 (1988).

Rosette leaves oblanceolate to obovate, sheathing at base, minutely toothed, acute to acuminate, 25–60 cm long, densely white tomentose on both surfaces, prominently veined.

Old leaves decomposing to form a fibrous sleeve below rosette. Cauline leaves linear to spathulate, 3–8 cm long, 1.5–10 mm wide. Capitula 10–20, 1.5–2 cm diam. on a shortly branched tomentose scape; scape 30–45 cm tall. Ray florets white to pale pink; ligule 4 mm long. Disc florets purple. Achenes cylindrical, 2.5 mm long, silvery grey to brown, strigose. Fig. 78.

Macquarie Is. Widespread and in places dominant, particularly in herbfield. Occurs also on Auckland and Campbell Islands. Flowers Sept.–Jan., but erratically; fruits about Dec.–Feb.

M.Is.: Langdon Point, 7 Dec. 1948, *N.R.Laird* (CHR, HO); Boiler Rocks, *R.D.Seppelt 12147* (CHR, HO); Langdon Point, *R.D.Seppelt 12181* (AD, HO); 300 m NW of Handspike Corner, *R.D.Seppelt 12211* (HO, MEL); northern side of Bauer Bay, *R.D.Seppelt 12805* (AD, HO, MEL).

This species is a favoured food of rabbits on the island and some reduction in range has occurred as a result, G.R.Copson, *loc. cit.* The illustration of *P. hookeri* by J.Buchanan (*op. cit.* pl. 37) was considered by T.Kirk (*loc. cit.*) and T.F.Cheeseman, *Man. New Zealand Fl.* 296 (1906), to be based on *P. criniferum* Hook.f.

7. CONYZA

Conyza Less., *Syn. Gen. Compos.* 203 (1832), *nom. cons.*; from the Greek plant name *konyza*, sometimes used to indicate fleabane, as the crushed leaves of some species are said to repel fleas.

Type: *C. chilensis* Spreng., *typ. cons.*

Erect, annual or perennial herbs. Leaves alternate, toothed to pinnately lobed, usually attenuate at base but sessile. Capitula small, in a terminal, branched inflorescence; involucre campanulate or urceolate; bracts in 2 or 3 whorls, narrow, acuminate; receptacle domed, honeycombed. Florets inconspicuous, ±exceeded by pappus hairs; disc florets few, with tubular, 5-lobed corolla, surrounded by more numerous marginal florets with a filiform, usually minutely ligulate corolla. Achene small, laterally compressed; pappus hairs in 1 or 2 whorls, the outer whorl much shorter.

A genus of c. 60, largely tropical species, extending into warm-temperate regions; 1 weedy species has become naturalised on Christmas Is. and Cocos (Keeling) Is. Most species are weedy.

***Conyza bonariensis** (L.) Cronquist, *Bull. Torrey Bot. Club* 70: 632 (1943)

Erigeron bonariense L., *Sp. Pl.* 2: 863 (1753). T: S America, Herb. C.Linnaeus 994.11; iso: LINN. Epithet from *Bonaria*, a Latinisation of Buenos Aires, indicating an origin in Argentina.

Sparingly branched herb to 80 cm tall; stems coarsely hairy. Leaves clustered at base, becoming more scattered on elongated flowering shoot; basal leaves narrowly decurrent, linear-elliptic, serrate to lobulate, acute, pubescent, greyish green, with lamina c. 4–10 cm long; upper leaves shorter, narrower, entire. Capitula in an apical, branched inflorescence; involucre campanulate, 3.5–4 mm long; bracts narrowly elliptic with hyaline margins, pubescent, often purple-tipped. Florets mainly filiform and minutely ligulate, with a few tubular and 5-lobed; corolla c. 3 mm long, cream. Achene c. 1.5 mm long; pappus hairs c. 3.5 mm long, dark yellowish, in 1 whorl.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. a common species in disused quarries, in poor soil remaining after phosphate mining and on other waste land. On Cocos (Keeling) Is. a common weed in disturbed areas, roadsides and around settlements, in coralline sand. A S American weedy species which has become widely naturalised in tropical to warm-temperate regions, including Australia.

Ch.Is.: old mine site, 0.5 km N of airport, *R.Shivas 941* (PERTH); South Point, Field 17, primary coloniser on mined area, *D.J. & B.P.Du Puy CI106* (CBG, K). C.K.Is.: settlement, West Is., *I.R.Telford 9961 & C.Howard* (CBG, K); SE of airstrip, West Is., *A.S.George 16221* (CBG, K); Quarantine Station, West Is., *D.G.Williams 115* (CBG, PERTH).

An infusion of the leaves can be used as a diuretic.

8. BLUMEA

Blumea DC., *Arch. Bot. (Paris)* 2: 514 (1833), *nom. cons.*; after the Dutch botanist C.L. von Blume, (1796–1862), physician in Batavia (Java) and director of the Botanic Garden at Leiden, a distinguished plant taxonomist and author of the first *Flora of Java*.

Type: *B. balsamifera* (L.) DC., *typ. cons.*

Erect herbs or occasionally shrubs, often foetid. Leaves alternate, often sessile, toothed to pinnately lobed, often hairy and glandular. Capitula usually combined into a lax to dense, branched inflorescence, but sometimes few or solitary; involucre broadly to narrowly campanulate; bracts in several successively reduced whorls, usually linear, pubescent with scarious margins; receptacle ±flat, pilose to glabrous. Florets inconspicuous, ±exceeded by pappus hairs; disc florets few, with tubular, usually 5-lobed corolla, surrounded by more numerous marginal florets with filiform, usually minutely 2–4-toothed corolla. Achene oblong, ribbed, usually pubescent; pappus hairs in 1 whorl.

A tropical and subtropical Old World genus of c. 49 species, distributed from Africa and Madagascar through SE Asia, Indo-China, the Philippines and Malesia to northern Australia and the Pacific islands; 2 very dissimilar species occur on Christmas Is. The species often form part of the secondary growth on disturbed land but sometimes occur as undergrowth in shaded forest or in forest clearings and margins.

A.J.Randeria, The composite genus *Blumea*, a taxonomic revision, *Blumea* 10: 176–317 (1960).

Erect, usually unbranched herb; leaves sparsely hairy when young, glossy, not foetid; leaf base without appendages; capitula c. 9 mm long, in slender, erect inflorescences; receptacle hairy **1. B. lanceolaria**

Much-branched shrub; leaves covered in a whitish, felty indumentum, especially beneath, pungently scented when crushed; leaf base with c. 4–6 short, leafy appendages; capitula c. 6–7 mm long, in large, much-branched inflorescences; receptacle glabrous **2. B. balsamifera**

1. Blumea lanceolaria (Roxb.) Druce, *Rep. Bot. Exch. Club Brit. Isles* 4: 609 (1917)

Conyza lanceolaria Roxb., *Fl. Ind.* 2nd edn, 3: 432 (1832). T: illustration in *Icon. W.Roxburgh* no. 2333; holo: K. Epithet a variant of the Latin *lanceolatus* (lance-shaped), in reference to the leaves (although they are usually narrowly obovate).

B. spectabilis DC., *Prodr.* 5: 445 (1836). T: without locality, *R.Wight s.n.*; *n.v.*

Erect, usually unbranched herb c. 0.7–2 m tall; stems glabrescent. Leaves narrowly obovate, gradually tapering into short petiole, strongly serrate with unequal teeth, acute, sparsely hairy when young, dark green, glossy; lamina c. 10–30 cm long. Capitula in clusters of 1–4 from axils of leafy bracts along a slender, erect, unbranched inflorescence; stalks short, pubescent; involucre c. 9 mm long; bracts in several successively shorter whorls, linear, pubescent; receptacle hairy. Corolla c. 6 mm long, pale yellow, mostly filiform and minutely toothed, several tubular and 5-lobed; style yellow. Achene c. 1 mm long, ribbed, pubescent; pappus hairs c. 6 mm long, cream, uniseriate. Fig. 87E.

Christmas Is. C.W.Andrews, *Monogr. Christmas Is.* 181 (1900) and H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 200 (1906) both stated that it was common on Christmas Is., in open spaces in the forest where trees have fallen. It is now much more scarce, occurring occasionally in the rainforest on the plateau where it prefers damp conditions with some light, usually along disused drill-lines. Distributed from India and southern China through Indo-China and western Malaysia to Sumatra, Java and the Philippines.

Ch.Is.: N side Aldrich Hill, along old, disused drill line, *D.A.Powell 235* (K).

A.J.Randeria (*Blumea* 10: 219–220, 1960) divided this species into two varieties, the

variant from Christmas Is. corresponding mostly closely to var. *spectabilis* (DC.) Randeria. It differs from this, however, in its inflorescence shape, which is slender (not a large, lax panicle), and in its receptacle, which is distinctly hairy (not fimbrillate).

2. Blumea balsamifera (L.) DC., *Prodr.* 5: 447 (1836)

Conyza balsamifera L., *Sp. Pl.* 2nd edn, 2: 1208 (1763). T: Herb. C.Linnaeus 993.18; syn: LINN. Epithet from the Latin *balsamum* (a soothing or healing balm) and *ferre* (to bear), in reference to the camphor-scented oil produced by this species.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 716 (1973).

Shrub to 4 m tall; stems softly hairy. Leaves narrowly elliptic, narrowly decurrent with c. 2–6 short, serrate, leafy lobes, acute, covered with a whitish, felty indumentum, especially beneath, glandular, pungently scented when crushed; lamina c. 5–20 cm long. Capitula in a large, much-branched, leafy inflorescence; involucre 6–7 mm long; bracts in several successively smaller whorls, linear, pubescent; receptacle glabrous. Corolla c. 5 mm long, reddish at apex, mostly filiform and minutely toothed, a few tubular and 5-lobed; style yellow. Achene c. 1 mm long, angular; pappus hairs c. 3 mm long, white or becoming reddish, uniseriate. *Camphor Bush*, *Sembong*.

Christmas Is. Occurs occasionally on the plateau among secondary growth on roadsides and around mined areas. A SE Asian species, distributed from India and China through Indo-China to Malesia and the Philippines.

Ch.Is.: roadside near Central Workshops, *B.A.Mitchell 133* (CBG, K); North West Point, among shrubs on limestone boulders in mined area, *D.J. & B.P.Du Puy CI109* (CBG, K).

Ngai Camphor can be distilled from this species. It is similar to true Camphor which is produced from *Cinnamomum camphora* (L.) Presl (Lauraceae). This is highly valued medicinally in Malaysia and China being used as a lotion to relieve rheumatism, as an infusion of the leaves against stomach pains and fever, and in childbirth.

9. PLUCHEA

Pluchea Cass., *Bull. Sci. Soc. Philom. Paris* 1817: 31 (1817); after N.A.Pluche (1688–1761), a French monk and naturalist.

Type: *P. marilandica* (Michx.) Cass.

Shrubs, often aromatic. Leaves alternate, sessile or subsessile, entire or toothed, often minutely glandular. Capitula small, usually in a terminal, branched, corymbose inflorescence; involucre cup-shaped to urceolate; bracts in several successively reduced whorls; receptacle flat, glabrous. Florets inconspicuous among pappus hairs, violet or white; disc florets few, with a tubular, 5-lobed corolla, surrounded by more numerous marginal florets, with a filiform, minutely toothed corolla. Achene cylindrical, ribbed; pappus hairs in 1 whorl.

A tropical and subtropical genus of 40–50 species. Most are New World species, although several endemic species occur in Australia; 1 species naturalised on Christmas Is. They often grow in damp situations, sometimes tolerating some salinity.

*Pluchea indica (L.) Less., *Linnaea* 6: 150 (1831)

Baccharis indica L., *Sp. Pl.* 2: 861 (1753). T: India, Herb. C.Linnaeus 992.8; syn: LINN. Epithet from the Latin *Indicus* (India), indicating the country of origin of the type specimen.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 718 (1973).

Shrub to c. 1.5 m tall. Leaves obovate, tapering and decurrent to short petiole, coarsely serrate, obtuse and mucronate, sparsely and minutely pubescent and glandular, aromatic when crushed; lamina c. 2.5–6 cm long. Capitula in a terminal or axillary, dense, branched, corymbose inflorescence; involucre campanulate, c. 4 mm long; bracts in c. 6 whorls; outer

bracts ovate, appressed-pubescent; inner bracts longer and narrower. Corolla 3 mm long, violet, mostly filiform with minutely toothed apices, several larger and tubular, with 5-lobed, flared apex; style and anthers violet. Achene c. 1 mm long, angular, glabrous; pappus hairs c. 3.5 mm long, cream, uniseriate.

Christmas Is. Recently introduced on Christmas Is. Several plants recorded from the cliffs around the landing wharf at Flying Fish Cove. A SE Asian species, distributed from India and southern China, through Indo-China, the Philippines and Malesia to Australia (Qld, N.T.) and the Pacific islands.

Ch.Is.: wharf at Flying Fish Cove, *D.A.Powell 830* (K).

A salt-tolerant species. An infusion of the leaves is widely used as a sudorific to treat fevers. The leaves may also be used as a poultice for sores or cuts. It is cultivated in Malesia as a medicinal or hedge plant.

10. ECLIPTA

Eclipta L., *Mant. Pl.* 2: 157, 286 (1771), *nom. cons.*; from the Greek *ekleipo* (to be deficient), from the absence of a pappus on the achenes.

Type: *E. erecta* L., *nom. illeg.* = *E. alba* (L.) Hassk., *typ. cons.*

Erect to prostrate herbs. Leaves opposite, usually sessile or shortly petiolate, elliptic to ovate, simple, sometimes 3-veined from base. Capitula small, solitary or paired in leaf axils; involucre cup-shaped; bracts in 2 whorls, broad, herbaceous; receptacle convex, with linear, caducous scales. Florets small, white; disc floret corolla with a short, basal tube, funnel-shaped above, usually 4-lobed, surrounded by 2 whorls of rather inconspicuous ray florets with small, radiating ligule. Achene ovoid to oblong, mostly 2-angled, tuberculate; pappus represented by minute, apical rim extended into 2 minute teeth.

A small but widespread genus of c. 3 tropical to warm-temperate species; 1 species on Christmas Is. They are weedy plants of damp places characterised by the absence of a pappus on the achene, which is probably dispersed by adhering to the mud carried on the feet of birds.

*Eclipta prostrata (L.) L., *Mant. Pl.* 2: 286 (1771)

Verbesina prostrata L., *Sp. Pl.* 2: 902 (1753). T: illustration in L.Plukenet, *Phytographia* t. 118, fig. 5 (1691) & *Almagestum Botanicum* 100 (1696); lecto, *fide* D.O.Wijnands, *Bot. Commelins* 74 (1983). Epithet from the Latin *prostratus* (prostrate), in reference to the creeping growth habit.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 725 (1973).

Prostrate or ascending herb to c. 30 cm tall; stems often rooting at nodes. Leaves sessile, narrowly elliptic, shortly attenuate at base, shallowly serrulate, acute, sparsely covered by short, appressed, scabrid hairs, ±3-veined at base; lamina c. 1.5–3 cm long. Capitulum solitary or paired in leaf axils; stalks slender, c. 7–30 mm long; involucre hemispherical, c. 5 mm long; bracts in 2 whorls, oblong, acute; scales filiform. Disc florets: corolla c. 1.5 mm long, 4-lobed, cream. Ray florets: corolla c. 3 mm long, including the inconspicuous, narrow, bilobed, white, radiating ligule. Achene obovate, c. 2 mm long, mostly compressed, tuberculate; apex truncate, usually with 2 minute teeth.

Christmas Is. Uncommon. Collected once only from an area of water run-off in a limestone quarry, growing with *Alternanthera sessilis* (L.) DC. (Amaranthaceae), which has also been recorded only from this locality. A common, cosmopolitan weed of moist ground in warm or tropical climates, including Malesia and Australia (N.T.).

Ch.Is.: no precise locality, *D.A.Powell 512* (K).

11. WEDELIA

Wedelia Jacq., *Enum. Syst. Pl.* 8, 28 (1760), *nom. cons.*; probably after the German botanist W.G.Wedel (1645–1721).

Type: *W. fructicosa* Jacq.

Perennial herbs, often creeping or climbing, often scabrid. Leaves sessile or petiolate, opposite, lobed, toothed or entire. Capitula usually 1–few from upper leaf axils, sometimes terminal, long-stalked; involucre ±hemispherical; bracts broad, in 2 or 3 whorls; receptacle convex, with large, keeled scales enclosing the florets. Disc floret corolla tubular, 5-lobed; ray florets in 1 whorl, the corolla with conspicuous, 2- or 3-toothed yellow ligule. Achene narrowly obovoid, 2–4-angled, compressed; pappus absent, or represented by a scarious rim or 1 or 2 minute teeth.

A genus of c. 70 tropical and warm-temperate species, with greatest diversity in the New World; 1 species naturalised on Christmas Is.

*Wedelia trilobata (L.) Hitchc., *Rep. Missouri Bot. Gard.* 4: 99 (1893)

Silphium trilobatum L., *Syst. Nat.* 10th edn, 1232 (1759). T: Jamaica, *P.Browne s.n.*, in Herb. C.Linnaeus 1032.9; syn: LINN. Epithet from the Latin *tri-* (3-) and *lobatus* (lobed), in reference to the leaves.

A creeping herb with ascending flowering shoots to c. 40 cm tall; stems rooting at nodes. Leaves sessile, tapering at base, usually 3-lobed, acute, serrate, with sparse, stiff, appressed hairs; lamina c. 2–6 cm long. Capitulum axillary, solitary, conspicuous, daisy-like; involucre hemispherical, c. 1 cm long; bracts in 2 whorls, elliptic, acute, rough-hairy, herbaceous; scales narrowly elliptic, c. 6 mm long, acute, keeled, scarious. Disc florets: corolla c. 5 mm long, yellow; anthers blackish. Ray florets: corolla c. 12 mm long, bright yellow; ligule oblong, 4–5 mm wide, 3-toothed. Achene narrowly clavate, c. 5 mm long; pappus rim cup-shaped, c. 1 mm long, scarious.

Christmas Is. Occurs in two areas, both of which were formerly gardens cultivated by Chinese families. It spread rapidly when the gardens were abandoned, soon covering them. A New World species introduced in several countries, but uncommon in Malesia.

Ch.Is.: no precise locality, *D.A.Powell 537* (K).

This species is sometimes cultivated as an ornamental, being particularly useful as a ground-cover or edging plant.

12. MELANTHERA

Melanthera Rohr, *Skr. Naturhist.-Selsk.* 2: 213 (1792); from the Greek *melanos* (dark, black) and *anthera* (anther), descriptive of the dark, almost black anthers of the disc florets.

Type: *M. nivea* (L.) Small

Annual or perennial herbs, sometimes climbing. Leaves opposite, simple. Capitula terminal, solitary or in a lax, branched inflorescence; involucre shallow, hemispherical; bracts in 2 or 3 whorls, ovate; receptacle with large, many-veined scales enclosing florets. Disc floret corolla tubular or somewhat flared, 5-lobed; ray florets in a single whorl, the corolla with a conspicuous, radiating, yellow ligule. Achene obovoid, 2–4-angled; pappus absent or represented by several short bristles.

A pantropical and warm-temperate genus of c. 50 species, occurring in open woodland, savannah and forest margins, sometimes preferring damp or swampy conditions; 1 species is native to Christmas Is. and Cocos (Keeling) Is.

H.Wild, The African species of the genus *Melanthera* Rohr, *Kirkia* 5: 1–17 (1965).

Melanthera biflora (L.) Wild, *Kirkia* 5: 4 (1965)

Verbesina biflora L., *Sp. Pl.* 2nd edn, 2: 1272 (1763); *Wedelia biflora* (L.) DC. in R.Wight, *Contr. Bot. Ind.* 18 (1834). T: India, Herb. C.Linnaeus 1021.4; syn: LINN. Epithet from the Latin *bis* (twice) and *flos* (a flower), indicating that the capitula are often paired on each stalk.

Illustrations: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 728 (1973), as *Wedelia biflora* (L.) DC.; F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 169, fig. 25(2) (1980).

A perennial, straggling herb to c. 2 m tall. Leaves ovate, shortly tapering at base, serrate, acuminate, appressed-scabrid, 3-veined from near base; lamina c. 4–15 cm long; petiole 0.5–4 cm long. Capitula 1–3 on long stalks, sometimes combined into a lax inflorescence, daisy-like; involucre 6 mm long; bracts in 2 whorls, acute, appressed-pubescent, the apex spreading; scales oblong, c. 5 mm long, obtuse. Disc florets: corolla tubular, 4.5 mm long, acutely lobed, abruptly constricted at base, yellow; anthers dark. Ray florets: corolla c. 12 mm long, bright yellow; ligule oblong, 3–4 mm wide, 3-toothed. Achene obovoid, 3 mm long, truncate, 2–4-angled, pubescent at apex; pappus absent. Figs 58, 87C.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. occurs directly behind the sea cliffs among low shrubs, especially *Scaevola taccada* thickets which often form the first zone of shrubby vegetation. On Cocos (Keeling) Is. grows in strand communities in coralline sand. An Old World species, distributed from Africa, India, China and Japan through Indo-China, Malesia and the Philippines to northern Australia (N.T., Qld, N.S.W.) and the Pacific islands including Norfolk Is. and Lord Howe Is.

Ch.Is.: above E coast waterfall, near sea, *C.W.Andrews 56* (K); coastal cliffs, ravine S of Dolly Beach, *B.A.Mitchell 137* (CBG, K). C.K.Is.: Ujong Tanjong, West Is., *I.R.Telford 10000 & C.Howard* (CBG, K, MEL); lagoon beach near jetty, West Is., *A.S.George 16255* (CBG, PERTH); Home Is., *I.R.Telford 10069 & C.Howard* (AD, CBG, K).

The achenes lack a pappus and are probably sea-dispersed. The leaves have a diuretic action and in Malesia are used as a poultice for skin diseases, ulcers and wounds.

13. TITHONIA

Tithonia Desf. ex Juss., *Gen. Pl.* 189 (1789); after Tithonius of Greek mythology, a mortal who was loved by Eos, the goddess of the dawn, the orange flowers of the type species resembling the colours of the rising sun.

Type: *T. tagetiflora* Desf.

Annual or perennial herbs, or shrubs, sometimes very large. Leaves alternate, usually petiolate, palmately lobed to entire, 3-veined from near base. Capitula large, solitary or few on thick, hollow stalks; involucre broadly campanulate; bracts in 2–5 successively shorter whorls, oblong, with a spreading, herbaceous apex; receptacle convex, with persistent, rigid, usually trilobed scales enclosing florets. Disc florets with tubular, acutely 5-lobed corolla, yellow; ray florets in a single whorl, the corolla extended into a very large, conspicuous, yellow or orange ligule. Achene oblong, usually obtusely 4-angled; pappus scarious, with 1–several awns, sometimes absent.

The 11 species in this genus are native to Central America and the West Indies; 1 species naturalised on Christmas Is. They are mostly weedy, occurring in disturbed sites such as roadsides and on the margins of cultivation. Some species, such as *T. diversifolia* and *T. rotundifolia* (Mill.) S.F.Blake, are widely cultivated as ornamentals in the tropics and subtropics and have become naturalised in many localities. *Tithonia diversifolia* has become naturalised on Christmas Is.

J.C.La Duke, Revision of *Tithonia*, *Rhodora* 84: 453–522 (1982).

***Tithonia diversifolia** (Hemsl.) A.Gray, *Proc. Amer. Acad.* 19: 5 (1884)

Mirasolia diversifolia Hemsl., *Biol. Centr.-Amer., Bot.* 2: 168, t. 47 (1881). T: Orizaba, southern Mexico, *E.Bourgeau 2319*; lecto: K, *fide* J.C.La Duke, *op. cit.* 498; syn: K; Cordoba, *E.Bourgeau 1562*; syn: K. Epithet from the Latin *diversus* (diverse, different) and *folium* (a leaf), the lower leaves being strongly 3–5-lobed, while the upper leaves may be entire.

A large, perennial herb, to c. 2.5 m tall, forming dense stands. Leaves attenuate and auriculate at base, mostly palmately 3–5-lobed, serrate, acute, pubescent, greyish beneath; lamina c. 6–25 cm wide; petiole 1–7 cm long. Capitulum terminal, solitary, on long, hollow stalks, daisy-like; involucre 15–20 mm long; bracts in 3 successively shorter whorls, oblong to ovate; scales 10–15 mm long, 3-lobed, aristate. Disc florets: corolla c. 8 mm long. Ray florets: corolla 35–55 mm long, bright yellow; ligule oblong-elliptic, c. 8–12 mm wide, toothed. Achene 5–6 mm long, 2–4-angled, pubescent; pappus a toothed rim with 2–4 awns. Fig. 61.

Christmas Is. A common and striking roadside herb especially on the plateau, often forming dense, pure stands. It was probably introduced as a cultivated plant at the South Point settlement. A native of tropical Mexico and Central America, widely cultivated and often naturalised in Africa, SE Asia, northern Australia (Qld, N.S.W.) and N America.

Ch.Is.: no precise locality, *D.A.Powell 262* (K); Central Area Work Quarry, *R.Shivas 894A* (PERTH); roadside near LB3, Sept. 1983, *A.Stokes* (CBG); secondary regrowth along railway, NE of Hanitch Hill, *D.J. & B.P.Du Puy CI100* (CBG, K).

The species is cultivated for its showy flowers. Its strong growth habit and tendency to form dense stands through subterranean stolons make it a useful hedging plant.

14. ELEUTHERANTHERA

Eleutheranthera Poit. ex Bosc, *Nouv. Dict. Hist. Nat.* 7: 498 (1803); from the Greek *eleuther* (distinct) and *anthera* (an anther), in reference to the free or loosely cohering anthers.

Type: not designated.

Annual herbs. Leaves opposite, petiolate. Heads axillary and terminal, solitary or paired. Involucre campanulate, of 5–10 leafy bracts in 1 series containing few florets. Florets all tubular. Corolla 5-toothed. Anthers free or loosely cohering, mucronate, sagittate at base. Style arms hairy at apex. Achenes obovoid; pappus shortly cup-shaped, shortly hairy.

A genus of 2 species, 1 from Madagascar, the other from tropical America and widely naturalised in the Tropics, including on Christmas Is. and Cocos (Keeling) Is.

***Eleutheranthera ruderalis** (Sw.) Sch.Bip., *Bot. Zeit.* 24: 239 (1866)

Melampodium ruderale Sw., *Fl. Ind. Occid.* 3: 1372 (1806). T: Jamaica, *n.v.* Specific epithet is Latin for growing among rubbish.

Erect herb to 60 cm, usually much-branched. Leaves ovate or ovate-triangular, shallowly serrate, pilose; shortly decurrent to petiole; lamina 1–5 cm long; petiole 2–20 mm long. Heads 8–15 mm diam.; peduncle 2–12 mm long. Involucral bracts usually 5, ovate, 4–8 mm long, pilose, green. Florets 6–12. Corolla 3–4 mm long, yellow. Anthers black. Achenes c. 3 mm long, ribbed, verrucose.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. grows as a road- or track-side weed. On Cocos Is. recorded as a rare road-side weed in coralline sand. Native of Central America and the West Indies, widely naturalised in the tropics.

Ch.Is.: Dale track 1, *R.Pal 11* (CBG). C.K.Is.: Sydney Hwy, 1.5 km S of jetty, West Is., *D.G.Williams 119* (CBG, K, PERTH).

Superficially similar to *Ageratum conyzoides*, differing from it in the axillary heads with leafy involucral bracts. First collected on Christmas Is. in 1983 and on Cocos (Keeling) Is.

in 1986 but possibly overlooked earlier.

15. SYNEDRELLA

Synedrella Gaertn., *Fruct. Sem. Pl.* 2: 456, t. 171 (1791), *nom. cons.*; from the Greek *synedros* (placed together), as the capitula are usually borne very close together in the leaf axils.

Type: *S. nodiflora* (L.) Gaertn.

Herbs. Leaves opposite, ±petiolate, toothed, sometimes 3-veined from near base. Capitula small, narrow, axillary, ±sessile; involucre narrowly campanulate; bracts in 2 or 3 whorls, the outer leafy, the inner scarious; receptacle small, flat, with concave scales. Disc florets few, with narrowly funnel-shaped, 4- or 5-lobed, yellow corolla; marginal floret corolla with a long, tubular base and a short, yellow ligule. Achenes of 2 types: disc florets produce a narrow achene with 2 or 3 stiff, apical awns; marginal florets produce a broad, bilaterally flattened achene, with several marginal and apical spinelets.

A predominantly warm-temperate and tropical New World genus of c. 80 species, with 2 weedy species which have become naturalised throughout the tropics; 1 widely naturalised species occurs on Christmas and Cocos (Keeling) Islands.

***Synedrella nodiflora** (L.) Gaertn., *Fruct. Sem. Pl.* 2: 456, t. 171, fig. 7 (1791)

Verbesina nodiflora L., *Cent. Pl.* 1: 30 (1755). T: Herb. C.Linnaeus; ?syn: S *n.v.*, *fide* C.Jarvis, *pers. comm.* Epithet from the Latin *nodus* (a knot, node) and *flos* (a flower), the flowers being sessile at the stem nodes.

Erect herb 0.4–1.5 m tall. Leaves ovate, decurrent, shallowly serrate, acute, appressed-hairy, scabrid, 3-veined at base; lamina c. 2–14 cm long; petiole 0–3 cm long. Capitula inconspicuous, ±sessile, solitary or in small clusters; involucre ±cylindrical, c. 7–8 mm long; bracts few, in c. 2 whorls, the outer pair largest and herbaceous, hairy; scales c. 6 mm long, scarious. Disc florets: corolla c. 4 mm long, 4-lobed; anthers dark. Ray florets: corolla c. 4 mm long, bright yellow; ligule short, obovate, c. 1 mm wide, bilobed. Disc achene c. 4 mm long, tuberculate, with 2 stiff awns; ray achene with c. 12 marginal bristles.

Christmas Is., Cocos (Keeling) Is. Introduced to Christmas Is. very early as C.W.Andrews, *Monogr. Christmas Is.* 181 (1900), and H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 201 (1906), both recorded it as already common, the latter noting its spread from Flying Fish Cove to the mined areas on Phosphate Hill. It is now very common all over the island, especially on roadsides, cleared land and around Drumsite and Settlement, growing best in humid and somewhat shaded localities. On Cocos (Keeling) Is., grows as a weed of roadside and cultivation in coralline sand. A weedy species native to the West Indies, now widespread throughout the tropics.

Ch.Is.: common on shore terrace, *C.W.Andrews 48* (K); entrance to golf course, *R.Shivas 824* (PERTH); Stewart Hill, disturbed ground on track side, *D.J. & B.P.Du Puy CI34* (CBG, K). C.K.Is.: near kampong, top of lagoon beach, Home Is., *I.R.Telford 10050 & C.Howard* (AD, CBG, K); community vegetable garden, Home Is. (Pulu Selma), *D.G.Williams 207* (CBG, PERTH).

The fruit are efficiently dispersed in clothing.

16. BIDENS

Bidens L., *Sp. Pl.* 2: 831 (1753); *Gen Pl.* 5th edn, 362 (1754); from the Latin *bi* (two) and *dens* (a tooth), after the two awns on the achenes of the type species.

Type: *B. tripartita* L.

Erect to procumbent herbs; stems sometimes woody, sometimes angled. Leaves opposite, broad to linear, entire or bipinnate with few leaflets, usually toothed. Capitula long-stalked, solitary or in a branched inflorescence; involucre campanulate; bracts in 2 whorls, connate

at base, the outer whorl herbaceous, the inner whorl with membranous margins; receptacle with narrow, caducous scales. Disc florets many, with a tubular, usually 5-toothed corolla, yellow; ray florets in 1 whorl, occasionally absent, with an entire or toothed ligule, usually white or yellow. Achene narrow, compressed or angled, dark brown, usually with 2 or 3 apical, barbed awns.

A large cosmopolitan genus of c. 233 species, occurring in a range of habitats from wetlands to very dry, exposed semi-deserts. Some species are efficient colonisers; 1 widespread, weedy species occurs on Christmas Is.

E.E.Sherff, The genus *Bidens*, *Field Mus. Nat. Hist., Bot.* 16: 1–709 (1937); M.Tadessa, The genus *Bidens* (Compositae) in NE Tropical Africa, *Acta Univ. Upsal.* 24: 1–138 (1984).

***Bidens pilosa** L., *Sp. Pl.* 2: 832 (1753)

var. **minor** (Blume) Sherff, *Bot. Gaz.* 80: 387 (1925) & *Field Mus. Nat. Hist., Bot.* 16: 421–429, t. 102, figs c, d, k–r (1937)

B. sundaica var. *minor* Blume, *Bijdr.* 914 (1826). T: near Buitenzorg, Java, *C.L.Blume 900.146, 72, 73, 75*; syn: probably L *n.v.* Specific epithet from the Latin *pilosus* (hairy), in reference to the indumentum. Varietal epithet is the Latin for lesser or inferior.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 736 (1973).

A straggling herb to c. 1.5 m tall; stems square, often reddish. Leaves mostly 3–5-foliolate; petiole short. Leaflets ovate, c. 1–8 cm long, serrate, acute, narrowly decurrent, minutely hairy on veins and margins. Capitula solitary or few, in a lax, terminal inflorescence, daisy-like; involucre 5–6 mm long; bracts connate at base, the outer whorl smaller, spathulate; scales 5–6 mm long. Disc florets: corolla narrowly funnel-shaped, 3–4 mm long, 5-lobed, orange-yellow. Ray florets 5–7; corolla c. 6 mm long, white or pale yellow; ligule c. 3 mm wide, conspicuously 3-toothed. Achene linear, 5–8 mm long, black, usually with 3 apical, barbed awns. *Cobblers Pegs*.

Christmas Is. A very common, introduced, colonising species, often seen in cultivated areas, on roadsides and among limestone and loose soil in mined areas. A common, pantropical and subtropical weedy species, the variety occurring throughout most of the range of the species.

Ch.Is.: roadside herb, *D.A.Powell 531* (K); South Point road, *A.Pearson P58* (K); Toms Ridge mining area, *B.A.Mitchell 158* (CBG, K); weed in market garden, 2 km W of Settlement, *R.Shivas 816* (PERTH); old mine site, 0.5 km N of airport, *R.Shivas 942* (PERTH).

Bidens pilosa var. *minor* is distinguished by its small, white or pale yellow, ligulate ray florets, which are absent in the type variety. It should also be noted that M.Tadessa, *op. cit.* 122–129, indicated that varieties may not be distinguished as a complete range of intermediate states may occur. However, as individual populations can usually be referred to one of the varieties as distinguished above, the varietal distinction is maintained here.

The leaves are said to cure toothache, and the sap is used in Malesia to prepare eye-drops. The seeds have barbed bristles which attach firmly to anything that brushes against them and are commonly distributed in clothing.

17. TRIDAX

Tridax L., *Sp. Pl.* 2: 900 (1753); *Gen. Pl.* 382 (1754); from the ancient Greek plant name *Thridax*, for lettuce, arbitrarily applied by C.Linnaeus to this genus which does not resemble the lettuce.

Annual or perennial herbs; stems creeping, ascending or erect, pilose, sometimes glandular. Leaves opposite, petiolate, simple, toothed to lobed, hairy. Capitula terminal, 1–many on long stalks; involucre campanulate; bracts in 2 or 3 whorls, the outer whorl somewhat shorter and herbaceous, the inner whorls membranous; receptacle convex, with narrow,

scarious scales. Disc florets many, with tubular, usually 5-lobed, yellow corolla. Ray florets in 1 whorl; ligule mainly 3-toothed, usually white or yellow. Achene oblong, hairy; pappus 1 whorl of slender, plumose bristles.

A genus of c. 26 species from Mexico and tropical America; 1 species has become a widespread weed throughout the tropics and subtropics and is now naturalised on Christmas Is., Cocos (Keeling) Is. and the Coral Sea Is.

***Tridax procumbens** L., *Sp. Pl.* 2: 900 (1753)

T: Veracruz, Mexico, *W.Houstoun s.n.*, in Herb. Hort. Cliff. 418, *Tridax* 1; syn: BM. Epithet from the Latin *procumbens* (lying down) in reference to the habit of the plant.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 739 (1973).

Procumbent to ascending herb to c. 50 cm tall; stems pilose. Leaves ovate, obtuse at base, serrate to incised, acute, hairy; lamina c. 2.5–5.5 cm long; petiole c. 3–18 mm long. Capitulum solitary on very long, erect stalks, daisy-like; involucre cup-shaped, c. 5 mm long; bracts in 2 whorls, the outer whorl shorter, ovate, hairy, herbaceous. Disc florets: corolla c. 5 mm long, 5-lobed. Ray florets 5 or 6; corolla c. 6 mm long, cream or creamy yellow; ligule short, 3.5–4 mm wide, conspicuously 2- or 3-toothed. Achene c. 2 mm long; pappus of slender, plumose bristles 5–6 mm long, each with many fine, spreading hairs.

Christmas Is., Cocos (Keeling) Is., Coral Sea Is. Although not recorded by either C.W.Andrews or H.N.Ridley, it is now a common plant all over Christmas Is. It is most frequently found in open land around houses, in gardens, on roadsides and in mined areas, occurring as single stems to domed mounds. On Cocos (Keeling) Is. grows as a common weed around settlements, and in disturbed and open areas in coralline sand. On the Coral Sea Is. recorded for Willis Is. where it grows in herbfield in coralline sand. A native of Central America, this weedy species has now become widespread throughout the tropics and subtropics. It was first collected in Java about 1875.

Ch.Is.: shore terrace, Rocky Point, *A.Pearson P72* (K); central plateau, roadsides near Central Workshops, *B.A.Mitchell 93* (CBG, K); old mine site, 0.5 km N of airport, *R.Shivas 937* (PERTH). C.K.Is.: settlement, West Is., *I.R.Telford 9953 & C.Howard* (AD, CBG, K); old cemetery, West Is., *D.G.Williams 112* (CBG, PERTH). C.S.Is.: Willis Is., 21 Dec. 1981, *A.Skeat & J.Henry* (CBG).

The seeds are very efficiently carried, by the plumed pappus, on air currents. Contact with this plant can sometimes cause a minor skin irritation.

18. ARTEMISIA

Artemisia L., *Sp. Pl.* 2: 845 (1753); *Gen. Pl.* 5th edn, 367 (1754); named after the mythical Greek goddess Artemis, twin sister of Apollo, the virgin goddess of the moon and hunting. She was reputed to be able to kill without inflicting pain, hence the allusion may be to the stimulant and soothing, but ultimately harmful properties of some species.

Type: *A. vulgaris* L.

Herbs or shrubs, often aromatic. Leaves alternate, usually pinnatifid to bipinnate, often grey-hairy beneath. Capitula small, many, in a terminal or axillary, panicle-like inflorescence; involucre oblong to campanulate; bracts in several successively shorter whorls, with membranous margins; receptacle without scales, sometimes hairy. Florets all tubular, green, brown or yellowish; disc florets 4- or 5-lobed; marginal florets usually much narrower, minutely 2- or 3-toothed. Achene fusiform to oblong; pappus absent or reduced to a short, scarious ring.

A large, tropical to temperate genus of 250–400 species; 1 species naturalised on Christmas Is. Many species occur in arid localities, sometimes dominating the flora of the semi-desert steppes and plains of Asia and America. A high degree of salt tolerance in some species allows colonisation of sea-shore habitats and the 'sage brush' communities of North America. The genus is in need of a comprehensive taxonomic revision.

The inflorescence of *Artemisia* is adapted to wind-pollination. *Artemisia absinthium* L. (Wormwood) was formerly used in Europe in the preparation of the toxic alcoholic drink Absinthe. Vermouth is a wine-based beverage which also uses this species among its ingredients, but the bitter flavour derived does not include the toxic volatile oil. *Artemisia dracunculus* L. (Tarragon) is a widely used herb in European cuisine.

J.P.M.Brenan, *Artemisia verlotiorum* Lamotte and its occurrence in Britain, *Watsonia* 1: 209–223 (1950).

***Artemisia vulgaris** L., *Sp. Pl.* 2: 848 (1753)

T: Herb. C.Linnaeus 988.41; syn: LINN. Epithet is the Latin word for common or ordinary, signifying that this species is well-known and common in Europe.

Illustration: C.A.Backer, *Atlas 220 weeds sugar-cane fields Java* t. 742 (1973).

Erect herb to c. 2 m tall. Leaves deeply laciniate, decurrent, not toothed, woolly-pubescent and whitish beneath, dark green above, strongly aromatic; lobe apices acute; lamina c. 1.5–10 cm long; upper leaves often simple. Capitula sessile or short-stalked, pendent, in a large, branched, leafy, terminal or axillary inflorescence; ultimate branches raceme-like; involucre campanulate, 3–4 mm long; bracts in c. 3 whorls, oblong, membranous, woolly-pubescent. Florets minute, green; disc floret corolla narrowly funnel-shaped, c. 2.5 mm long, with 5 recurved lobes; marginal floret corolla filiform, 1.5–2 mm long, the style branches protruding from apex. Achene ellipsoidal, c. 1 mm long. *Mugwort*, *Hiya*. Fig. 87D.

Christmas Is. Introduced, usually occurring in open localities such as roadsides, field margins and waste ground in the central area of the plateau, although this range seems to be increasing. Native to Europe, northern Africa and Asia as far east as Turkestan and Siberia.

Ch.Is.: central area, *D.A.Powell 162* (K); central plateau, alongside railway line near Camp 4, *B.A.Mitchell 118* (CBG, K).

This species is treated here as a species aggregate. The aggregate includes *A. vulgaris* and *A. verlotiorum* Lamotte, two closely related taxa that are difficult to distinguish. In Europe they differ in their flowering season and vegetative habit, but those characters do not help in less seasonal localities. In the specimens from Christmas Is., the veinlets in the leaf are translucent, a character of *A. verlotiorum*, but this seems inadequate for the differentiation of two species.

This species is used in Malesia as a flavouring. It contains cineole and is used medicinally as a poultice or wash for sores and as a general antiseptic, expectorant and anthelmintic. It is reputed to discourage insect infestations of clothing and furniture.

19. COTULA

Cotula L., *Sp. Pl.* 2: 891 (1753); *Gen. Pl.* 5th edn, 380 (1754); from the Latin word for a small cup, in reference to the involucre.

Type: *C. coronopifolia* L.

Leptinella Cass., *Bull. Sci. Soc. Philom. Paris* 1822: 127 (1822). Type: *L. scariosa* Cass.

Perennial or annual herbs, prostrate or erect. Leaves mainly cauline, toothed or pinnate. Capitulum solitary, terminal or axillary, pedunculate; involucre hemispherical with 2 or 3 rows of herbaceous bracts. Outer florets pistillate, tubular. Disk florets functionally staminate (in subantarctic species). Pappus absent.

A genus of c. 80 species, mostly in the Southern Hemisphere, with c. 11 in Australia; 1 species on Macquarie Is.

D.G.Lloyd, A Revision of the New Zealand, Subantarctic, and South American Species of *Cotula*, Section *Leptinella*, *New Zealand J. Bot.* 10: 277–372 (1972); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 41 (1984).

Cotula plumosa (Hook.f.) Hook.f., *Handb. New Zealand Fl.* 141 (1864)

Leptinella plumosa Hook.f., *Fl. Antarct.* 1: 26 (1844). T: Auckland Islands, *J.D.Hooker 1448*; lecto: K *n.v.*, *fide* H.H.Allan, *Fl. New Zealand*, 1: 681 (1961); Campbell Is., *J.D.Hooker*; syn: ?K *n.v.*; Macquarie Is., *J.D.Hooker*; syn: ?K *n.v.* The Latin epithet refers to the feathery, dissected and villous leaves.

Illustrations: J.D.Hooker, *Fl. Antarct.* t. XX (1844), as *Leptinella plumosa*; B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* t. 33 (1955); D.G.Lloyd, *New Zealand J. Bot.* 10: fig. 25 (1972).

Perennial herb forming extensive mats; stems creeping, to 5 mm diam, with short, stout, ascending, green to purple, lateral branches bearing terminal rosettes of leaves, glabrous. Leaves oblanceolate in outline, 1–30 cm long (petiole comprising ¼–½ of length), 0.5–4.5 cm wide, 3-pinnate, soft, sparsely to densely villous; primary pinnae in 8–12 subopposite pairs. Scape slender, 2–10 cm long, shorter than leaves, villous. Capitulum 7–12 mm diam.; involucral bracts ovate-triangular, green with a dark tip, villous; pistillate florets 90–260 in 3–6 rows; staminate florets about the same. Achenes cylindrical, obscurely 4-angled, 1.8–2 mm long, glabrous or sparsely glandular-papillose, golden brown. *2n* = 52, D.G.Lloyd, *loc. cit.* Fig. 89A.

Macquarie Is. Widespread in maritime communities; rare inland, but recorded at altitudes up to 150 m. A circumantarctic species found on Auckland, Campbell, Antipodes, Macquarie, Kerguelen, Marion and Crozet Islands. Flowers Nov.–Mar.; fruits Feb.–May.

M.Is.: extending from southern slopes of Wireless Hill to southern slopes of Isthmus, 1 Dec. 1948, *N.R.Laird* (CHR, HO, MEL); Garden Cove, *G.Leaman & D.Montgomery 20* (HO); North Head, *R.D.Seppelt 11775* (HO); ANARE Stn near Biology Laboratory, *R.D.Seppelt 11971* (HO, MEL); between Langdon Bay and Unity Point, *R.D.Seppelt 12185* (HO).

A highly variable species. The variation in plants from Kerguelen Is. was described by A.Chastain, *Mem. Mus. Nat. Hist. Nat.* Ser. B. 11: 1–136 (1958). D.G.Lloyd & C.J.Webb, *New Zealand J. Bot.* 25: 99–105 (1987) treated *Leptinella* as a genus rather than as a section of *Cotula*.

20. CRASSOCEPHALUM

Crassocephalum Moench, *Methodus* 516 (1794); from the Greek *krassen* (strong, robust) and *kephale* (a head), indicating a genus of plants with robust capitula.

Type: *C. cernuum* (L.f.) Moench, *nom. illeg.* = *Crassocephalum rubens* (B.Juss. ex Jacq.) S.Moore

Erect or straggling annual herbs, rarely climbing. Leaves alternate, decurrent to petiole, sometimes auriculate, entire to lyrate-pinnatifid, toothed. Capitula terminal, solitary or several in corymbose clusters, on bracteate stalks; involucre cylindrical to urceolate; bracts in 2 whorls, with an inner whorl of long, slender, cohering bracts, subtended by an outer whorl of short, free bracts; receptacle convex, ±honeycombed. Florets all tubular; corolla filiform, narrowly funnel-shaped, 5-lobed, reddish, yellow or purplish. Achene narrowly cylindrical, ribbed, pale at base; pappus a whorl of fine, silky, white hairs.

A genus of c. 40 species from tropical and subtropical Africa and Madagascar, often preferring damp and partially shaded situations and able to colonise disturbed sites; 1 species is an aggressive weed which is rapidly increasing its range in SE Asia, Malesia, Australia and the Pacific islands, and is also present on Christmas Is.

R.O.Belcher, The typification of *Crassocephalum* Moench and *Gynura* Cass., *Kew Bull.* 455–465 (1955); C.G.G.J. van Steenis, Notes on the introduction of *Crassocephalum crepidioides* (Bth.) S.Moore in Indo-Australia (Compositae), *J. Ind. Bot. Soc.* 46: 463–469 (1967).

***Crassocephalum crepidioides** (Benth.) S.Moore, *J. Bot.* 50: 211 (1912)

Gynura crepidioides Benth. in W.J.Hooker, *Niger Fl.* 438 (1849). T: Sierra Leone, *G.Don*; syn: BM. Epithet from the plant genus *Crepis* (Asteraceae), which this species resembles.

Erect herb, sparingly branched, 30–90 cm tall. Leaves ovate or elliptic, attenuate at base, usually lyrately lobed with broadly rounded to acute sinuses, coarsely and irregularly serrate, acute at apex, sparsely puberulous; lamina c. 5–15 cm long; petiole to 3 cm long. Capitula stalked, in terminal clusters of c. 2–8, nodding at first; involucre cylindrical, 10–12 mm long, flattened at base; inner bracts linear, cohering to near apex, recurved in fruit, the outer whorl much shorter. Corolla 8–9 mm long, slightly flared, minutely lobed, brick red at apex. Achene linear-elliptic, c. 2 mm long, ribbed, dark red-brown; pappus hairs c. 12 mm long, silky, white.

Christmas Is. First collected in 1981 but by then already rather common on all mined areas, especially on the margins of forest and mines among low shrubs, herbs and grasses. Also occurs on road- and track-sides through the forest, preferring moist localities with some shade. A native of Africa and Madagascar, now a widespread, introduced weed of cultivated and disturbed land from Sir Lanka, India and southern China through Indo-China, the Philippines and Malesia to Australia (Qld) and the western Pacific islands.

Ch.Is.: mined areas, *D.A.Powell 529, 530* (K); National Park, circuit track, 7 Dec. 1983, *B.Reimann* (CBG); SW of Murray Hill, *D.J. & B.P.Du Puy, CI51* (CBG, K).

First recorded in Sumatra and Java in 1927, in New Guinea and the Philippines around 1948, and in Australia in 1955. This extremely rapid rate of spread is due in part to the efficiency of wind-dispersal of the seed and to the wide tolerance of soil types and climates exhibited by this species. The young plants may be used as a vegetable.

21. EMILIA

Emilia Cass., *Bull. Sci. Soc. Philom. Paris* 1817: 68 (1817). Eponymy not known.

Type: *E. flammea* Cass. = *E. sonchifolia* (L.) DC.

Herbs. Leaves alternate, rosulate and cauline, reducing up the stems, sessile, amplexicaul. Heads few in an open terminal inflorescence, rarely solitary, many-flowered; involucre ±cylindrical; involucral bracts in 1 series, linear, reflexing after flowering. Florets all tubular. Corolla 5-toothed, red, pink or purple; segments linear. Anthers entire at base, acute. Style arms filiform, the apices hairy. Achenes linear, ribbed; pappus hairs many, dentate.

A genus of c. 30 species of tropical Africa and Asia; 1 species on Cocos (Keeling) Is., also in tropical and subtropical Australia.

Emilia sonchifolia (L.) DC., *Prodr.* 6: 302 (1838)

Cacalia sonchifolia L., *Sp. Pl.* 2: 835 (1753). T: Ceylon and China; *n.v.* Specific epithet referring to the resemblance of the leaves to those of *Sonchus*.

Erect herb to 80 cm, usually branching at base, ±glabrous. Lower leaves ±ovate to obovate, to 16 cm long, narrowed and sometimes petiole-like towards base, dentate; upper leaves lyrate to sagittate, dentate. Heads 10–13 mm long, 4–5 mm diam.; peduncle 1–15 cm long. Involucral bracts 7–10, 9–12 mm long. Corolla pink to purple. Achenes 2–3 mm long; pappus 8–10 mm long, white.

Cocos (Keeling) Is. Grows in open areas, around settlements and on roadsides in coralline sand. Native to tropical Asia; widely naturalised, including tropical and subtropical Australia.

C.K.Is.: near kampong, top of lagoon beach, Home Is., *I.R.Telford 10051 & C.Howard* (CBG, K); NW of Tajong Klikil, West Is., *D.G.Williams 16* (CBG); without precise locality, *F.W. & M.Jowett 31* (K).

Excluded species

Spilanthes iabadicensis A.H.Moore, *Proc. Amer. Acad.* 42: 542 (1907).

A further weedy species, *Spilanthes iabadicensis* A.H.Moore, was recorded on Christmas Is. by H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 156, 157 (1906), as *S. acmella*, but no specimen was collected. He stated, 'As I was chiefly interested in the indigenous plants at the time I paid less attention to the introduced species, but noted *Hibiscus abelmoschus* and *Spilanthes acmella*, neither seen since'. This statement was made after a visit of only 10 hours, made in 1890, only two years after the first settlement of Christmas Is. This species has not been recorded again and can be omitted from the list of species present on the island.

MONOCOTYLEDONAE

83. HYDROCHARITACEAE

I.R.H.Telford (C.K.Is., A.R.)

Aquatic herbs; stems usually rhizomatous or stoloniferous. Leaves alternate, opposite or whorled, radical or cauline, simple. Flowers in a few-flowered cyme or solitary, enclosed in or arising from a spathe, usually unisexual; spathe 2-fid or of 2 free segments. Flowers usually unisexual. Hypanthium usually elongate. Perianth segments 6 in 2 whorls, the inner sometimes petaloid or absent. Male flowers; stamens 2–many; anthers 2-locular, dehiscing by longitudinal slits. Female flowers: ovary inferior, of 3–6 united carpels, 1-locular; placentation parietal or laminar when partial partitions intruded; styles as many as carpels, usually 2-lobed or 2-fid; stigmas papillate. Fruit dry or fleshy, capsular or dehiscing irregularly. Seeds several to many; endosperm usually absent.

An almost cosmopolitan family of 15 genera and c. 105 species of marine and freshwater habitats; 11 genera, 17 species in Australia, of which 1 widespread tropical marine species also occurs on Cocos (Keeling) Is., Ashmore Reef and Cartier Is.

C. den Hartog, Hydrocharitaceae, *Fl. Males.* ser. I, 5: 381–413 (1957); H.I.Aston, *Aquat. Pl. Australia* 210–240 (1973); D.Simpson, *Fl. Trop. E. Africa* 1–29 (1989).

THALASSIA

Thalassia Banks & Sol. ex K.D.Koenig in C.D.E.Konig & J.Sims, *Ann. Bot.* 2: 96 (1805); from the Greek *thalassa* (the sea), in reference to the marine habitat.

Type: *T. testudinum* K.D.Koenig

Schizotheca Ehrenb., *Abh. Konigl. Akad. Wiss. Berlin* 1832, 1: 429 (1834). T: *S. hemprichii* Ehrenb.

Submerged marine rhizomatous herbs, dioecious. Leaves alternate, distichous on short, erect stems, sessile, linear, with a basal sheath; nerves longitudinal. Inflorescence pedunculate, unisexual, 1-flowered. Spathe usually bifid at apex. Male flowers: perianth segments 3; stamens 3–many; pollen united into thread-like chains. Female flowers: perianth similar to male; styles 6, each bifid into filiform segments. Fruit a capsule; valves many. Seeds few to many, ±conical.

A genus of 2 species, 1 Caribbean, the other of the tropical W Pacific and Indian Oceans, including Cocos (Keeling) Is., Ashmore Reef and Cartier Is.; also tropical Australia.

Thalassia hemprichii (Ehrenb.) Asch. in Petermann's, *Geogr. Mitth.* 17: 242 (1871)

Schizotheca hemprichii Ehrenb., *Abh. Konigl. Akad. Wiss. Berlin* 1832, 1: 429 (1834). T: Ethiopia, Eritrea, Massawa, 1820–1826, *Ehrenberg*; holo: B; iso: BM, K, L, P, *fide* D.Simpson, *op. cit.* 24. Eponymy of epithet not known.

Illustration: H.I.Aston, *Aquat. Pl. Australia* 235, fig. 94 (1975).

Rhizomes long, marked by annular scars. Leaves to 30 cm long, 4–11 mm wide, serrulate, rounded at apex; nerves 10–17. Male inflorescences paired, sometimes solitary; spathe 20–25 mm long, slit on one side; peduncle c. 3 cm long. Male flower: pedicel 2–3 mm long; perianth segments 7–8 mm long; stamens 3–12; anthers subsessile. Female inflorescence solitary; spathe similar to male but not slit; peduncle 1–4 cm long. Female flower: pedicel 10–15 mm long, elongating to 40 mm; hypanthium 2–3 cm long; ovary c. 10 mm long; styles 15–20 mm long. Fruit ±globose, 2–3 cm diam., shortly beaked, softly spiny; valves 8–20. Seeds 3–9, 7–10 mm long. *Turtle Grass*.

Cocos (Keeling) Is., Ashmore Reef, Cartier Is. On Cocos (Keeling) Is. grows on flats between fringing reefs and beaches and in lagoons in coralline sand and coral debris near low watermark, often exposed at low tide. On Ashmore Reef grows in coralline sand flats to the E of West Is.; recorded by D.Carter, ANPWS, *pers. comm.* On Cartier Is. grows as dense meadows on the fringing reef flats. Widespread through the tropical Indian and W Pacific Oceans including Australia.

C.K.Is.: lagoon, North Keeling Is., *I.R.Telford 10030 & C.Howard* (CBG, MEL); lagoon, North Keeling Is., *D.G.Williams 56* (CBG, K); Klapa Tuju, West Is., *I.R.Telford 9993 & C.Howard* (CBG, PERTH). A.R.: material unavailable. C.Is.: Cartier Is., *K.F.Kenneally* 6373 (PERTH).

Superficially similar to *Thalassodendron ciliatum* in the Cymodoceaceae but differs in its shorter, erect stems less than 10 cm long. Description largely drawn from H.I.Aston, *op. cit.* 235, as only sterile collections were available from Cocos (Keeling) Is.

84. CYMODOCEACEAE

I.R.H.Telford (C.K.Is.)

Marine rhizomatous herbs, dioecious. Leaves alternate, distichous on erect stems, linear or strap-like from a basal sheath, ligulate at sheath/lamina junction; venation longitudinal. Flowers in an axillary or terminal bracteate cyme or panicle, or solitary or paired, unisexual. Perianth absent. Male flowers: anthers 2, paired on a common filament or sessile, 2-locular, dehiscing by longitudinal slits. Female flowers: carpels 2, free, 1-locular; placentation apical; ovule solitary, pendulous; stigmas 2 or 3. Fruit small, indehiscent, hard. Seed lacking endosperm.

A family of 5 genera and 18 species mostly of tropical and subtropical coasts, rarely of temperate waters; 5 genera, 10 species in Australia, of which 2 genera (2 species) occur around Cocos (Keeling) Is. Often included in Zanichelliaceae or Zosteraceae, differing from the former in the filamentous pollen and marine habitats, from the latter in inflorescence structure and floral morphology.

H.I.Aston, Zanichelliaceae, *Aquat. Pl. Australia* 301–325 (1973); F.R.Fosberg & S.A.Renvoize, Potamogetinaceae, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 300–302 (1980).

KEY TO GENERA

Rhizomes woody; leaves more than 8 mm wide	**1. THALASSODENDRON**
Rhizomes herbaceous; leaves less than 2 mm wide	**2. SYRINGODIUM**

1. THALASSODENDRON

Thalassodendron Hartog, *Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk, Tweede Sect.* 59: 186 (1970); from *Thalassia*, a superficially similar genus of family Hydrocharitaceae, and the Greek *dendron* (a tree), in reference to the larger habit of the genus.

Type: *T. ciliatum* (Forssk.) Hartog

Submerged marine herbs; rhizomes woody, marked by annular scars. Leaves linear, strap-like, serrulate towards apex. Flowers terminal, solitary. Male flowers: anthers 2, united, each with an apical appendage. Female flowers: carpels 2, free; stigmas 2. Fruit of 1 or 2 fertilised ovaries enclosed by the fleshy inner bract, usually viviparous.

A genus of 2 species of the tropical Pacific and Indian Oceans, 1 of which occurs on Cocos (Keeling) Is.

Thalassodendron ciliatum (Forssk.) Hartog, *Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk, Tweede Sect.* 59: 188 (1970)

Zostera ciliata Forssk., *Fl. Aegypt.-Arab.* 157 (1775). T: Red Sea, *collector unknown*; *n.v.*

Rhizomes 2–5 mm diam., roots 1–5 per internode, branching. Leaf lamina 7–15 cm long; sheath 1.5–4.5 cm long. Male flowers: anthers c. 6 mm long. Female flowers: ovary and style c. 6 mm long; stigmas c. 2 cm long.

Cocos (Keeling) Is. Grows in extensive patches at the N end of the lagoon of the main atoll below low tide level to a depth of 8 m. Widespread through the tropical Indian and W Pacific Oceans including NE Australia.

C.K.Is.: W entrance to lagoon, between North Point, West Is., and Horsburgh Is., *D.G.Williams s.n.* (BISH, CBG, K, MEL).

Dispersed by free floating detached fruiting branches up to 5 cm long. Superficially similar to *Thalassia hemprichii* of the Hydrocharitaceae but differs in the longer, erect stems, 10–65 cm long.

Descriptions largely drawn from H.I.Aston, *op. cit.* 319–321, as only sterile collections were available from the oceanic islands.

2. SYRINGODIUM

Syringodium Kütz. in R.Hohenacker, *Alg. Marin. Sicc.* 9 no. 426, (1860); J.E.Dandy & G.Tandy, *J. Bot.* 77: 116 (1939); from the Greek *syrix* (a pipe) and *-odes* (like), in reference to the stems.

Type: *S. filiforme* Kütz.

Submerged marine herbs; rhizomes herbaceous, marked by annular scars. Leaves linear or terete. Inflorescence cymose, enclosed in sheath of a reduced leaf. Male flowers pedicellate, subtended by a bract-like scale; anthers sessile, united at base, lacking apical appendages. Female flowers sessile or subsessile; stigmas 2, thread-like. Fruit ellipsoidal, beaked.

A genus of 2 species of the tropical Pacific and Indian Oceans including Australia; 1 species on Cocos (Keeling) Is.

Syringodium isoetifolium (Asch.) Dandy in J.E.Dandy & G.Tandy, *J. Bot.* 77: 116 (1939)

Cymodocea isoetifolia Asch., *Sitzungsber. Ges. Naturf. Freunde Berlin* 3 (1867). T: Australia, *collector unkown*, *n.v.* Epithet referring to the resemblance of the leaves to those in the genus *Isoetes*.

Illustration: H.I.Aston, *Aquat. Pl. Australia* 320, fig. 130 (1973).

Rhizomes c. 1 mm diam.; roots 1–3 per internode, unbranched or scarcely branched. Leaves

narrowly linear or subterete to 30 cm long, 1–2 mm wide; basal sheath auriculate, 15–50 mm long. Inflorescence 25–40 mm long. Male flowers: pedicels c. 7 mm long; anthers c. 4 mm long. Female flowers: ovary 3–4 mm long; stigmas 4–8 mm long. Fruit 3.5–4 mm long.

Cocos (Keeling) Is. Recorded from two populations at the N end of the lagoon of the main atoll in coralline sand at a depth of c. 1.5 m. Widespread through the Indian and W Pacific Oceans including tropical and subtropical Australia.

C.K.Is.: W entrance to lagoon, off North Point, West Is., *D.G.Williams s.n.* (BISH, CBG, K, MEL).

Description largely drawn from H.I.Aston, *op. cit.* 319, as only sterile collections were available from Cocos (Keeling) Is.

85. ARECACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R.)

Palms; stems woody, usually stout, unbranched, solitary or clustered, sometimes very short or scandent. Leaves alternate, forming a terminal crown, large, pinnate, bipinnate, or palmate, evergreen. Inflorescences axillary or terminal, usually branched, usually bracteate; primary bracts usually large, persistent or caducous. Flowers usually small, many, bisexual or unisexual, actinomorphic, ±sessile or pedicellate or immersed in the rachilla. Perianth usually of 3 sepals and 3 petals, valvate or imbricate. Stamens usually 6–many, reduced to staminodes or lacking in pistillate flowers. Ovary superior, apocarpous or syncarpous; locules usually 1–3, reduced or lacking in staminate flowers; ovule 1 per locule. Fruit usually a berry, often dry, or a drupe. Endosperm present.

A mainly tropical and subtropical family extending into warm-temperate regions, containing c. 2750 species in c. 200 genera; 2 species occur naturally on Christmas Is., including a distinctive endemic species, while several others are cultivated, including *Areca catechu* L. (Betel Nut Palm), *Elaeis guineensis* Jacq. (African Oil Palm), *Ptychosperma macarthurii* (Veitch.) H.Wendl. ex Hook.f., and a species of *Phoenix* L. (Date Palm). One species on Cocos (Keeling) Is. and Ashmore Reef.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Arecaceae, *Fl. Java* 3: 165–199 (1968); H.E.Moore in A.C.Smith, Arecaceae, *Fl. Vit. Nova* 1: 392–438 (1979); N.W.Uhl & J.Dransfield, Arecaceae, *Genera Palmarum* 331–479 (1987).

KEY TO GENERA

Fruit 1.3–1.7 cm long, fleshy, ripening through white to red; inflorescence with 9–11 bracts covering the peduncle; a monocarpic palm **1. ARENGA**

Fruit c. 20–35 cm long, with a smooth, thin pericarp, a thick, fibrous mesocarp, and a hard, bony endocarp; inflorescence with a single large, sheathing bract; inflorescences produced in succession from the crown **2. COCOS**

1. ARENGA

Arenga Labill. in A.P.de Candolle, *Bull. Sci. Soc. Philom. Paris* 2: 162 (1800), *nom. cons.*; a Latin transcription of the Javanese name *aren*, for the type species.

Type: *A. saccharifera* Labill. = *A. pinnata* (Wurmb) Merr.

Dwarf to large, single-stemmed or clustered palms, usually monoecious. Leaf sheath with

fibrous margins; petiole present; lamina pinnate; pinnae induplicate, linear to cuneate, paler beneath, ragged at apex. Inflorescences mostly unisexual, generally produced basipetally, solitary or multiple from each node; peduncle bearing a 2-keeled prophyll and several bracts; rachis usually with many unbranched rachillae. Flowers unisexual; sepals 3, short, imbricate; petals 3, valvate, fused at base, much longer than sepals. Male flower buds cylindrical; stamens 6–many. Female flower buds spherical; ovary trilocular. Fruit fleshy, 1–3-seeded, scarred at apex, subtended by persistent petals; endosperm homogeneous.

A genus of c. 17 species distributed from eastern India and the Himalayas to southern China, Taiwan and the Ryukyu Islands, and S through Indo-China and Malesia to north-eastern Australia (Qld). They are mainly primary rainforest species, some tree-like and sometimes gregarious, others occurring as forest undergrowth palmlets.

The fruit sap contains minute, sharp crystals that are a potent skin irritant. Several species are cultivated as ornamentals. *Arenga pinnata* (Wurmb) Merr. is important in SE Asia and Malesia as a source of sugar in the sap tapped from the peduncles of young inflorescences. This sugary sap is also drunk or fermented to make palm wine. The trunk yields starch, fibres and rope, and the leaves may be used as thatch. It is a monocarpic species which builds up a large reserve of carbohydrate in its trunk prior to flowering. Another monocarpic species, with similarly large reserves, occurs on Christmas Is.

The inflorescences tend to be unisexual, through selective abortion within the triads of flower buds borne on the rachillae. Only the central buds reach maturity in female inflorescences, and only the lateral buds in male inflorescences.

Useful taxonomic characters in *Arenga* include growth patterns and flowering behaviour. The genus can be divided on the basis of whether or not individual stems die after flowering, and whether or not regeneration occurs through the growth of shoots at the base of the stem. The inflorescences may be solitary or multiple at the nodes and may develop from the base of the stem upwards (acropetally), or from the apex of the stem downwards (basipetally), the latter occurring more frequently.

R.B.Kurtz, *Arenga listeri* (Palmae), *Principes* 14: 111–116 (1970); D.A.Powell & J.Covacevich, Lister's Palm, *Arenga listeri*, on Christmas Island: A rare or vulnerable species?, *Principes* 27: 89–93 (1983); J.Dransfield & J.P.Mogea, The flowering behaviour of *Arenga* (Palmae: Caryotoideae), *Bot. J. Linn. Soc.* 88: 1–10 (1984).

Arenga listeri Becc. in D.Oliver, *Hooker's Icon. Pl.* 20: t. 1985 (1891)

T: Christmas Is., 3 Oct. 1887, *J.J.Lister*; holo: K. Named after J.J.Lister, the naturalist aboard H.M. Survey Ship *Egeria*, who in 1887 spent 10 days on Christmas Is., collecting natural history specimens and data.

Illustrations: R.B.Kurtz, *Principes* 14: 111–116, figs 1–5 (1970); D.A.Powell & J.Covacevich, *Principes* 27: 89–93, figs 1 & 2 (1983).

A single-stemmed, monocarpic tree palm, 10–20 m tall; trunk naked, erect; upper nodes with c. 5–7 inflorescence buds. Leaf pinnate; sheath to 1 m long, with tangled, brown, marginal fibres; petiole short; rachis c. 3–4 m long; pinnae solitary in juveniles, paired except 2 basal clusters of c. 4 in adults, to 90 cm long, greyish beneath. Inflorescences unisexual, panicle-like; females largest, to 2 m long; peduncle bracts 9–11. Male flowers paired; petals oblong, c. 7 mm long, obtuse, green, buff within; stamens many, reflexed, bright yellow. Female flowers solitary; petals triangular, c. 5 mm long; ovary large, exceeding petals. Fruit ellipsoidal, 13–17 mm long, fleshy, ripening through white to red. *Christmas Island Palm*, *Lister's Palm*. Figs 63, 88.

Christmas Is. Endemic. Sometimes gregarious, forming almost pure stands on basaltic outcrops where there is usually more moisture in the soil, especially in the shorter forest on the terraces. Also frequent as an undercanopy tree throughout the taller rainforest on the plateau and terraces, with the juveniles forming important elements of the shrub layer.

Ch.Is.: near Waterfall, *B.A.Mitchell 79* (CBG); middle terrace, below Ross Hill trig., *D.J. & B.P.Du Puy CI84* (CBG, K); below Ross Hill trig., *D.J. & B.P.Du Puy CI85* (BO, CBG, K); Grants Well, *D.J. & B.P.Du Puy CI105* (BO, CBG, K); behind Greta Beach, *D.J. & B.P.Du Puy CI112* (CBG, K).

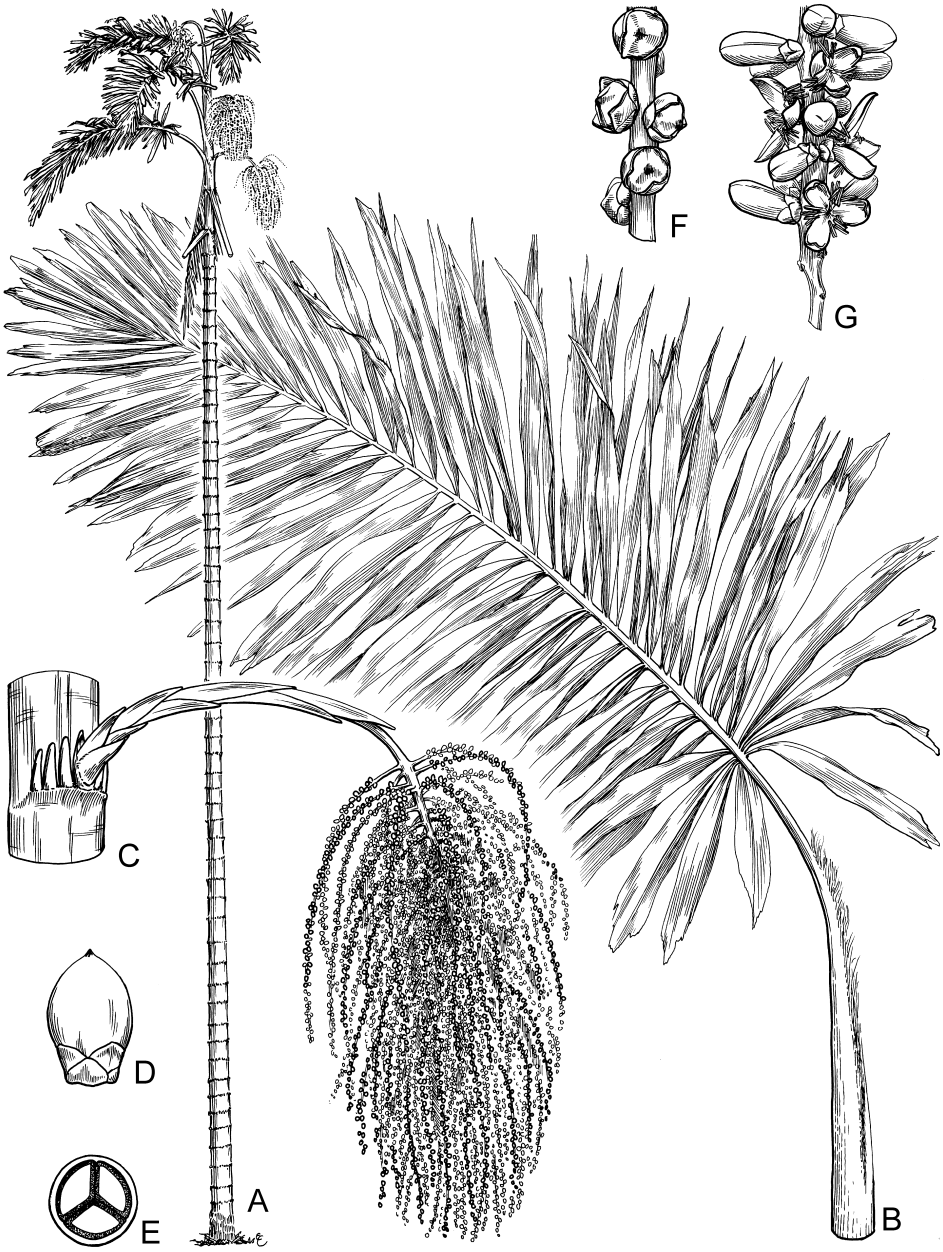

Figure 88. **A–G**, ARECACEAE: *Arenga listeri*. **A**, fertile plant with female inflorescences X0.0075; **B**, leaf and sheath X0.05; **C**, female inflorescence, with fruit, and stem node with several buds X0.05; **D**, fruit X1; **E**, fruit, T.S. X1 (**A–E**, D. & B.Du Puy CI105, K); **F**, female flowers X1 (J.Lister *s.n.*, K); **G**, male flowers X1 (D. & B.Du Puy CI112, K). Drawn by E.Catherine.

A distinctive species, possibly related to *A. porphyrocarpa* (H.Mart.) H.E.Moore or *A. microcarpa* Becc. Shares the monocarpic habit with *A. pinnata*, the Sugar Palm (which otherwise differs in many characters), an economically important palm for its sugary sap and the large reserve of starch built up in the trunk prior to flowering and fruiting. *Arenga listeri* could have similar commercial properties. On Christmas Is., Robber crabs (*Birgus latro*) gather around fallen palm trees to eat the starchy core of the trunk. In order to collect the crabs for a meal or for fishing bait, an *Arenga* palm is sometimes felled and the trunk split open, attracting large numbers of crabs a few days later. The crabs also relish the ripe fruit, gathering around the base of a fruiting palm to eat the fruit as it falls, some even climb up to the inflorescences. The fruit is also a favourite of the endemic Christmas Island Imperial Pigeon (*Ducula whartoni*). It is perhaps surprising that these animals are not affected by the highly irritant sap of the fruit, which contains large quantities of minute sharp crystals which cause intense itching and discomfort if accidentally rubbed into the skin. The growing point (or 'cabbage') used to be eaten by the Chinese mine workers.

The female inflorescences sometimes rupture the base of the leaf sheath, but most develop after the leaves have fallen to expose the stem and buds.

Typically, the most apical inflorescence is female and develops first. Then the central buds at the nodes develop, again as females, and finally the lateral buds of the nodes develop sequentially into male inflorescences as the tree gradually dies.

2. COCOS

Cocos L., *Sp. Pl.* 2: 1188 (1753); *Gen. Pl.* 5th edn, 495 (1754); said to be derived from the Portuguese word *coco*, (a palm), but also used for a hobgoblin, the seed of the coconut, with its 3 pores, bearing a fancied resemblance to a grotesque face.

Type: *C. nucifera* L.

Single-stemmed, monoecious, tall palms. Leaf sheath fibrous; petiole present; lamina pinnate; pinnae induplicate, minutely scaly beneath. Inflorescences bisexual, protandrous, produced continuously from crown, solitary from each node; peduncle robust, bearing a tubular, 2-keeled prophyll and a very large, woody, tubular bract enclosing young inflorescence, eventually splitting and becoming navicular; rachis with many unbranched rachillae. Flowers unisexual; sepals 3, short, imbricate; petals 3. Male flower buds ovoid; petals valvate, much exceeding sepals; stamens 6. Female flowers large; buds spherical; petals imbricate, resembling sepals; ovary trilocular. Fruit large, fibrous, with 1 large seed.

A monotypic genus, probably originating in the tropics of Malesia or the Pacific islands, now widely cultivated throughout the tropics including Christmas Is. and Cocos (Keeling) Is. It is regarded as naturalised on Christmas Is. This tree has many uses but the most valuable part is the endosperm, which forms as a white layer c. 1 cm thick over the inside of the endocarp. This is rich in a valuable edible oil. The endocarp also encloses a large cavity containing a translucent liquid, the water, which can be drunk.

S.F.Glassman, Revisions of the palm genus *Syagrus* Mart. and other selected genera in the *Cocos* alliance, *Illinois Biol. Monogr*. 56: 118–120 (1987).

Cocos nucifera L., *Sp. Pl.* 2: 1188 (1753)

T: illustrations of 'Tenga' in H.A.Rheede, *Hortus Indicus Malabaricus* 1: 1–8, t. 1–4 (1678); lecto, *fide* H.E.Moore & J.Dransfield, *Taxon* 28: 64–65 (1979). Epithet from the Latin *nux* (a nut) and *ferre* (to bear, to carry), indicating that this species bears nut-like fruit.

Illustration: N.W.Uhl & J.Dransfield, *Genera Palmarum* t. 28B, 493, fig. 174 (1987).

A single-stemmed palm to c. 25 m tall; trunk naked, ascending. Leaf pinnate; sheath a network of fibres; petiole 1–1.3 m long; rachis 4–5 m long; pinnae solitary, regularly arranged, linear, c. 60–90 cm long, acute, minutely scaly beneath. Inflorescences bisexual, panicle-like, c. 1–1.5 m long; bract c. 70–100 cm long, woody. Male flowers paired or

solitary, fragrant; petals narrowly ovate, 10–13 mm long, yellow; stamens 6. Female flower solitary, towards bases of rachillae, spherical; petals 20–25 mm long, resembling sepals. Fruit ellipsoidal, c. 20–35 cm long, obtusely 3-angled; pericarp smooth, thin; mesocarp thick, fibrous; endocarp hard, bony, with 3 basal pores. *Coconut Palm*.

Christmas Is., Cocos (Keeling) Is., Ashmore Reef. On Christmas Is. commonly planted in both gardens and waste or disturbed land. A large, dense, probably native stand occurs in the damp sand behind Dolly Beach. Native to Cocos (Keeling) Is., common on ocean and lagoon beach tops in coralline sand where reported in large numbers by early visitors. On Ashmore Reef planted by Indonesian fishermen at the wells on Middle and East Is. The species is thought to have originated somewhere around Malesia, the Philippines, northern Australia or the western Pacific islands.

Ch.Is.: no precise locality, *D.A.Powell 736* (K); garden in Settlement, *G.J.Collins s.n.* (K). C.K.Is.: North Keeling Is., *I.R.Telford 10031 & C.Howard* (CBG); on road to Bechet Besar, West Is., *D.G.Williams 251* (CBG).

The coconut is an important tree crop cultivated throughout the tropics and subtropics. It is usually regarded as a sea-shore or coastal forest palm, which is probably its natural environment, but it will flower and fruit successfully inland. Coconut water is a refreshing drink, especially when the nut is slightly immature. The white, mature endosperm (flesh) may be squeezed to yield a richer milk used in Malay cooking, or the flesh may be grated or shredded. If the flesh is grated and boiled, a rich, fragrant oil floats to the surface. This oil is extracted commercially from the dried flesh (copra). The oil is used to make margarine, soap and skin lotions or balms. Copra and oil have been produced commercially on Cocos (Keeling) Is. Large plantations were established for that purpose on much of the main atoll. The fibrous husk of the fruit can be used to make rope or matting. The leaves are used for thatching and weaving, and the growing point (cabbage) is delicious eaten boiled, pickled or raw. If the young inflorescence is bound with rope, then bruised and the tip cut off, a sweet juice can be collected. This may be boiled down to form 'jaggery' sugar, or fermented to make toddy (wine) or arrack (spirits). On Cocos (Keeling) Is. one variant is preferred for its flesh, another for its water.

86. PANDANACEAE

B.C.Stone (Ch.Is., C.K.Is.)

Trees, shrubs or lianas, dioecious; stems erect or ascending, simple or branched, sympodial, marked by leaf scars. Aerial and adventitious roots produced, function various from proproots to aborted nubs or spines. Leaves 3-ranked in spirals, simple, pleated; midrib keeled below; veins longitudinal, many, parallel; base sheathing, never tubular. Inflorescence terminal, sometimes on a specialised branch, unisexual; bracts spathaceous, coloured or white. Staminate inflorescence soon pendulous, usually multispicate; flower with stamens mostly adnate in bundles or staminate phalanges of 3–many; phalanges of various forms, usually with a column and free filaments, sometimes pendent from edge or undersurface of a peltate disc, or subsessile and subtended by a cupular organ, rarely with a pistillode. Pistillate inflorescence erect; flowers of 1-locular carpels, or 2–many-locular fused carpels or carpellate phalanges; style absent or indistinct, sometimes spiniform; ovules solitary or several to many. Fruit a drupe or polydrupe; endocarp woody or soft; pericarp thin, fleshy to pulpy. Endosperm produced.

A family of 3 genera and c. 880 species. The family is restricted to the Old World tropics, ranging from western Africa to Polynesia. *Pandanus* has the widest distribution; *Freycinetia* ranges from Sri Lanka and the Nicobar Islands E to the high islands of Polynesia; and *Sararanga* has 1 Philippine and 1 New Guinea – Solomon Islands species. In Australia, *Freycinetia* is limited to tropical Qld, north-eastern N.S.W. and Norfolk Is.;

about 20–25 species of *Pandanus* are found along the northern tropical coasts of W.A., N.T., Qld and S into N.S.W.; also 1, possibly 2, species occur on Lord Howe Is., 2 endemic species occur on Christmas Is. and 1 endemic variety occurs on Cocos (Keeling) Is.

A very clearly defined and easily recognised family of ancient lineage; clearly identifiable fossil pollen of mid-Cretaceous age has been recovered in various sites. The nearest related family appears to be the Arecaceae, but there are many differences. Formerly, the Typhaceae were considered relatives but this is now definitely disproved.

H.N.Ridley, Pandanaceae, *J. Straits Branch Roy. Asiat. Soc.* 23: 123–140 (1891); C.W.Andrews, Pandanaceae, *Monogr. Christmas Is.* (1900); O.Warburg, Pandanaceae, *Pflanzenr.* 3, 4(9): 1–99 (1900); U.Martelli, Pandanaceae, *Webbia* 1: 361–371 (1905); H.N.Ridley, Pandanaceae, *J. Straits Branch Roy. Asiat. Soc.* 45: 137–271 (1906); H.St.John, Pandanaceae, *Pacific Sci.* 19: 113–119 (1965); B.C.Stone, Pandanaceae, *Fed. Mus. J.* n. ser. 28: 1–100 (1983); B.C.Stone, Pandanaceae, *Gardens Bull. Singapore* 39(2): 193–202 (1986).

PANDANUS

Pandanus Parkinson, *J. Voy. South Seas* 46 (1773), *nom. inval.*; *Pandanus* Parkinson ex Z., *Naturforscher* (*Halle*) 4: 250 (1774); from the Malay name *pandan* or *pandang*.

Type: *P. tectorius* Parkinson ex Du Roi.

Usually trees or shrubs; stems sometimes spiny; prop roots usually arising at stem base, sometimes from branches, sometimes spiny; adventitious roots often in leaf axils. Leaves crowded, linear-ensiform, rarely narrowly elliptic, sheathing at base, M-shaped in T.S.; midrib prickly beneath; margins prickly. Staminate inflorescence a raceme of spikes; spikes usually of 3–60 stamens; filaments smooth; anthers usually oblong or linear. Pistillate inflorescence a solitary head, raceme, or spike of heads, bracteate. Pistillate heads of free or fused carpels; ovule 1 per carpel; style absent or spiniform; stigma U- or V-shaped or a groove. Fruit a drupe or polydrupe with fused, hard, bony endocarp. $2n = 60$.

A genus of c. 700 species, restricted to the Old World tropics from West Africa to Polynesia, and from Okinawa and Hawaii S to Australia. The centres of speciation are Madagascar and Malesia. Two species endemic on Christmas Is.; 1 endemic variety of another species on Cocos (Keeling) Is.

1 Polydrupe with carpels tending to be bi- or triseriate, or imperfectly radially arranged; carpels usually 6–9, rarely to 12 per polydrupe; stigma 3–4 mm long and wide; polydrupe often somewhat to markedly compressed; staminate phalanges umbelliform with a column bearing c. 13–15 stamens clustered at apex; anthers 3–4 mm long, apiculate; anther apiculus with a terminal cluster of glandular hairs **3. P. elatus**

1: Polydrupe with carpels arranged centrifugally; carpels 9–26 per polydrupe; stigma 1–3 mm long and wide; polydrupe slightly or not compressed laterally; staminate phalanges racemose with 15–36 stamens; anthers 2–5 mm long; anther mucro acute, glabrous

2 Polydrupe with 9–26 carpels, usually c. 15, each with rounded-pyramidal tips; polydrupe sides usually sulcate between carpels; staminate phalanges 15–20 mm long; anthers c. 5 mm long; leaf margins near base with rather small prickles 1–3 mm long, usually 2–5 mm apart **2. P. christmatensis**

2: Polydrupe with c. 9–13 carpels, usually c. 12, each with low or subtruncate tips; polydrupe sides usually smooth, non-sulcate; staminate phalanges 9–14 mm long; anthers c. 2 mm long; leaf margins near base with prickles c. 3–4 mm long, 5–15 mm apart **1. P. tectorius**

1. Pandanus tectorius Parkinson ex Du Roi as Z., *Naturforscher* 4: 250 (1774)

var. **cocosensis** B.C.Stone, *Fl. Australia* 50: 571 (1993)

T: top of beach, Cocos (Keeling) Is., 26 June 1961, *H.St.John 26414*; holo: BISH. Epithets from the Latin *tectorius* (used for covering), apparently referring to the use of the leaves for thatching in Tahiti (J.Parkinson, *J. Voy. South Seas* 46, 1773); and *cocosensis* referring to the type locality.

Shrub or small tree; prop roots basal. Leaves 1–1.5 m long, often somewhat twisted, elongate to subflagelliform-triquetrous at tip, glaucous beneath; marginal prickles c. 3–4 mm long, 5–15 mm apart near base. Staminate inflorescence c. 35–40 cm long, with c. 11 spikes, bracteate; bracts cream-white; spikes to 6 cm long; staminate phalanges with c. 25–36 stamens, 9–14 mm long. Pistillate inflorescence peduncle elongate; head with c. 40–80 carpellate phalanges; stigma 2–3 mm long and wide. Polydrupe of 9–13 carpels, obcuneate, subtruncate or low-convex, 6–7.5 cm long, 4.5–5 cm wide, often scarred with longitudinal corky scars, subparallel laterally in upper third or half; apex subtubular with carpel tips very low-pyramidal or rounded, not very prominent.

Cocos (Keeling) Is. Endemic. Occurs on the strand in white, coralline sand, a habitat well-exploited by other varieties of the same species in other parts of the world.

C.K.Is.: Home Is., *I.R.Telford & C.Howard 10078* (CBG, PH, pistillate tree, fruit immature); West Is., *I.R.Telford & C.Howard 10037* (CBG, PH, staminate tree).

The Cocos (Keeling) Is. form of this species is regarded as a distinct variety. Variation and distribution of this widespread species are still far from completely understood. It is noteworthy that plants with a similar appearance, especially in regard to the form of the polydrupe, are to be found in Java (and probably Sumatra), and westwards. *Pandanus platycarpus* Warb., based on a collection from Zanzibar, has rather similar polydrupes. The tendency of this species to drift and invade remote islands is well demonstrated by the occurrence of various forms of *P. tectorius* throughout Polynesia, along the coast of Australia, in parts of Melanesia and Indonesia, and (possibly) in some islands of the Indian Ocean near Africa. Indeed *P. kirkii* Rendle of eastern Africa is very similar.

Pandanus tectorius var. *cocosensis* differs from *P. christmatensis* in several, though not very obvious, ways. They have a similar habit, leaf form, and inflorescence type, but in *P. christmatensis* the leaves appear to be somewhat less glaucous beneath; the marginal prickles are smaller and more crowded; the staminate inflorescence is larger, and the stamen phalanges are larger, with more densely crowded stamens in the racemose arrangement, and the anthers are longer. In the polydrupes, *P. christmatensis* shows perhaps a greater number of carpels, and each carpel tends to be somewhat better separated, with both lateral intercarpellary sulci and deeper apical sulci; the carpel tips are more elevated. Despite these differences it is clear that the two forms are very closely related, and it seems most probable that *P. christmatensis* is a local derivative of *P. tectorius*-like ancestors.

2. Pandanus christmatensis Martelli, *Webbia* 1: 362 (1905)

T: Christmas Is., 1897, *C.W.Andrews*; holo: BM (staminate). Epithet from the name of the island on which the type was collected.

Pandanus nativitatis Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 238 (1906). T: Waterfall, Christmas Is., Oct. 1904, *H.N.Ridley*; holo: SING.

Small tree or shrub to 10 m tall; prop roots basal. Leaves 1–2 m long, 5–8 cm wide, arching-drooping, attenuate to flagelliform, darker green above; marginal prickles antrorse, 1–3 mm long and 2–5 mm apart near base. Staminate inflorescence spicate-racemose; spikes 6–9 cm long; bracts white; staminate phalanges with 15–32 stamens. Pistillate head ellipsoidal-subglobose, c. 22 cm long; peduncle c. 20–24 cm long, 2 cm thick; head of 50–70 carpellate phalanges ripening to orange polydrupes. Polydrupes of 9–26 carpels, plump, pyriform-ovoid, rounded-convex, 6.5–7.5 cm long, 4–5.7 cm wide; carpel apex acuminate-pyramidal, angular, with a depression or platform behind stylar process; apical and lateral sutures evident; stigma c. 1–2 mm long.

Christmas Is. Endemic. Forms dense thickets on shore terraces, often next to the sea,

thriving on exposed limestone cliffs with scarcely any soil. Also occurs inland on limestone and beneath the rainforest canopy particularly on limestone scree. These thickets are often dense tangles of descending prop roots, decumbent-ascending stems and projecting branches.

Ch.Is.: no precise locality, 1897, *C.W.Andrews* (BM, staminate fl.); NE coast, alt. c. 24 m, *D.A.Powell & H'ng Kim Chey P-2* (KLU, PH); NE coast, alt. c. 37 m, *D.A.Powell & H'ng Kim Chey P-1* (KLU, PH).

Pandanus christmatensis belongs in sect. *Pandanus* and is a close relative of *P. tectorius*, the type species. In view of the variability in that species and the controversial status of the many closely related species, it is currently difficult to establish the phylogenetic position for what here is considered an endemic. Some forms in southern Java currently considered species may not be specifically distinct. A remarkably similar species, *P. platycarpus* Warb., was obtained in Zanzibar. It appears likely that sea-borne dispersal of viable polydrupes westward in the Indian Ocean does occur occasionally, and it is possible that *P. platycarpus* and *P. christmatensis* are especially close relatives.

3. Pandanus elatus Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 239 (1906)

T: plateau, Oct. 1904, *H.N.Ridley*; lecto: SING; iso: K, *fide* H.St.John, *Pacific Sci.* 19: 113–116 (1965). Epithet from the Latin *elatus* (tall), in reference to the habit.

Erect tree to 20 m tall; prop roots basal. Leaves to 3 m long and 10 cm wide, erect-arching, attenuate; marginal prickles antrorse, 3–3.5 mm long, 4–10 mm apart. Staminate inflorescence large, pendent, spicate-racemose; spikes 7–11, c. 9–20 cm long; staminate phalanges with c. 15–23 stamens, subumbellate, 12–18 mm long. Pistillate head sometimes 2 or 3 together; peduncle c. 35–50 cm long, c. 6 cm thick; head of 90–110 carpellate phalanges. Polydrupe of 5–12 carpels, compressed, obovoid or subcuneate, convex or subtruncate, 7.5–8.6 cm long, 4.5–7 cm wide, angulate, with evident apical, and sometimes lateral sutures, but lateral faces mostly smooth; stigma erect or oblique, c. 3–3.5 mm long.

Christmas Is. Endemic. Prevalent in deeper soil in the rainforest, sometimes in small groups.

Ch.Is.: Murray Hill track, Oct. 1904, *H.N.Ridley* (SING, staminate); interior of island, 10 Oct. 1982, *D.A.Powell & H'ng Kim Chey* (KLU, PH, staminate); interior of island, Nov. 1983, *D.A.Powell & H'ng Kim Chey* (KLU, PH, pistillate).

Pandanus elatus belongs in subg. *Rykia* sect. *Roussinia* (Gaudich.) B.C.Stone, with one other species, *P. leram* Jones, of Nicobar and Andaman Islands and the south coasts of Sumatra and western Java. It is well differentiated from *P. christmatensis* in habit and vegetative and reproductive features. Moreover, the plants do not usually form the intricate thickets that characterise *P. christmatensis*. No record of colour of the bracts or ripe fruits is available, but in *P. leram* the bracts are yellowish and the fruits turn orange or yellow-orange, and the same colours might be expected for *P. elatus*.

87. ARACEAE

D.J.Du Puy (Ch.Is.)

Perennial herbs or somewhat woody climbers. Leaves alternate, often basal, simple or variously compound, parallel or net-veined. Inflorescence consisting of a spadix and a large, sheathing spathe. Flowers crowded on spadix, small, usually sessile, bisexual or unisexual, often with pistillate flowers in lower part of spadix and staminate above, sometimes with sterile flowers between. Perianth reduced; lobes 4–6, free, united, or sometimes absent. Stamens 4–6, free or synandrous, dehiscing through slits (not on Christmas Is.) or pores. Ovary superior, 1–many-locular with 1–many ovules; stigma sessile or on a short style.

Fruit a berry. Endosperm present or absent.

A family of c. 110 genera and over 2000 species, mainly tropical, but also in temperate regions. *Xanthosoma sagittifolium* (Coco Yam) and *Colocasia esculenta* (Taro) are widely cultivated in the tropics as starch-rich root vegetables, and both occur on Christmas Is. A third species, in the genus *Remusatia*, has also been recorded. *Caladium bicolor* (Aiton) Vent. is often cultivated as an ornamental with brightly coloured leaves, and *Epipremnum pinnatum* (L.) Engl. cv. '*aureum*', a climber with yellow-flecked, ovate leaves, is also cultivated and can sometimes persist around gardens, growing through trees and on cliffs, eventually reaching a large size.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Araceae, *Fl. Java* 3: 100–126 (1968); D.H.Nicolson in A.C.Smith, Araceae, *Fl. Vit. Nova* 1: 438–460 (1979); S.J.Mayo, *Fl. Mascareignes* 192: 1–29 (1984); S.J.Mayo, *Fl. Trop. E. Africa*, Araceae: 1–71 (1985).

KEY TO GENERA

1 Leaves not peltate; spathe not constricted above basal tube — **1. XANTHOSOMA**

1: Leaves peltate; spathe constricted above basal tube

2 Leaves more numerous; shoots without bulbils; spadix with four regions, the uppermost a sterile tip c. 1–3 cm long — **2. COLOCASIA**

2: Leaves solitary or rarely paired; erect shoots with burr-like bulbils present from base of plant; spadix with three regions, lacking a sterile tip — **3. REMUSATIA**

1. XANTHOSOMA

Xanthosoma Schott in H.W.Schott & S.F.L.Endlicher, *Melet. Bot.* 19 (1832); from the Greek *xanthos* (yellow) and *soma* (a body), in reference to the tuber, which has yellowish flesh in some variants of the type species.

Type: *X. sagittifolium* (L.) Schott

Erect, tuberous herbs. Leaves ovate to oblong, not peltate; base hastate or sagittate. Inflorescence near apex of leafy plants, several together. Spathe not constricted; lower part tubular, persistent; blade broad, withering, caducous. Spadix with 3 zones, the lowermost with female flowers, above them a sterile zone, and with male flowers towards apex. Male flowers with 4–6 sessile anthers united in a synandrium. Female flowers with broad, cohering stigmas forming a disc broader than ovary; ovaries 2–4-locular. Fruit a many-seeded berry.

A genus containing c. 40 species, in the New World tropics. *Xanthosoma sagittifolium* is widely cultivated for its edible tubers, and has become naturalised on Christmas Is.; several other species are used as garden ornamentals.

***Xanthosoma sagittifolium** (L.) Schott in H.W.Schott & S.F.L. Endlicher, *Melet. Bot.* 19 (1832), as *sagittaefolium*

Arum sagittifolium L., *Sp. Pl.* 2: 966 (1753), as *sagittaefolium*. T: illustration of 'Arum minus esculentum, sagittariae foliis viridi nigricantibus', from Jamaica, in H.Sloane, *Voy. Jamaica Nat. Hist.* 1: t. 106, fig. 2 (1707); lecto, *fide* R.A.Howard, *J. Arnold Arbor.* 60: 288 (1979). Epithet from the Latin *sagitta* (an arrow) and *folium* (a leaf), descriptive of the arrow-head shape of the leaf lamina.

Illustration: A.B.Graf, *Tropica* 3rd edn, 124 (1986).

A very large, robust herb, 1–2 m tall; stem base tuberous; sap milky. Leaf lamina held ±horizontally, very large, broadly oblong-ovate, to 60 cm long, deeply sagittate with subacute lobes at base, obtuse and shortly acuminate; petiole attached at margin, to 100 cm long, erect. Spathe c. 15–25 cm long; tube c. 6–7 cm long, inflated, not constricted above; limb c. 15 cm long, broad, whitish, deciduous at maturity. Spadix 15 cm or more long; basal

region female, 3–4 cm long; middle region sterile, 2.5–3.5 cm long; upper region male, 6–8 cm long, without a sterile tip. *Coco Yam*.

Christmas Is. Introduced by the Chinese for cultivation for its edible, starchy tubers. It has become naturalised in several places on the island, especially in damper areas, and sometimes marks the sites of disused gardens. Probably originated in the New World tropics, now commonly cultivated and naturalised throughout the tropics.

Ch.Is.: no precise locality, *D.A.Powell 699* (K).

The white sap is a skin irritant. The tubers, although edible, are considered inferior to those of the somewhat similar *Colocasia esculenta* (Taro), which differs in its distinctly peltate leaves.

2. COLOCASIA

Colocasia Schott in H.W.Schott & S.F.L.Endlicher, *Melet. Bot.* 18 (1832), *nom. cons.*; from the Greek *kolokasion*, the name used by Dioscorides for the edible root of *Nelumbo nucifera* Gaertn., the Lotus.

Type: *C. antiquorum* Schott, *typ. cons.*

Erect, tuberous herbs. Leaves ovate, peltate, cordate or sagittate at base. Inflorescence towards apex of leafy plants. Spathe constricted; lower part tubular, persistent; limb narrow, soon withering. Spadix with four regions, the lowermost with female flowers, above them sterile flowers, then male flowers and a sterile apical region. Male flowers with 3–6 sessile stamens united in a synandrium. Female flowers with cohering stigmas forming a disc narrower than ovary; ovaries unilocular. Fruit a many-seeded berry.

A genus of about 8 species from Indonesia and Polynesia; 1 species is cultivated and has become partially naturalised on Christmas Is.

***Colocasia esculenta** (L.) Schott in H.W.Schott & S.F.L.Endlicher, *Melet. Bot.* 18 (1832)

Arum esculentum L., *Sp. Pl.* 2: 965 (1753). T: illustration of 'Arum minus, nympheae foliis esculentum', from Jamaica, in H.Sloane, *Voy. Jamaica Nat. Hist.* 1: t. 106, fig. 1 (1707). Epithet from the Latin *esca* (food), in reference to the edible tubers.

Illustrations: S.J.Mayo, *Fl. Mascareignes* 192: 19, t. 2 (1984); A.B.Graf, *Tropica* 3rd edn, 103, 105 (1986).

A large herb reaching c. 1 m tall; stem base tuberous, with spreading stolons. Leaves broadly ovate, pendent, 20–60 cm long, cordate at base with rounded lobes and distinctly peltate, obtuse and shortly acuminate; petiole to 85 cm long, erect. Spathe 20–30 cm long; tube 4–5 cm long, constricted above; blade 19–25 cm long, narrow, yellow to orange. Spadix 11–14 cm long; basal region female, 3.5–4.5 cm long; middle region sterile, 4–4.5 cm long; upper region male, 4–4.5 cm long; apical sterile region 1–3 cm long. *Taro*.

Christmas Is. Introduced by the Chinese and found in gardens and on the fringes of many cultivated areas and around habitation. Native to the Old World tropics, widely cultivated as a vegetable and often naturalised.

Ch.Is.: no precise locality, *D.A.Powell 701* (K).

Contains an irritant sap. The tubers, petioles and young leaves are eaten as a cooked vegetable and on Christmas Is. it is preferred to the rather larger *Xanthosoma sagittifolium*.

3. REMUSATIA

Remusatia Schott in H.W.Schott & S.F.L.Endlicher, *Melet. Bot.* 18 (1832); named after J.P.A.Remusat, an 18th–19th century French physician and connoisseur of the Far East, especially China, becoming professor of Chinese in Paris in 1814, and chairman of the Asiatic Society.

Type: *R. vivipara* (Roxb.) Schott

Erect or ascending, often epiphytic, tuberous herbs. Leaves ovate, often solitary, peltate, cordate at base, deciduous. Inflorescence apical, appearing before leaves. Spathe constricted; lower part tubular, inflated, persistent; blade broad, becoming reflexed, persistent. Spadix with three regions, the lowermost with female flowers, above them a sterile region, and an apical region with male flowers. Male flowers with 2 or 3 stamens united in a synandrium. Female flowers with a sessile, subglobose stigma narrower than ovary; ovaries 2–4-locular. Fruit a many-seeded berry.

A genus of c. 3 species, with 1 species widespread in the Old World tropics including Christmas Is.

Remusatia vivipara (Roxb.) Schott in H.W.Schott & S.F.L.Endlicher, *Melet. Bot.* 18 (1832)

Arum viviparum Roxb., *Hort. Bengal.* 65 (1814), as *viviparium.* T: illustration of 'Maravara Tsjembo' in H.A.Rheede, *Hortus Malabaricus* 12, t. 9 (1693), from India (Kerala). Epithet from the Latin *vivus* (living) and *parere* (to bear), after the erect stems bearing bulbils, which resemble viviparous inflorescences.

Illustration: S.J.Mayo, *Fl. Trop. E. Africa,* Araceae: 41, fig. 11 (1985).

A lithophytic or epiphytic, seasonally dormant herb, c. 50 cm tall; tuber small, 2–4 cm diam.; shoots few, erect, unbranched, c. 10–30 cm tall, bearing well-spaced, small clusters of bulbils; bulbils 2–5 mm long, with scales prolonged into hooked tips. Leaves broadly ovate, usually solitary, sometimes paired, cordate with rounded lobes at base, obtuse and shortly acuminate, distinctly peltate; lamina c. 20 cm long; petiole c. 15–25 cm long, erect. Spathe 7–11 cm long; tube ovoid, 2–4 cm long, strongly constricted above; blade subcircular, c. 6–8 cm long, cream, reflexed. Spadix 3–4.5 cm long; basal female region c. 2 cm long; middle sterile region c. 1.1 cm long; upper male region c. 1–1.2 cm long, club-shaped, without sterile tip.

Christmas Is. Usually occurs in primary or secondary forest, on rocks or tree trunks, occasionally as a terrestrial. Collected by C.W.Andrews on Christmas Is. in 1897 but not recorded since. Has a very wide range in the Old World tropics, including Africa, Madagascar, Sri Lanka, India, SW China, Indo-China, Malesia and northern Australia.

Ch.Is.: Phosphate Hill road, *C.W.Andrews 115* (K).

Many populations of this species do not flower, perhaps because vegetative propagation is so successful. The specimen cited above from Christmas Is. has bulbils but no flowers.

88. COMMELINACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Annual or perennial herbs, usually ±succulent; stems jointed. Leaves simple, alternate, with sheathing base. Inflorescence usually a cincinnus, rarely flowers solitary. Flowers usually bisexual, actinomorphic or zygomorphic. Sepals 3, herbaceous. Petals 3, coloured or white, equal or unequal, free or ±united, ephemeral or deciduous. Stamens 6, or 3 fertile and 3

staminodes, rarely only 1 fertile; anthers usually longitudinally dehiscent. Ovary superior, usually 3-locular; ovules 1 or few per locule; stigma and style usually simple. Fruit usually a thin-walled, loculicidal capsule, rarely fleshy and indehiscent. Endosperm present.

A family of 40 or more genera and perhaps 1000 species, mainly tropical or subtropical, extending into warm-temperate regions; 2 genera (2 species) on Christmas Is., of which 1 species also on Cocos (Keeling) Is.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Commelinaceae, *Fl. Java* 3: 12–22 (1968); A.C.Smith, Commelinaceae, *Fl. Vit. Nova* 1: 277–283 (1979).

KEY TO GENERA

Creeping herb with all-green, alternate leaves; flowers blue, zygomorphic, with 2 large, clawed petals and 1 reduced petal **1. COMMELINA**

Erect herb with closely spaced leaves forming a rosette, the leaves dark green above, purple beneath; flowers white, actinomorphic, the petals equal, not clawed **2. RHOEO**

1. COMMELINA

Commelina L., *Sp. Pl.* 1: 40 (1753); *Gen. Pl.* 5th edn, 25 (1754); named after the early Dutch botanists Johan & Caspar Commelin and Caspar's son, representing the two showy petals and a third which is inconspicuous.

Type: *C. communis* L.

Herbs, sometimes creeping. Leaves alternate, sessile or shortly petiolate, with tubular, sheathing bases. Inflorescence leaf-opposed, of 1 or 2 cincinni enclosed in a spathaceous bract. Flowers usually bisexual, zygomorphic. Sepals 3, unequal, the 2 larger ones often connate at base. Petals 3, unequal, the upper 2 larger, clawed, generally blue, delicate, the lower reduced, ±sessile. Fertile stamens 3, with glabrous filaments; staminodes 3, with cruciform anthers. Ovary 3-locular; ovules 1 or 2 per locule; style slender; stigma minute, capitate. Fruit a dry, dehiscent capsule.

A mainly pantropical genus containing 200–250 species. One weedy species has become naturalised on Christmas Is.

*Commelina benghalensis L., *Sp. Pl.* 1: 41 (1753)

T: illustration in L.Plukenet, *Almagestum Botanicum* 135, fig. 3 (1691). Epithet indicating that the type specimen was collected in Bengal, a region now divided into Bangladesh and part of north-eastern India.

Illustration: E.Hafliger & U.Kuhn, *Monocot Weeds* 3: 101, & plate (1982).

A creeping herb, to c. 30 cm tall; stems jointed, succulent, stoloniferous. Leaves ovate to elliptic, c. 2–9 cm long, obtuse, shortly hairy, narrowed into a short petiole with reddish marginal bristles, and a basal, tubular sheath. Inflorescence leaf-opposed; bract funnel-shaped, c. 10–12 mm long, flattened, shortly hairy. Sepals 3, unequal, free, bluish. Petals 3, unequal, the upper 2 conspicuous, c. 8 mm long including a claw 2 mm long; lamina subcircular. Stamens 3, with 1 yellow and 2 blue anthers; staminodes 3, with yellow, cruciform anthers; filaments glabrous, blue. Style slender, blue. Capsule pyriform, enclosed by bract.

Christmas Is. Common along roadsides, in marginal or disturbed vegetation and in gardens, especially in the east of the island in damp soil. A widespread, weedy species in tropical and subtropical Africa, SE Asia (from the Middle East to China and Japan, and Indo-China), Malesia to Australia and the Pacific islands, and occasionally in the New World.

Ch.Is.: Waterfall Rd, *D.A.Powell 328* (K); Rocky Point, on cleared ground at base of first inland cliff, *A.Pearson P53* (K); roadside at Settlement, *R.Shivas 986* (PERTH).

The stems sometimes produce cleistogamous, subterranean flowers within a small, yellowish bract.

2. RHOEO

Rhoeo Hance ex Walp., *Ann. Bot. Syst.* 3: 659 (1853); derivation obscure, perhaps from the Greek *rhoia* (a pond, watering place for horses), in reference to the inflorescence bracts which often contain a little water.

Type: *R. discolor* (L'Hér.) Hance ex Walp.

An erect herb. Leaves spirally arranged, sessile, with sheathing base. Inflorescences usually of paired cincinni, enclosed by a pair of spathaceous bracts which form a boat-shaped structure, borne on a short peduncle among leaf bases. Flowers bisexual, actinomorphic, clustered. Sepals 3, equal, ±petaloid. Petals 3, free, equal. Stamens 6, all fertile; filaments hairy. Ovary 3-locular; ovule 1 per locule; style slender; stigma minute, capitate. Fruit a dry, dehiscent capsule.

A monotypic genus native to tropical Mexico, Central America and the West Indies. Widely cultivated in warm regions; 1 species naturalised on Christmas Is. and Cocos (Keeling) Is.

The genus is sometimes included in the genus *Tradescantia* L.

***Rhoeo spathacea** (Sw.) Stearn, *Baileya* 5: 198, fig. 57 (1957)

Tradescantia spathacea Sw., *Prodr.* 57 (1788). T: cult. Jamaica, *O.Swartz*; holo: S *n.v.*, *fide* C.Jarvis, *pers. comm.* Epithet from the Latin *spatha* (a broad, flat blade), also used for the bracts of palm inflorescences, and now a botanical term, referring to the boat-shaped bract enclosing the inflorescence.

Illustrations: S.R.Chant in V.H.Heywood (ed.), *Fl. Pl. World* 280, fig. 5 (1978); A.B.Graf, *Tropica* 3rd edn, 307 (1986).

A robust, short-stemmed, erect herb, c. 25–50 cm tall. Leaves closely spaced, ±forming a rosette, lanceolate, 15–30 cm long, acute, glabrous, dark green above, purple beneath; base sheathing stem. Inflorescence short-stalked, among leaf bases; peduncle with 2 bracts and an apical pair of overlapping bracts forming a boat-shaped structure 4–5 cm across, glabrous, purple, enclosing flowers. Sepals 3, oblong, white. Petals 3, ovate, c. 8 mm long, white. Stamens 6, with yellow anthers; filaments white-hairy. Style slender. Capsule ellipsoidal, c. 5–6 mm long, often only with 2 developed locules. *Moses-in-a-cradle*.

Christmas Is., Cocos (Keeling) Is. Commonly cultivated on Christmas Is. and dispersed among garden refuse, now naturalised and spreading over the steep volcanic rocks at Waterfall, tolerating deep shade under the forest canopy. Also occurs along the east coast among limestone pinnacles behind the sea cliff, hidden beneath *Scaevola* bushes and on one of the rocks in Flying Fish Cove, near Smith Point. On Cocos (Keeling) Is. naturalised near the kampong in coral rubble on Home Is. A native of tropical and subtropical Central America and the Caribbean, frequently cultivated and often naturalised throughout the tropics.

Ch.Is.: no precise locality, *D.A.Powell 494* (K). C.K.Is.: Home Is., *I.R.Telford 10061 & C.Howard* (CBG, K).

89. JUNCACEAE

E.Edgar (M.Is.)

Herbs tufted or rhizomatous, usually with basal grass-like or terete leaves, or with leaves reduced to bracts. Flowers usually bisexual, in loose compound cymes or heads, or solitary

in leaf-axils. Perianth of 6 free glumaceous tepals. Stamens 3 or 6, or variable 3 to 6. Ovary 1- to 3-locular; style single with 3 stigmas; ovules 3–many. Fruit a capsule.

A cosmopolitan family of 8 genera and c. 400 species; 2 genera and 75 species in Australia with 2 genera (2 species) on Macquarie Is.

T.F.Cheeseman, The Vascular Flora of Macquarie Island, *Austral. Antarctic Exped. 1911–14, Sci. Reports*, Series C. –Zool. & Bot., 7(3): 30–31 (1919); B.W.Taylor, The Flora, Vegetation and Soils of Macquarie Island, *ANARE Reports*, Series B, Botany, 2: 138–141 (1955); D.M.Moore, Chromosome numbers of flowering plants from Macquarie Island, *Bot. Not.* 113: 185–191 (1960); L.B.Moore & E.Edgar, Juncaceae, *Fl. New Zealand* 2: 55–79 (1970).

KEY TO GENERA

Leaves flat, terete, or reduced to basal sheaths; leaf margins always glabrous; capsule with many seeds **1. JUNCUS**

Leaves flat; leaf margins hairy, at least near mouth of sheath; capsule with 3 seeds **2. LUZULA**

1. JUNCUS

Juncus L., *Sp. Pl.* 1: 325 (1753); *Gen. Pl.* 5th edn, 152 (1754); from the Latin *juncus*, a rush.

Type: *J. acutus* L.

Glabrous, perennial or rarely annual herbs, tufted or rhizomatous. Stems usually simple, erect. Leaves flat, or tubular and compressed with internal septa, or terete and stem-like or reduced to basal sheaths. Inflorescence cymose, much-branched or a compact head, or flowers few or rarely solitary. Flowers usually bisexual, often subtended by bracteoles. Tepals 6, in 2 whorls. Stamens 3, 6, or variable 3 to 6. Seeds many, minute, often tailed at one or both ends.

A cosmopolitan genus of c. 300 species, chiefly in temperate regions, often in wet places, rare in the tropics; c. 44 native and c. 20 naturalised species in Australia; 1 native species on Macquarie Is.

A.Lourteig, Revision de *Juncus* subgenus *Septati* Buch. *§29 Buch. Bull. Comité Natl. Franc. Rech. Antarct. – Biologie* 23: 33–49 (1968).

Juncus scheuchzerioides Gaudich., *Ann. Sci. Nat. (Paris)* 5: 100 (1825)

T: Falkland Islands, *C.Gaudichaud-Beaupré*; holo: P *n.v.* Epithet from the generic name and the suffix *-oides* (resembling).

Illustration: D.M.Moore, *Fl. Tierra del Fuego* 322, fig. 261 (1983).

Tufted perennial, very variable in size, 2–30 cm tall. Stems much-branched at base, often creeping and rooting. Leaves very narrow, transversely septate. Inflorescence of 1, rarely 2, small clusters of 3–6 flowers overtopped by longer cauline leaves; tepals, 3–4 mm long, green to reddish brown. Stamens 6. Capsule slightly shorter to slightly longer than tepals, light- or red-brown at maturity. *2n* = 40, D.M.Moore, *Bot. Not.* 113: 187 (1960). Fig. 89C.

Macquarie Is. Grows in free water or in very moist to very wet peat, often forming large stands, from sea level to 150 m alt. Also on Antipodes, Auckland and Campbell Islands and in southern S America (Chile to Tierra del Fuego), South Georgia and Falkland, Marion, Crozet and Kerguelen Islands. Flowers Dec.–Apr.

M.Is.: vicinity of Half Moon Bay, 16 Jan. 1949, *N.R.Laird* (HO); Boiler Rocks area, *R.D.Seppelt 12154* (CHR,

HO); Handspike Corner, *R.D.Seppelt 12227* (HO); 500 m SW of Mt Ifould, *R.D.Seppelt 12378* (CHR, HO); NE side Red River Valley, *R.D.Seppelt 12686* (CHR, HO).

2. LUZULA

Luzula DC. in J.B.A.P.Lamarck & A.P.de Candolle, *Fl. Franç.* 3rd edn, 3: 158 (1805), *nom. cons.*; from Italian *luzziola* (a firefly), in reference to the shining florets.

Type: *L. campestris* (L.) DC.

Perennial, grasslike, tufted to stoloniferous herbs, sometimes cushion-forming. Stems simple, erect, often with 1 or 2 cauline leaves. Leaves flat or channelled, hairy on margins, at least near mouth of sheath. Inflorescence a terminal cyme, congested to a single head or much-branched. Flowers bisexual, subtended by bracteoles. Tepals 6, in 2 whorls. Stamens 3 or 6. Ovary 1-locular. Seeds 3, each with basal tail (caruncle).

A cosmopolitan genus of c. 80 species, chiefly in temperate regions; 13 native and 3 naturalised species in Australia; 1 native species on Macquarie Is.

F.Buchenau, *Luzula campestris* und verwandte Arten, *Oesterr. Bot. Z.* 48: 209–220, 243–246, 284–297 (1898); E.Edgar, *Luzula* in New Zealand, *New Zealand J. Bot.* 4: 159–184 (1966).

Luzula crinita Hook.f., *Fl. Antarct.* 1: 84, t. 48 (1844)

L. campestris var. *crinita* (Hook.f.) Buchenau, *Oesterr. Bot. Z.* 48: 215 (1898). T: Auckland Islands, Dec. 1840, *J.D.Hooker*; lecto: K, *fide* E.Edgar, *Fl. Australia* 50: 571 (1993). Epithet from the Latin *crinitus* (having a tuft of hairs), apparently in reference to the leaves.

Stiff, dark green tufts, very variable in size, 4–45 cm tall. Leaves with incurved margins; marginal hairs long, close-set near mouth of sheath and sparser above. Inflorescence usually a single, rounded to oblong, brownish black head with densely crowded florets; bracteole margin densely villous. Flowers 2–2.5 mm long. Stamens 6. Capsule c. equal to tepals, dark brown.

Macquarie Is. Grows in *Agrostis* grassland, in fellfield and on margins of marshes, from sea level to 370 m alt. Also on Antipodes, Auckland and Campbell Islands. Flowers Oct.–Jan.

M.Is.: Watersupply Ck, 7 Oct. 1948, *N.R.Laird* (HO); Wireless Hill, 26 Nov. 1948, *N.R.Laird* (HO); western side of Red River Valley, *R.D.Seppelt 11905* (HO); 400 m N of Pyramid Peak, *R.D.Seppelt 12040* (HO).

F.Buchenau (*op. cit.* 215–220) treated many Southern Hemisphere *Luzula* species as varieties of European *Luzula campestris*. E.Edgar (*op. cit.* 160–162) discussed the differences between *L. campestris* and New Zealand species, including *L. crinita*, and referred southern taxa to species distinct from *L. campestris*.

90. CYPERACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)
E.Edgar (M.Is.)

Annual or perennial, tufted or rhizomatous herbs, bisexual or monoecious, rarely dioecious; culms often 3-angled. Leaves with linear or terete lamina and a closed basal sheath, the lamina sometimes absent. Inflorescence a capitate cluster, spike, umbel or panicle, often compound as a pseudowhorl of several rays, the outer rays longer than the inner, and subtended by a pseudowhorl of leaf-like bracts. Flowers wind-pollinated, combined into few

to several spikelets, each flower enclosed by a glume; glumes distichous or spirally arranged, often overlapping. Perianth absent or reduced to hypogynous bristles or scales. Stamens usually 1–3. Ovary superior; locule 1; ovule 1 per locule; style usually 2- or 3-branched. Fruit an achene or nutlet, ±3-angled or bilaterally compressed. Endosperm present. *Sedges*.

A cosmopolitan family of c. 90 genera and c. 4000 species; 47 genera and 650 species in Australia; 4 genera (7 species) on Christmas Is.; 5 genera (5 species) on Cocos (Keeling) Is.; 3 genera and 4 species on Macquarie Is. Christmas Is. has 2 indigenous sedges, *Mariscus javanicus* and *Fimbristylis cymosa*, and 5 weedy species have been introduced and are naturalised. *Cyperus alternifolia* L. is cultivated as a garden plant.

Members of this family occur in many types of habitat and are often important in grassland and savanna, but are most characteristic of wet and marshy habitats, especially in temperate and subpolar regions. Although important as fodder, and for thatching and weaving, they have little direct economic importance. *Cyperus papyrus* L. (Papyrus reed) was used in antiquity to make paper. *Cyperus esculentus* L. (Tiger Nut or Chufa) and *Eleocharis dulcis* (Burm.f.) Hensch. (Chinese Water-Chestnut) both produce edible tubers and are commercially cultivated.

T.F.Cheeseman, The Vascular Flora of Macquarie Island, *Australas. Antarctic Exped. 1911–14, Sci. Reports*, Series C. – Zoo. and Bot., 7(3): 31–33 (1919); B.W.Taylor, The Flora, Vegetation and Soils of Macquarie Island, *ANARE Reports* Series B, Botany 2: 141–144 (1955); D.M.Moore, Chromosome numbers of flowering plants from Macquarie Island, *Bot. Not.* 113: 185–191 (1960); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Cyperaceae, *Fl. Java* 3: 451–495 (1968); L.B.Moore & E.Edgar, Cyperaceae, *Fl. New Zealand* 2: 167–285 (1970); J.H.Kern, Cyperaceae, *Fl. Males.* ser. I, 7: 435–753 (1974); T.Koyama in A.C.Smith, Cyperaceae, *Fl. Vit. Nova* 1: 220–274 (1979).

KEY TO GENERA ON TROPICAL AND SUBTROPICAL ISLANDS

1 Inflorescence a sessile, ±spherical head of densely crowded spikelets, sometimes with 1–3 small, secondary heads — **5. KYLLINGA**

1: Inflorescence compound with stalked clusters or racemes of spikelets, or occasionally a ±sessile cluster of spikelets

2 Inflorescence with rays bearing simple or branched racemes with many crowded spikelets; spikelets falling entire at maturity, not leaving an exposed rachilla — **2. MARISCUS**

□**3** Annual, tufted; bracts below inflorescence 3–6; culms less than 15 cm tall (C.K.Is.) — **4. QUEENSLANDIELLA**

3: Perennial, shortly rhizomatous; bracts below inflorescence 6–9; culms more than 15 cm tall (Ch.Is.) — **2. MARISCUS**

2: Inflorescence with rays bearing clusters of several spikelets, or the clusters ±sessile; spikelets with caducous glumes that fall individually at maturity, leaving persistent rachilla of spikelet exposed

4 Spikelets with spirally arranged glumes; bracts with expanded, sheathing bases; style base thickened and jointed to ovary — **7. FIMBRISTYLIS**

4: Spikelets with distichous, overlapping glumes; bracts without expanded bases; style base not thickened or jointed to ovary

5 Nut 3-angled, 1 side facing rachilla — **1. CYPERUS**

5: Nut compressed, 1 angle facing rachilla — **3. PYCREUS**

KEY TO GENERA ON SUBANTARCTIC ISLANDS

1 Flowers bisexual; nut directly subtended by glume **6. ISOLEPIS**

1: Flowers unisexual; nut enclosed in utricle which is subtended by glume

2 Rachilla produced into a hook; inflorescence a single spike **8. UNCINIA**

2: Rachilla not produced into a hook; inflorescence of 1–many spikes **9. CAREX**

1. CYPERUS

Cyperus L., *Sp. Pl.* 1: 44 (1753); *Gen. Pl.* 5th edn, 26 (1754); the classical Greek name for a sedge.

Type: *C. esculentus* L.

Tufted to spreading, often rhizomatous sedges. Leaves basal, sometimes reduced to a sheath only. Inflorescence terminal, umbel-like, with simple or branched rays bearing spikelets, often crowded, sometimes reduced to a single head, subtended by leaf-like bracts. Spikelets bisexual, usually compressed, usually with many glumes. Glumes distichous, often overlapping, caducous at maturity, leaving the persistent rachilla. Hypogynous bristles absent. Stamens usually 2 or 3. Style trifid, not thickened or jointed at base. Nutlet usually 3-angled.

A pantropical and subtropical genus extending into warm-temperate regions, containing c. 250 species; 2 species have been introduced to Christmas Is., 1 species is native to Cocos (Keeling) Is. A third species, *C. iria* L., was recorded for Christmas Is. by H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 240 (1906), as a 'recent introduction' which 'seemed hardly to have established itself', on Smith Point. This record has not been confirmed, but this species is not now known to occur on the island. Most species prefer moist or wet localities. *Cyperus alternifolia* L. (Umbrella Plant) is sometimes cultivated in gardens.

There is no generally accepted delimitation of this genus. *Kyllinga* Rottb. and *Mariscus* Vahl are accepted here as separate genera, although they are included in *Cyperus* by some other authors.

S.T.Blake, *Cyperus rotundus* (nutgrass) and its allies in Australia, *Univ. Queensland Pap. Bot.* 2(2): 1–13 (1942).

1 Tufted, non-tuberous plant; spikelets ±terminal on rays of inflorescence (Ch.Is.) **1. C. compressus**

1: Rhizomatous, tuberous plant; spikelets loosely or densely scattered along upper part of rays of inflorescence

2 Spikelets usually loosely arranged along rachis, 1–1.5 mm wide, glumes 3–3.5 mm long; nutlet 3-angled (Ch.Is.) **2. C. rotundus**

2: Spikelets usually densely arranged along rachis, 2–2.5 mm wide; glumes 2–2.5 mm long; nutlet ±concavo-convex (C.K.Is.) **3. C. stolonifer**

1. *Cyperus compressus L., *Sp. Pl.* 1: 46 (1753)

T: Jamaica. Illustration in H.Sloane, *Voy. Mad. Jam.* 1: 117, t. 76, fig. 1 (1707); *fide* C.Jarvis, BM, pers. comm. Epithet from the Latin *compressus* (pressed together), in reference to the flattened spikelets.

Illustrations: C.A.Backer, *Weed Fl. Javanese sugar-cane fields* t. 126 (1930); E.Hafliger & U.Kuhn, *Monocot Weeds* 3: 13 (1982).

A small, tufted, non-tuberous sedge; culms 10–30 cm tall, 3-angled. Leaves mostly basal, stiff, ±flat, long-acuminate, glabrous; margin rough towards apex; lamina 5–20 cm long, 1–2 mm wide; sheaths reddish. Bracts 3–5, spreading, 2–15 cm long, mostly much longer than inflorescence, resembling the leaves. Inflorescence a ±sessile cluster of c. 4–8 spikelets, often with several additional long- or short-stalked clusters. Spikelets all

±terminal, densely clustered, flattened, 6–12 mm long, 2–2.5 mm wide. Glumes many, distichous, overlapping, ovate, 3–3.5 mm long, keeled, mucronate, pale green tinged with yellow-brown. Nutlet obtusely 3-angled, glossy, blackish.

Christmas Is. Grows mainly in the east along roads and around habitation. A pantropical and subtropical weedy species, occurring in waste ground, roadsides, cultivated land, grassland and on seashores, preferring seasonally wet sites.

Ch.Is.: edge of road at Drumsite, *D.A.Powell 314* (K); along NE coast road to Waterfall, *R.Shivas 892B* (PERTH).

2. *Cyperus rotundus L., *Sp. Pl.* 1: 45 (1753)

T: India, Herb. P.Hermann no. 36, vol. 1, fol. 3; syn: BM. Epithet is the Latin for spherical, in reference to the rounded subterranean tubers.

Illustrations: J.H.Kern, *Fl. Males.* ser. I, 7: 594, fig. 49 (1974); E.Hafliger & U.Kuhn, *Monocot Weeds* 3: 24, & plate (1982).

A small, mat-forming sedge with wiry rhizomes and small, subspherical tubers; culms 10–30 cm tall, 3-angled. Leaves basal, flat, glabrous, acuminate; lamina 7–23 cm long, 2–3 mm wide; sheath reddish. Bracts usually 2 or 3, spreading, 1–13 cm long, usually with at least the lowest exceeding the inflorescence, resembling the leaves. Inflorescence of several short- to long-stalked, lax clusters of spikelets, sometimes with a sessile cluster of spikelets. Spikelets slender, scattered along short rachis, ±flattened, 4–15 mm long, 1–1.5 mm wide. Glumes many, distichous, overlapping, ovate, 3–3.5 mm long, keeled, obtuse, pale green to brown. Nutlet 3-angled, blackish. *Nut Grass*.

Christmas Is. On Christmas Is. occurs mainly along roadsides and around habitation in the east. Widely distributed throughout the tropics and subtropics, extending into many temperate regions, including all of the mainland states of Australia.

Ch.Is.: along roads and in gardens, *D.A.Powell 311* (K); along NE coast road to Waterfall, *R.Shivas 899B* (PERTH); along road in Settlement, *D.J. & B.P.Du Puy CI89* (CBG, K).

The young tubers may be eaten like nuts and are reputed to reduce fevers. This species can become a noxious weed of cultivation. As treated here *C. rotundus* is a species complex with several published subspecies which have sometimes been treated at specific rank.

3. Cyperus stolonifer Willd. ex Kunth, *Enum. Pl.* 2: 59 (1837)

T: Willdenow Herb. 1362, fol. 1; *n.v.* Epithet from the Latin *stoloniferous* (bearing stolons), in reference to the growth habit.

Spreading sedge; rhizomes long-spreading, tuberous; culms 10–60 cm tall. Leaves basal, flat, acuminate, glabrous; lamina 5–60 cm long, 2–4 mm wide; sheath reddish brown. Bracts usually 3, spreading, 1.5–20 cm long, usually exceeding inflorescence. Inflorescence of several short- to long-stalked clusters of spikelets. Spikelets densely arranged on rachis, ±flattened, 4–20 mm long, 1.5–2 mm wide. Glumes many, distichous, overlapping, ovate, obtuse, c. 2.5 mm long, dirty white sometimes streaked red-brown, with hyaline margin. Nutlet ±concavo-convex, dull dark brown.

Cocos (Keeling) Is. Grows along the lagoon shore-line of the main atoll in open areas in coralline sand. Also in coastal sands of the tropical Indian and west Pacific Oceans, including northern Australia.

C.K.Is.: main jetty, Home Is., *D.G.Williams 156 & Amat Noor* (BISH, CBG, PERTH); settlement, West Is., *I.R.Telford 9956 & C.Howard* (AD, CBG, K); S end of airstrip, West Is., *D.G.Williams 94*, (CBG, NSW).

2. MARISCUS

Mariscus Vahl, *Enum. Pl.* 2: 372 (1805), *nom. cons.*; a Latin word used for a sedge.

Type: *M. capillaris* (Sw.) Vahl, *typ. cons.*

Tufted to spreading, often rhizomatous sedges. Leaves towards culm bases. Inflorescence terminal, often clustered or umbel-like, with rays bearing simple or branched racemes of spikelets, often crowded, subtended by a whorl of long, leaf-like bracts. Spikelets bisexual, ±terete to flattened, with few to many glumes, falling entire at maturity. Glumes distichous, overlapping, persistent on caducous rachilla. Hypogynous bristles absent. Stamens 1–3. Style trifid, not jointed or thickened at base. Nutlet 3-angled.

A genus of c. 2000 species distributed from the tropics and subtropics into the temperate zones of both hemispheres, with greatest diversity in the New World tropics; 2 species on Christmas Is., 1 of which also on Cocos (Keeling) Is.

Some authors (e.g. K.L.Wilson *pers. comm.*) include this genus under *Cyperus*.

Rays of inflorescence with branched, compound racemes of spikelets; spikelets 5–7 mm long, with 5–9 glumes; bracts subtending inflorescence mostly 15–80 cm long (Ch.Is., C.K.Is.) **1. M. javanicus**

Rays of inflorescence each with a single, short, unbranched raceme at apex; spikelets 2–3 mm long, usually with 4 glumes; bracts subtending inflorescence mostly 6–20 cm long (Ch.Is.) **2. M. macrocarpus**

1. Mariscus javanicus (Houtt.) Merr. & F.P.Metcalf, *Lingnan Sci. J.* 21: 4 (1945)

Cyperus javanicus Houtt., *Nat. Hist.* 13: 68, t. 88, fig. 1 (1782). T: Java, *C.P.Thunberg*; *n.v.* Epithet indicating that the type specimen was collected in Java.

Mariscus albescens Gaudich. in L. de Freycinet, *Voy. Uranie* 415 (1829). T: Moluccas ('Rawak'), *C.Gaudichaud-Beaupré*; holo: probably P *n.v.*

Illustration: J.H.Kern, *Fl. Males.* ser. I, 7: 636, fig. 63 (1974).

A medium-large, tufted, shortly rhizomatous sedge; culms 25–70 cm tall, obtusely 3-angled. Leaves basal, long-acuminate, arching, flat to canaliculate, greyish green; lamina 15–130 cm long, 5–9 mm wide; sheath chestnut brown. Bracts 6–8, spreading, leaf-like, mostly 15–80 cm long, much longer than inflorescence. Inflorescence with several main rays, each with compound, branched racemes at apex, consisting of many densely clustered spikelets. Spikelets compressed, 5–7 mm long, 1.5–2 mm wide, pale brown. Glumes 5–9, ±distichous and overlapping, lowest pair c. 1 mm long, the others 2–3 mm long, acute, weakly keeled. Nutlets 1–6 in each spikelet, 3-angled, dark brown, glossy. Fig. 64.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. confined mainly to the east coast on the sea cliffs around Ethel Beach and Waterfall and along the road to Waterfall from Settlement. It also occurs occasionally in damp localities at higher altitudes, even on the plateau. On Cocos (Keeling) Is. common at the tops of lagoon beaches and open areas in coralline sand. A widely distributed species occurring from India, S China, and Taiwan and the Ryukyu Islands, S through Indo-China and Malesia to tropical Australia and the Pacific islands; also rarely in Africa and Madagascar.

Ch.Is.: Waterfall, *H.N.Ridley 12* (K); Waterfall Rd, *D.A.Powell 313* (K); Drumsite, disused roadside, *D.J. & B.P.Du Puy CI67* (CBG, K). C.K.Is.: Direction Is., *I.R.Telford 10082 & C.Howard* (CBG, K); near settlement, West Is., *I.R.Telford 9974 & C.Howard* (BISH, CBG, K, NSW).

J.H.Kern, *Fl. Males.* ser. I, 7: 637 (1974), noted that this species may not be distinct from *Cyperus ligularis* L., which is widespread in western Africa and tropical America.

2. *Mariscus macrocarpus Kunth, *Enum. Pl.* 2: 120 (1837)

Scirpus cyperoides L., *Mant. Pl.* 2: 181 (1771); *Cyperus cyperoides* (L.) Kuntze, *Revis. Gen. Pl.* 3: 333 (1898). T: southern Africa, *J.F.Drege s.n.*; *n.v.* Epithet from the Greek *makros* (long, large) and *karpos* (a fruit, seed), descriptive of the relatively narrow, oblong nutlets of this species.

Illustration: E.Hafliger & U.Kuhn, *Monocot Weeds* 3: 57 (1982), as *M. sumatrensis* (Retz.) J.Raynal.

A tufted, shortly rhizomatous sedge; culms 15–40 cm tall, 3-angled, somewhat bulbous at base. Leaves basal, acuminate, flat, soft; lamina 6–20 cm long, c. 3.5–5 mm wide; lower sheaths reddish. Bracts c. 7–9, spreading, leaf-like, 6–20 cm long, longer than inflorescence. Inflorescence an umbel-like head with c. 6–12 short, unbranched rays, each with a single, apical raceme of many densely crowded spikelets. Spikelets ±terete, 2–3 mm long, c. 0.5 mm wide, green. Glumes usually 4, the lower pair c. 1 mm long, the upper pair 2–3 mm long, acute, enclosing remainder of spikelet. Nutlets 1 or occasionally 2 in each spikelet, narrow, oblong, 3-angled, red-brown.

Christmas Is. Not common, occurring in disturbed or cultivated areas, especially on the plateau. A widespread tropical and subtropical species distributed from SE Asia (India, S China), Indo-China, Malesia to Australia and the Pacific islands. It also occurs in Africa, and has been introduced in the West Indies.

Ch.Is.: central plateau, alongside railway at Camp 4, *B.A.Mitchell 110* (CBG, K); nursery, overlooking Settlement, *R.Shivas 962* (PERTH).

This species was first described by C.Linnaeus, in 1771 as *Scirpus cyperoides* L. and is well known by the name *Cyperus cyperoides* (L.) Kuntze. However, this epithet was not transferred to *Mariscus*, and this cannot now be done as the name *M. cyperoides* (Roxb.) A.Dietr. was published in 1833 for a taxon now included in *Cyperus pseudokyllingioides* Kük. (referable to the genus *Courtoisina* Sojak).

The next published names, *Kyllinga umbellata* Rottb., published in 1773, and *Kyllinga sumatrensis* Retz. (as *Kyllingia*), published in 1786, are both illegitimate due to the citation of *Scirpus cyperoides* L. as a synonym in their original publications.

The next name, *M. sieberianus* Nees, first listed in 1835, is a '*nomen nudum*', not validly published until C.B.Clarke used the name in 1893.

The first validly published name available for this species, in the genus *Mariscus*, therefore appears to be *M. macrocarpus* Kunth, published in 1837.

3. PYCREUS

Pycreus P.Beauv., *Fl. Oware* 2: 48 (1816); *Cyperus* subg. *Pycreus* (P.Beauv.) Miq., *Fl. Ned. Ind.* 3: 254 (1856); generic name an anagram of *Cyperus*.

Type: *P. polystachyos* (Rottb.) P.Beauv.

Annual or perennial herbs; culms tufted, 3-angled; rhizomes short. Leaves basal, usually with flat lamina. Inflorescence dense or open, terminal, umbel-like with several rays, sometimes congested, subtended by leaf-like bracts. Spikelets compressed, with few to many glumes. Glumes distichous, strongly folded, caducous at maturity leaving the persistent rachilla. Stamens 1–3. Stigmas 2, not jointed at base. Nut laterally compressed.

A pantropic and warm temperate genus of c. 100 species; 1 species on Cocos (Keeling) Is., also in mainland Australia and Norfolk Is. Included under *Cyperus* sect. *Pycreus* in several recent treatments, including that by J.H.Kern, *Fl. Males.* ser. I, 7: 646 (1974).

Pycreus polystachyos (Rottb.) P.Beauv., *Fl. Oware* 2: 48 (1816)

Cyperus polystachyos Rottb., *Descr. Pl. Rar.* 21 (1772). T: 'K.Plukenet. Tab. 416. Fig. 6'. Epithet from the Greek *poly* (many), *stachys* (spike), in reference to the inflorescence.

Annual or perennial; stems to 80 cm tall. Leaf margin scabrid; lamina to 20 cm long, 1.5–5

mm wide. Inflorescence dense; involucral bracts 3–6, 2–10 cm long; primary rays 3–8, to 3 cm long. Spikelets 2–15 per spike, narrowly ovate, compressed, 5–25 mm long, 8–many-flowered. Glumes elliptic-ovate, c. 2 mm long, keeled, 3-nerved, chartaceous, brown with hyaline margins. Stamens 2, rarely 1. Stigmas 2. Nut oblong, c. 1 mm long, brown to black.

Cocos (Keeling) Is. Grows in open areas in coralline sand. A pantropical and warm temperate species from the Mediterranean through S Asia and the Pacific, including mainland Australia and Norfolk Is.

C.K.Is.: N end of airstrip verge, West Is., *D.G.Williams 15* (CBG, K, NSW); E verge of airstrip, West Is., *D.G.Williams 92* (BISH, CBG, PERTH).

A variable species, particularly in size and density of the inflorescence, with several named varieties considered by J.H.Kern, *op. cit.* 649, to be of little taxonomic value.

4. QUEENSLANDIELLA

Queenslandiella Domin, *Biblioth. Bot.* 85: 415 (1915); *Cyperus* sect. *Queenslandiella* (Domin) J.Kern, *Fl. Males.* ser. I, 7: 654 (1974); from the diminutive of Queensland, the Australian State of the type locality of the type species.

Type: *Q. mira* Domin = *Q. hyalina* (Vahl) F.Ballard

Annual tufted herbs with fibrous roots; rhizomes or stolons absent; culms 3-angled. Leaves grass-like, ±basal. Inflorescence umbel-like with several rays subtended by several leaf-like bracts. Spikelets several-flowered; rachilla disarticulating at base, the spikelet falling entire. Stigmas 2. Nut laterally compressed.

A monotypic genus, the species widespread in maritime habitats of the tropical Indian Ocean including Cocos (Keeling) Is. and Australia (Qld). Placed in *Cyperus* subg. *Kyllinga* (Rottb.) Kük. by J.H.Kern, *Fl. Males.* ser. I, 7: 654 (1974).

Queenslandiella hyalina (Vahl) F.Ballard, *Hooker's Icon. Pl.* 33: t. 3208 (1933)

Cyperus hyalinus Vahl, *Enum. Pl.* 2: 239 (1805). T: E India, *Röttler, n.v.* Epithet from the Latin *hyalinus* (transparent), in reference to the glumes.

Illustration: J.H.Kern, *Fl. Males.* ser. I, 7: fig. 68 (1974), as *Cyperus hyalinus*.

Culms to 15 cm tall. Leaf margin scabrid; lamina to 10 cm long, 1–3 mm wide. Inflorescence on peduncle 2–5 cm long; involucral bracts 3–6, 2–9 cm long, 1.5–2 mm wide; rays 3–6, to 6 cm long with 5–20 spikes. Spikes ±ellipsoidal, 8–12 mm long; spikelets ovate, compressed, 4–8 mm long, 4–10-flowered. Glumes ovate, 3-nerved, 2–3 mm long with an apical mucro c. 0.5 mm long, hyaline. Stamens 2. Nut suborbicular to elliptic, 1–2 mm long, brown to black.

Cocos (Keeling) Is. Known from a single collection from a *Cocos* plantation in coralline sand. Widespread in tropical maritime habitats from eastern Africa through islands of the Indian Ocean, S Asia, Malesia and Australia (Qld).

C.K.Is.: Direction Is., *D.G.Williams 124* (CBG, K, NSW).

5. KYLLINGA

Kyllinga Rottb., *Descr. Icon. Rar. Pl.* 12 (1773); named after P.L.Kylling (c. 1640–1696), a Danish botanist and apothecary.

Type: *K. nemoralis* (J.R.Forst. & G.Forst.) Dandy ex Hutch. & Dalziel, *typ. cons.*

Perennial, rhizomatous sedges. Leaves basal. Inflorescence a terminal, clustered head of 1–3 sessile spikes, subtended by several leaf-like bracts; spikes usually ovoid, ellipsoidal or spherical, with many, densely crowded spikelets. Spikelets bisexual, bilaterally compressed, with several distichous, keeled glumes, the lowest 2 florets sterile, the central

1 or sometimes 2 bisexual, and the upper male or sterile, falling entire at maturity. Hypogynous bristles absent. Stamens 2 or 3. Style bifid, not thickened or jointed at base. Nutlets usually solitary in each spikelet, biconvex, ±lens-shaped.

A genus of 40–50 species, widely distributed through the tropics, subtropics and warm-temperate regions, with greatest diversity in Africa; 2 species naturalised on Christmas Is. The species occur in open forests, grasslands and disturbed sites, often on poor or sandy soil, usually preferring damp or seasonally wet sites such as lake, swamp and stream margins or ditches. The genus is badly in need of taxonomic revision.

Whorl of bracts subtending inflorescence containing 5–7 bracts; inflorescence green becoming pale brown, 7–12 mm diam.; spikelets c. 4 mm long; glumes with a toothed keel **1. K. polyphylla**

Whorl of bracts subtending inflorescence containing 3 or 4 bracts; inflorescence white becoming creamy brown, 4–6 mm diam.; spikelets 2.5–3 mm long; glumes with a winged and toothed keel **2. K. nemoralis**

1. *Kyllinga polyphylla Willd. ex Kunth, *Enum. Pl.* 2: 134 (1837)

T: Herb. C.L.Willdenow; syn: B; Africa (Guinea, Congo) and Mauritius, Herb. J.W.Hornemann; syn: probably C *n.v.* Epithet from the Greek *polus* (much, many) and *phyllon* (a leaf), indicating the relatively large number of leaf-like bracts beneath the inflorescence.

Illustration: E.Hafliger & U.Kuhn, *Monocot Weeds* 3: 50 (1982), as *K. erecta*.

A medium-sized, clump-forming, rhizomatous sedge; culms closely spaced, 20–50 cm tall, sharply 3-angled. Leaves mostly basal, acute, ±flat, glabrous; lamina often reduced, to 15 cm long, 3–5 mm wide; sheath and basal scales purplish red. Bracts 5–7, in a spreading whorl, 8–20 cm long, resembling leaves. Inflorescence a sessile, subspherical head of spikelets 7–12 mm diam., green becoming pale brown, often combined with 1–few secondary heads. Spikelets densely crowded, falcate, compressed, c. 4 mm long, c. 1 mm wide. Glumes several, the basal pair very short, the next pair as long as and enclosing spikelet, mucronate, keeled; keel toothed. Nutlet ±lens-shaped, blackish.

Christmas Is. Grows mainly in disturbed, roadside and railway bank habitats, especially in limestone rubble and near settled areas, but also in other grassy or weedy, open places. A native of tropical eastern Africa, introduced in SE Asia, Malesia and the Pacific islands.

Ch.Is.: no precise locality, *D.A.Powell 649* (K); central plateau, alongside railway at Camp 4, *B.A.Mitchell 109* (CBG, K); Drumsite, roadside, *D.J. & B.P.Du Puy CI95* (CBG, K).

This species is also known by the later name of *K. aromatica* Ridl., published in 1884, and subsequently as *Cyperus aromaticus* (Ridl.) Mattf. & Kük., and *C. aromaticus* var. *elatus* (Steud.) Kük. The epithet '*polyphylla*' could not be transferred to *Cyperus*, as *C. polyphyllus* had already been used by J.L.M.Vahl for a separate species. S.S.Hooper, *Kew Bull.* 26: 580 (1972), included *K. polyphylla* as a variety of *K. erecta* Schumach., but this has not been widely accepted.

2. *Kyllinga nemoralis (J.R.Forst. & G.Forst.) Dandy ex Hutch. & Dalziel, *Fl. W. Trop. Africa* 2: 486, 487 (1936)

Thryocephalon nemorale J.R.Forst. & G.Forst., *Char. Gen. Pl.* 65, t. 65 (1775) & 2nd edn, 130, t. 65 (1776). T: Society Islands, *J.R.Forster & J.G.Forster*; *n.v.* Epithet from the latin *nemus* (a grove, an open woodland with pasture), indicating that the species occurs in this type of woodland.

Illustrations: C.A.Backer, *Weed Fl. Javanese sugar-cane fields* t. 144 (1930); E.Hafliger & U.Kuhn, *Monocot Weeds* 3: 51, & plate (1982), as *K. monocephala* Rottb.

A small, tufted, rhizomatous sedge; culms closely spaced, 4–25 cm tall, 3-angled. Leaves mostly basal, acute, ±flat, glabrous; lamina well-developed, 2–15 cm long, 2–3 mm wide; sheath reddish brown. Bracts 3 or 4 in a spreading whorl, 3.5–10 cm long, resembling leaves. Inflorescence a sessile, spherical head of spikelets, 4–6 mm diam., usually solitary or with very small secondary heads, white becoming creamy brown. Spikelets densely crowded, compressed, 2.5–3 mm long, c. 1 mm wide. Glumes several, the basal pair very

short, the next pair as long as and enclosing the spikelet, apiculate, keeled; keel winged and toothed. Nutlet oblong, biconvex, pale brown. *Poverty Grass*.

Christmas Is., frequent along roadsides especially in the east and also in lawns and grassy areas. A pantropical species, common in SE Asia and Malesia, less so in Africa, Madagascar and Australia, and scarce in the New World.

Ch.Is.: along roads, especially in settled areas, *D.A.Powell 649* (K); entrance to golf course, *R.Shivas 842* (PERTH).

Kyllinga nemoralis is said to have some medicinal uses. Hindus claim that the root is an antidote to poisons, while the leaves are used against diarrhoea in Amboina, and against measles in Celebes. Although this species is commonly known as *K. monocephala* Rottb., this name is illegitimate because an earlier name, *Schoenus coloratus* L. (now *K. brevifolia* Rottb.), was cited in its original synonymy. When included in *Cyperus*, this species is named *Cyperus kyllingia* Endl., a name based on *Kyllinga monocephala*.

6. ISOLEPIS

Isolepis R.Br., *Prodr.* 221 (1810); from the Greek *isos* (equal) and *lepis* (a scale), in reference to the glumes of the spikelet being all similar.

Type: *I. setacea* (L.) R.Br.

Annual or perennial sedges, usually slender, often aquatic, tufted or rhizomatous. Culms without nodes except in aquatic species. Leaves narrow and grasslike or almost setaceous, few to many or all reduced to sheaths. Inflorescence an apparently lateral cluster of 1–many small, crowded spikelets subtended by a culm-like green bract appearing as a continuation of the culm. Flowers bisexual, each subtended by a glume; perianth bristles absent.

A widespread genus of c. 70 species with a concentration of species in eastern and southern Africa and Australasia; c. 25 native and 1 naturalised species in Australia; 1 native species on Macquarie Is.

K.L.Wilson, A synopsis of the genus *Scirpus* sens. lat. (Cyperaceae) in Australia, *Telopea* 2: 153–172 (1981).

Isolepis aucklandica Hook.f., *Fl. Antarct.* 1: 88 (1844); t. 50 (1845)

Scirpus aucklandicus (Hook.f.) Boeckel., *Linnaea* 36: 491 (1870). T: Auckland Islands, Nov.–Dec. 1840, *J.D.Hooker*; lecto: K, *fide* L.B.Moore & E.Edgar, *Fl. New Zealand* 2: 182 (1970). Named for the Auckland Is. where the type was collected.

Perennial, 1–7 cm high; rhizomes slender, branched. Leaves many, stiff, narrowly linear or almost setaceous, usually overtopping culms; sheaths hyaline, brownish and often red-flecked to purple-red. Spikelet solitary, ovoid, 2–3 mm long, partly hidden by dilated base of erect floral bract. Glumes dark purple-red with green keel thickened and excurrent at apex. Stamens 3. Style branches 3. Nut 1–2 mm long, trigonous, straw-coloured to greyish. *2n* = 42, D.M.Moore, *Bot. Not.* 113: 187 (1960). Fig. 89D.

Macquarie Is. Grows in very wet sites in pools and in peat, sea level to 180 m alt. Plants are generally scattered but may form small, bright green, dense, turfy patches, see B.W.Taylor, *ANARE Reports* Series B, Botany 2: 142 (1955). Also in New Guinea, Australia, New Zealand (North, South and Stewart Islands), and on Antipodes, Auckland and Campbell Islands. Flowers Dec.–Feb.

M.Is.: West Point, 27 Jan. 1949, *N.R.Laird* (HO); N side of Bauer Bay, *R.D.Seppelt 12145* (HO); Handspike Point, *R.D.Seppelt 12218* (HO); Hasselborough Bay, *R.D.Seppelt 12245* (CHR, HO); base of coastal slope E of Boiler Rocks, *R.D.Seppelt 12512* (CHR, HO).

Figure 89. **A**, ASTERACEAE: *Cotula plumosa* X1 (E.Wollaston, 8 Dec. 1960, CBG). **B**, POACEAE: *Deschampsia chapmanii* X1 (R.Seppelt 12596, CBG). **C**, JUNCACEAE: *Juncus scheuchzerioides* X1 (R.Hnatiuk 11780, CANB). **D**, CYPERACEAE: *Isolepis aucklandica* X2 (R.Seppelt 12245, CANB). **E**, POACEAE: *Poa cookii* X0.5 (J.Smith 768, CBG). Drawn by D.Boyer.

7. FIMBRISTYLIS

Fimbristylis Vahl, *Enum. Pl.* 2: 285 (1805), *nom. cons.*; from the Latin *fimbria* (a fringe) and *stylus* (a style), descriptive of the fringed or fimbriate styles of some species.

Type: *F. dichotoma* (L.) Vahl, *typ. cons.*

Mainly tufted sedges. Leaves ±basal, those on culm usually reduced, sometimes to a sheath. Inflorescence terminal, often compound and umbel-like, sometimes ±capitate with short rays, subtended by short bracts with expanded, sheathing base. Spikelets bisexual, solitary or clustered, terete to compressed, with few to many glumes. Glumes spirally arranged, overlapping, caducous at maturity, leaving persistent rachilla. Hypogynous bristles absent. Stamens 1–3. Style 2- or 3-branched, thickened at base and jointed to ovary, sometimes fimbriate. Nutlets 3-ridged to lens-shaped, smooth to tuberculate.

A pantropical and subtropical genus, extending into some warm-temperate regions, containing 100–200 species. There is a centre of diversity in Malesia, with c. 78 species; 1 species occurs on Christmas Is. and Cocos (Keeling) Is. The species generally occur in damp or wet habitats, especially on the margins of lakes, pools, swamps and streams, and in wet grasslands and rice fields.

Fimbristylis cymosa R.Br., *Prodr.* 228 (1810)

T: near Endeavour R., [Qld], *R.Brown, Iter Australiense 5959*; iso: BM, K. Epithet from the Latin *cymosus* (cyme-like) in reference to the contracted, cymose inflorescence.

A small, densely tufted sedge; culms obtusely 3-angled, 6–40 cm tall. Leaves mostly basal, wiry, obtuse, channelled, coriaceous, glabrous; margins rough; lamina 4–20 cm long, 0.5–2 mm wide. Bracts 2 or 3, erect, 0.5–2.5 cm long, slender and green at apex, with broad, scarious base. Inflorescence a dense capitulum of short-stalked spikelets and spikelet clusters 1–3 cm diam. Spikelets terete, 3–6 mm long, c. 2 mm diam., with many glumes. Glumes spirally arranged, tightly overlapping, oblong to ovate, c. 1.5–2 mm long, notched to mucronate, light brown with pale scarious margins. Nutlets 3-angled or lens-shaped, ±smooth.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. a common species, occcurring on limestone pinnacles behind the sea cliffs, in exposed situations open to occasional inundation and salt spray, especially on the E and S coasts; less frequent in poor soil in open, disturbed sites inland, including the plateau. On Cocos (Keeling) Is. grows in open areas, strand communities in coconut plantations in coralline sand. A pantropical species, including Australia.

Ch.Is.: sea cliff at North East Point, *D.A.Powell 312* (K); western flank of airport, *D.A.Powell 765* (K); 'Ravine' sea cliffs, E coast, *B.A.Mitchell 198* (CBG, K). C.K.Is.: near Tanjong Klikil, West Is., *I.R.Telford 9991 & C.Howard* (CBG, K, NSW); Home Is., *I.R.Telford 10076 & C.Howard* (CBG, K, MEL).

This variable species normally has obtuse leaves c. 1–2 mm wide, and specimens of this nature are found at the inland sites on Christmas Is., even though it is unusual to find the species away from the coast. The coastal specimens on Christmas Is. have unusually narrow leaves (c. 0.5–1 mm wide).

8. UNCINIA

Uncinia Pers., *Syn. Pl.* 2: 534 (1807); from the Latin *uncinus* (a hook or barb), in reference to the hook-tipped rachilla of the female floret.

Type: none designated.

Perennial, tufted or shortly rhizomatous, monoecious; culms trigonous, occasionally terete. Leaves grass-like; margins ±scabrous. Inflorescence a simple, terminal spike with unisexual flowers. Male at top of spike, each consisting of 3 stamens. Female flowers below males, each enclosed in a glumaceous trigonous or planoconvex sac (utricle) with style branches

and hook-tipped rachilla protruding from mouth of utricle; perianth absent; style branches 3. Nut enclosed in utricle and subtended by a glume.

A genus of c. 50 species principally in the Southern Hemisphere but not in S Africa; about 7 native species in Australia; 2 species on Macquarie Is.

B.G.Hamlin, A revision of the genus *Uncinia* (Cyperaceae–Caricoideae) in New Zealand, *Bull. Domin. Mus.* 19: 1–106 (1959); A.Lourteig, Étude sur *Uncinia compacta* R.Br. (Cyperaceae), *Bull. Comité Natl. Franc. Rech. Antarct. – Biologie* 23: 25–31 (1968).

Female flowers c. 10 per spike; glumes dark brown, bright green at centre; leaves involute, rigid **1. U. hookeri**

Female flowers c. 30 per spike; glumes light brown with light green centre; leaves flat, soft **2. U. divaricata**

1. Uncinia hookeri Boott in J.D.Hooker, *Fl. Antarct.* 1: 91 (1844); t. 51 (1845)

U. riparia var. *hookeri* (Boott) Kük., *Pflanzenr.* 38: 63 (1909). T: Auckland Islands, Nov,–Dec. 1840, *J.D.Hooker*; lecto: K, *fide* B.G.Hamlin, *Bull. Domin. Mus.* 19: 62 (1959). Named after Joseph Hooker, collector of the type.

Tufts stiff from a slender rhizome, with culms 3–18 cm tall. Leaves rigid, involute, dark green; lamina 3–20 cm long, 1–2 mm wide; sheaths reddish brown. Spike 1–3 cm long; female flowers c. 10, crowded above, more distant below. Glumes c. equalling utricles, dark brown with bright green centre, deciduous at maturity. Utricle ±trigonous, 4–5 mm long, less than 1 mm diam., light green, faintly nerved, narrowed above to beak c. 1 mm long.

Macquarie Is. Grows in dry to wet peat, in grassland and herbfield, from sea level to 220 m alt. Also on Antipodes, Auckland and Campbell Islands. Flowers Nov.–Jan.

M.Is.: Langdon Point, 8 Jan. 1949, *N.R.Laird* (CHR, HO, MEL, NSW); Green Gorge, *R.Hnatiuk 11531* (CANB); N side of Bauer Bay, *R.D.Seppelt 12146* (AD, CHR, HO); c. 800 m NE of Mt Law, on western slopes of Green Gorge Basin, *R.D.Seppelt 12591* (AD, HO); Finch Ck, Sandy Bay, *R.D.Seppelt 12681* (AD, AK, CANB, CHR, HO, MEL).

Both *U. hookeri* and *U. divaricata* have been referred by various authors, e.g. A.Lourteig, *op. cit.* 27, to the Australian *U. compacta* R.Br., but this latter species has tough, flat leaves to c. 3 mm wide. The female flowers of *U. compacta* are densely crowded as in *U. divaricata* but much fewer, 10 to 15, and the utricles are larger, 5–6 mm long and 1–2 mm wide. A.Lourteig, *op. cit.* 28–29, recorded *U. compacta* from Kerguelen, Marion, Crozet, Gough and New Amsterdam Islands. It is possible that some of these records may refer to either *U. hookeri* or *U. divaricata*.

2. Uncinia divaricata Boott in J.D.Hooker, *Fl. Nov.-Zel.* 1: 286 (1853)

T: Milford Sound, N.Z., *D.Lyall*; lecto: K, *fide* B.G.Hamlin, *Bull. Domin. Mus.* 19: 54 (1959). Epithet from the Latin *divaricatus* (divaricate), in reference to the spreading mature utricles.

Plant shortly rhizomatous, to 18 cm tall; culms 5–10 cm tall at flowering, overtopped by leaves. Leaves flat, soft; lamina 10–25 cm long, to 3 mm wide; sheaths light brown. Spikes 2 cm long; female flowers c. 30, densely crowded. Glumes longer than, equalling or shorter than utricles, light brown with light green midrib. Utricles ±trigonous, c. 4.5 mm long, slightly more than 1 mm diam., light greenish brown, nerved; beak less than 1 mm long.

Macquarie Is. Grows in grassland. Also occurs in N.Z. (North and South Islands) and on Campbell Is. Flowers Jan.–Feb.

M.Is.: N side of Green Gorge, *R.D.Seppelt 12453* (AD, AK, CANB, CHR, HO, MEL); N side of Floating Island Tarn, *R.D.Seppelt 15058* (CHR); Green Gorge, *R.D.Seppelt 15651* (CHR).

9. CAREX

Carex L., *Sp. Pl.* 2: 972 (1753); *Gen. Pl.* 5th edn, 420 (1754); from the Latin *carex*, a reed-grass, rush or sedge.

Type: *C. pulicaris* L.

Perennial, tufted or rhizomatous, monoecious, rarely dioecious; culms usually 3-angled. Leaves linear, tristichous, usually basal. Inflorescence of 1–several bisexual or unisexual spikes. Flowers unisexual; perianth absent. Male flower consisting of 3 stamens. Female flower consisting of a single pistil enclosed in a glumaceous sac (utricle); stigmas 2 or 3, protruding. Nut enclosed in utricle and subtended by a glume.

A cosmopolitan genus of 1500 to 2000 species; c. 45 native and c. 5 naturalised species in Australia; 1 native species on Macquarie Is.

Carex trifida Cav., *Icon.* 5: 41, t. 465 (1799)

T: Puerto Egmont, Falkland Islands, *L.Née*; holo: MA *n.v.*, photo CHR. Epithet from the Latin *trifidus* (divided into 3), in reference to the 3 stigmas.

Illustration: B.W.Taylor, *ANARE Reports* Series B, Botany 2: 144, pl. 34 (1955).

Tufts robust, to 1 m tall. Leaves harsh, with scabrous margins; lamina to 1 m long, 6–15 mm wide. Inflorescence of 6–9 sturdy, rather close-set, ±sessile, chestnut-brown spikes, with longer subtending leaf-like bracts. Spikes 2–8 cm long, 10–15 mm wide, the upper 2 to 4 spikes male, the lower female. Glumes longer than utricles, long-awned. Female flowers with 3 stigmas; utricles c. 5 mm long, nerved, with narrow beak; beak c. 1 mm long. *2n* = 60, D.M.Moore, *Bot. Not.* 113: 187 (1960).

Macquarie Is. Grows near Handspike Corner on W coast in swampy ground often with base in water. Flowers Nov.–Jan. Also in N.Z. (South and Stewart Islands), S America (Chile to Tierra del Fuego), the Snares, and Antipodes, Auckland, Campbell and Falkland Islands.

M.Is.: Handspike Point, 7 Jan. 1949, *N.R.Laird* (CHR, HO); NW slopes of plateau, 20 Jan. 1949, *N.R.Laird* (CHR, HO); 400 m NW of Handspike Corner, *R.D.Seppelt 12210* (CHR, HO).

91. POACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is., A.R., C.S.Is.)
E.Edgar (M.Is., H.Is.)

Annual or perennial dioecious or monoecious herbs, or (in our area only in cultivation) woody and tree-like (Bamboos); stems (culms) clumped, rhizomatous or stoloniferous, erect to spreading, often hollow with solid nodes. Leaves alternate, with a basal sheath enclosing the culm and a narrow, spreading lamina, the junction marked adaxially by a membranous or hairy ligule. Flowers 1–several in scaly spikelets, the spikelets combined into paniculate or racemose inflorescences, the racemes solitary or 2–several in an apical whorl or spread along a central axis, sometimes 1-sided. Spikelets pedicellate or sessile, generally of 2 basal scales (glumes) and 1–several flowers (florets), each floret with 2 basal scales (lemma and palea) enclosing stamens and ovary; glumes, lemmas and paleas coriaceous to hyaline, awned, toothed or entire, glabrous to hairy, and variously modified, reduced or absent. Florets sometimes unisexual or sterile. Stamens usually 3, rarely 1, 2, 4 or 5, (unusually 2 or 6); anthers bilocular, longitudinally dehiscent. Ovary unilocular and uniovular with 2 (unusually 3) feathery stigmas. Fruit usually a caryopsis with thin pericarp adnate to the seedcoat. Endosperm copious. *Grasses and Bamboos*.

A very large, cosmopolitan family containing 8,000–10,000 species in c. 650 genera. There are 40 genera in our areas: 27 genera (35 species) on Christmas Is.; 24 genera (26 species) on Cocos (Keeling) Is.; 6 genera (7 species) on Ashmore Reef; 6 genera (6 species) on the Coral Sea Is.; 6 genera (10 species) on Macquarie Is. and 2 genera (4 species) on Heard Is. Grasses dominate huge areas of tropical savanna and temperate steppe regions, in the zone between desert and forest, especially where the climate is seasonally dry; they also extend into subpolar regions. They are also frequent colonisers of cultivated and other disturbed sites. They usually require open situations, and few species occur in shaded habitats.

Grasses are vital sources of carbohydrate and are the staple food for much of mankind. The major cereal crops are *Triticum* L. (Wheat), *Oryza* L. (Rice), *Zea* L. (Maize). *Avena* L. (Oats), *Hordeum* L. (Barley) and *Sorghum* Moench (Sorghum). *Saccharum* L. (Sugar Cane) is a major source of sugar. On Christmas Is. several species of grass are cultivated, including *Saccharum spontaneum* L. and *Sorghum bicolor* (L.) Moench, which also occur outside cultivation. *Zea mays* L. (Maize) is cultivated in Chinese gardens and is occasionally encountered in freshly cleared areas, where it has been planted to yield a quick crop before the area is choked by invasive weeds. It is a robust, easily recognised grass with single, erect culms, a terminal panicle of paired, male spikelets and axillary, female inflorescences enclosed by several sheaths, with a tassel of long, silky styles protruding (*D.A.Powell 828*, K). *Cymbopogon citratus* (DC.) Stapf (Lemon Grass) is cultivated in many gardens for use as a culinary seasoning. It forms very dense clumps about 50 cm tall and can be easily recognised by the pungent lemon scent from the crushed leaf (*D.A.Powell 715*, K). Lemon Grass has been cultivated on the island since at least 1904 (H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 166, 168 (1906), as *Andropogon nardus* L.) but has not been recorded in flower. Finally, a slender bamboo about 4 m tall, probably a species of *Gigantochloa* Munro, is occasionally cultivated as a garden ornamental.

The forests of Christmas Is. contain only 1 indigenous species, *Oplismenus compositus* (Creeping Beard Grass). Several of the species occurring around the sea cliffs such as *Lepturus repens* and the endemic *Ischaemum nativitatis* are also native to the island. However, the majority of the grasses are weedy species which have colonised disturbed sites since the destruction of the forest cover on the island commenced in 1888. Of the 11 species recorded by H.N.Ridley (1906), 4 are no longer known to exist on the island.

On Cocos (Keeling) Is. of the 26 species, 12 are probably native, the remainder being relatively recent introductions. *Sorghum bicolor* (Sorghum) is cultivated for stock feed and *Zea mays* is grown in vegetable gardens.

On Ashmore Reef 5 genera and 5 species are native and a further genus is represented by 2 introduced species. *Zea mays* has been recorded sporadically around the well on East Is.

On the Coral Sea Is. 5 of the genera and species are probably native.

On Macquarie Is. 5 of the genera are native with 1 species endemic and 1 genus introduced; on Heard Is. both genera are native. On both Macquarie and Heard Islands the widespread weed *Poa annua* has been introduced.

The systematic arrangement followed in this treatment is that used in W.D.Clayton & S.A.Renvoize, *Genera Graminum* (1986).

T.F.Cheeseman, The Vascular Flora of Macquarie Island, *Australas. Antarctic Exped. 1911–14, Sci. Reports*, Series C. Zoology and Botany, 7(3): 33–38 (1919); T.F.Cheeseman, Gramineae, *Man. New Zealand Fl.* 2nd edn, 132–212 (1925); B.W.Taylor, The Flora, Vegetation and Soils of Macquarie Island, *ANARE Reports*, Series B, Botany, 2: 1–192 (1955); D.M.Moore, Chromosome numbers of flowering plants from Macquarie Island, *Bot. Not.* 113: 185–191 (1960); A.Lourteig & P.Cour, Essai sur la distribution géographique des plantes vasculaires de l'Archipel de Kerguelen, *Bull. C.N.F.R.A.* 3: 67–70 (1963); V.D.Zotov, Grasses of the subantarctic islands of the New Zealand region, *Rec. Domin. Mus.* 5: 101–146 (1965); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Poaceae (Gramineae) *Fl. Java* 3: 495–641 (1968); H.B.Gilliland, *Fl. Malaya* (*Grasses of Malaya*) 3:

1–318 (1971); W.D.Clayton, S.M.Phillips & S.A.Renvoize in R.M.Polhill (ed.), Gramineae. *Fl. Trop. E. Africa*, Gramineae 2: 177–450 (1974); J.W.Parham in A.C.Smith, Poaceae, *Fl. Vit. Nova* 1: 290–391 (1978); W.D.Clayton & S.A.Renvoize in R.M.Polhill (ed.), Gramineae, *Fl. Trop. E. Africa*, Gramineae 3: 451–898 (1982); W.D.Clayton & S.A.Renvoize, *Genera Graminum* 1–377 (1986); R.D.Webster, *The Australian Paniceae* (*Poaceae*) 1–322 (1987).

KEY TO SUBTROPICAL GENERA

1 Inflorescence a globose head of spikelets subtended by long bristles **32. SPINIFEX**

1: Inflorescence a raceme or panicle, not a globose head

2 Inflorescence a raceme of 1–5 florets subtended by a spathe-like leaf

3 Racemes in a pseudo-panicle; plant clumped **39. APLUDA**

3: Racemes solitary; plant creeping **23. THUAREA**

2: Inflorescence not a raceme of 1–5 florets subtended by a spathe-like leaf

4 Inflorescence erect, unbranched, racemose, with the spikelets or spikelet groups sessile or shortly stalked and evenly distributed around a central rachis

5 Inflorescence of many spiny and bristly burrs around a central rachis, the burrs c. 3.5–4 mm diam., with an outer whorl of barbed bristles surrounding a rigid cup with intercrossing spines, containing 2–4 spikelets **31. CENCHRUS**

5: Spikelets not contained in bristly and spiny burrs

6 Spikelets short-stalked, free, spirally arranged around rachis; rachis not segmented, persistent; a short, fine, extensively creeping, rhizomatous grass **17. ZOYSIA**

6: Spikelets immersed in cavities in the cylindrical rachis, covered by a glume; rachis segmented, breaking up at maturity, the spikelets falling attached to rachis segments; erect, often tufted grasses

7 A rather small, slender grass; leaf lamina c. 2.4–4 mm wide, usually inrolled, with smooth margins; leaf sheaths glabrous **13. LEPTURUS**

7: A large, robust grass; leaf lamina c. 10–18 m wide, with rough, sharp margins; leaf sheaths with many fine, sharp bristles **40. ROTTBOELLIA**

4: Inflorescence of more than 1 raceme, or branched and paniculate, rarely with a solitary raceme in which case spikelets arranged along 1 side of rachis (a pair of terminal racemes appressed and appearing like a solitary raceme may cause confusion in *Ischaemum*)

8 Inflorescence of 2–many unbranched racemes paired or whorled at or near culm apex, sometimes with 1 or 2 racemes inserted on culm slightly below apex

9 Racemes 2 at culm apex, appressed and often ±resembling a solitary raceme; lower glume coriaceous and with 2 membranous submarginal wings in upper half **38. ISCHAEMUM**

9: Racemes 2–many, not appressed; glume not winged, not as above

10 Racemes bristly, the spikelets with 1 or 3, short or long awns

11 Racemes robust, c. 1.5–3.5 cm long, 4–6 in a flat, spreading whorl; rachis of raceme exceeding spikelets as a short point; upper glume with a short, stiff awn **10. DACTYLOCTENIUM**

11: Racemes slender, c. 3.5–7 cm long

12 Racemes 2 or 3, ±erect; awns 1 per spikelet from the fertile lemma **15. LEPTUROPETIUM**

12: Racemes 8–20 in an ascending whorl; rachis of raceme with spikelets continuing to apex; awns 3 from each spikelet, slender, inserted on lemma of 1 fertile and 2 sterile florets **14. CHLORIS**

10: Racemes not bristly, the spikelets without awns

13 Spikelet mostly in pairs (in 2 rows) along rachis, 1 spikelet of each pair with a pedicel as long as the spikelet, the other spikelet sessile **30. DIGITARIA**

13: Spikelets solitary (in 2 rows) along rachis, all ±sessile

14 Spikelets c. 4–5 mm long, with 4 or 5 florets, the intact spikelet with 5–7 subequal, overlapping scales (glumes and lemmas) visible **9. ELEUSINE**

14: Spikelets c. 1–2.5 mm long, with a single fertile floret, the intact spikelet with 2 or 3 scales (glumes and lemmas) visible

15 Racemes 2; spikelets subcircular, broad and obtuse, flat on 1 surface, with a marginal ring of long hairs **25. PASPALUM**

15: Racemes usually 3–5, occasionally 2; spikelets narrow, elliptic, acute, not as above

16 Leaves c. 1–3 mm wide; racemes 4 or 5 in an apical whorl; spikelets with 2 glumes **16. CYNODON**

16: Leaves c. 5–12 mm wide; racemes 3 or occasionally 2, usually with an apical pair and the third inserted on culm below; spikelets lacking lower glume **26. AXONOPUS**

8: Inflorescence of few to many racemes scattered along a central axis, usually panicle- or spike-like, or a much-branched panicle

17 Inflorescence spike-like; racemes very short, partially immersed in hollows of flattened axis **28. STENOTAPHRUM**

17: Inflorescence not spike-like; racemes not in hollows of axis

18 Spikelets with many long, silky hairs from base, exceeding spikelets

19 Spikelets covered in long, silky, usually purple-pink hairs; spikelets solitary **29. RHYNCHELYTRUM**

19: Hairs ±confined to a whorl at base of spikelets, whitish; spikelets mostly in pairs along infloresecence branchlets, on unequal pedicels, or one pedicellate, the other sessile

20 Spikelets with a twisted yellow awn c. 9–13 mm long **37. BOTHRIOCHLOA**

20: Spikelets not awned

21 A coarse grass with leaf lamina c. 5–12 mm wide, often inrolled, and slender culm up to 3 mm thick; panicle narrow, cylindrical, with appressed branchlets; spikelets c. 3 mm long **34. IMPERATA**

21: A very robust grass with leaf lamina up to 30 mm wide, flat, and thick culms up to 20 mm thick; panicle larger, plumose, with ±spreading branchlets; spikelets c. 5 m long **33. SACCHARUM**

18: Spikelets glabrous to hairy, the hairs shorter than the spikelets

22 Some or all spikelets with bristle-like awns (sometimes hidden between awnless spikelets in *Chrysopogon*)

23 Some or all spikelets with a basal whorl of short hairs

24 Spikelets in clusters of 3 at apex of slender branchlets, the central spikelet with a straight, yellow awn; spikelet cluster with a basal whorl of ginger hairs extending down 1 side of branchlet; a short, creeping grass with erect flowering culms **36. CHRYSOPOGON**

24: Spikelets in pairs along branchlets, 1 spikelet of each pair usually awned (or sometimes few spikelets in inflorescence awned), the awn bent in the middle; whorl of hairs below spikelet not as above; a tall, erect grass **35. SORGHUM**

23: Spikelets lacking a whorl of short hairs at base

25 Spikelets solitary, c. 8–10 mm long (excluding awns); a robust, reed-like grass up to 3 m tall, with a large panicle up to 70 cm long and leaf lamina c. 20–40 mm wide **7. ARUNDO**

25: Spikelets mostly paired, c. 3–4 mm long (excluding awns); grass not as above, smaller, with leaf lamina c. 2–15 mm wide

26 Spikelet awned from lemma of fertile floret (awn from within spikelet), the awn twisted and bent in the middle; inflorescence dense; the spikelets overlapping; an erect, tufted grass **37. BOTHRIOCHLOA**

26: Spikelets awned from glumes (awn from outer scales of spikelet), the awn not twisted, straight; inflorescence lax; a decumbent grass forming loose mats **18. OPLISMENUS**

22: Spikelets not awned

27 Leaf lamina ciliate; fertile lemma coriaceous, rounded, with a slender mucro c. 1 mm long (enclosed by apex of upper glume) **24. UROCHLOA**

27: Leaf lamina not ciliate; lemma not as above, without a distinctive mucro

28 Small to medium, creeping to erect grasses up to 90 cm tall, frequently much less, with slender culms; spikelets c. 1.5–4 mm long

29 Spikelets with 4–many florets alternating along a central rachilla

30 Spikelets breaking up at maturity **8. ERAGROSTIS**

30: Spikelets falling entire **11. DESMOSTACHYA**

29: Spikelets containing a single fertile floret (subtended by a male or sterile lemma)

31 Spikelets with a slender, awn-like bristle c. 3–7 mm long inserted on stalk below spikelet base and usually exceeding spikelet **27. SETARIA**

31: Spikelets not subtended by an awn-like bristle

32 Inflorescence a lax panicle with spikelets on long slender pedicels

33 Spikelet with a bead-like globose thickening at base **22. ERIOCHLOA**

33: Spikelets lacking a bead-like thickening at base **19. PANICUM**

32: Inflorescence not as above

34 Inflorescence a condensed, elongated panicle with primary branches remaining ±erect and appressed to central axis, and spikelets ±appressed to primary branches; spikelets narrow, breaking up above glumes at maturity, the glumes persistent on branchlets; upper lemma thin, herbaceous to membranous **12. SPOROBOLUS**

34: Inflorescence of 1–several racemes scattered along a central axis, the upper racemes sometimes becoming gradually reduced; spikelets plump, falling entire at maturity; upper lemma coriaceous to crustaceous, pale

35 Spikelets in 1 or 2 rows along rachises of racemes; lemma of upper floret minutely rugulose, not glossy; palea of upper floret lacking a reflexed apex **21. BRACHIARIA**

35: Spikelets forming 4 rows along rachises of racemes; lemma of upper floret smooth, glossy; palea of upper floret with a minute, reflexed apex **20. ECHINOCHLOA**

28: Robust, erect grasses c. 1–3 m tall, with thick culms; spikelets c. 5.5–14 mm long

36 Inflorescence unisexual, the female inflorescence from lower leaf axils and enclosed by several sheaths, with only a tassel of long, silky styles protruding, the male inflorescence terminal, an open panicle with paired spikelets, one of each pair pedicellate **†ZEA**

36: Inflorescence a bisexual, terminal panicle, the spikelets solitary or paired, not as above

37 Spikelets paired, one pedicellate, male and reduced, the other sessile, bisexual and plump, acute; glumes coriaceous, the lower 3-toothed; lemmas hyaline, glabrous **35. SORGHUM**

37: Spikelets solitary, bisexual, long-acuminate; glumes membranous, long-acuminate; lemmas membranous, with long, silky hairs **7. ARUNDO**

†*Zea* is not established in the wild and is not treated further in the text.

KEY TO SUBANTARCTIC GENERA

1 Spikelets with 1 bisexual floret only, or with 1 fertile floret and 2 sterile florets; rachilla not exceeding florets

2 Spikelets with l bisexual floret only; plant not coumarin-scented **6. AGROSTIS**

2: Spikelets with terminal bisexual floret and 2 sterile florets; plant coumarin-scented **5. ANTHOXANTHUM**

1: Spikelets with 2 or more florets, bisexual, male, or female, none sterile; rachilla exceeding florets

3 Lemma toothed; awn, if present, dorsal or subterminal **4. DESCHAMPSIA**

3: Lemma entire; awn, if present, terminal

4 Lemma keeled throughout **3. POA**

4: Lemma rounded at back, sometimes keeled near tip

5 Lemma awned; ligule truncate; caryopsis with linear hilum **1. FESTUCA**

5: Lemma awnless; ligule tapered; caryopsis with subbasal punctiform hilum **2. PUCCINELLIA**

Subfam. POOIDEAE

Trib. POEAE

1. FESTUCA

Festuca L., *Sp. Pl.* 1: 73 (1753); *Gen. Pl.* 5th edn, 33 (1754); from the Latin *festuca* (a stalk, stem or straw).

Type: *F. ovina* L.

Tufted perennials, often stoloniferous, rarely rhizomatous. Leaf lamina flat or involute; ligule membranous, usually short. Inflorescence a narrow or open panicle. Spikelets few- to several-flowered, laterally compressed, often long-pedicellate; rachilla breaking above glumes and between florets, exceeding florets. Glumes narrow, acute, unequal, the lower 1-nerved, upper 3–5-nerved. Lemma dorsally rounded, obscurely 5-nerved, with a terminal awn or awnless. Palea slightly shorter than lemma, 2-keeled. Lodicules 2. Stamens 3. Caryopsis obovoid-oblong; hilum ±linear, almost as long as caryopsis.

Widespread genus of about 80 species, mostly from temperate regions of both hemispheres but extending into montane areas of the tropics; about 9 native and 4 naturalised species in Australia; 1 native species on Macquarie Is.

J.R.B.Tallowin & R.I.Lewis Smith, Studies in the reproductive biology of *Festuca contracta* T.Kirk on South Georgia: I. The reproductive cycles, *Brit. Antarct. Surv. Bull.* 45: 63–76 (1977).

Festuca contracta Kirk, *Trans. & Proc. New Zealand Inst.* 27: 353 (1895)

T: Macquarie Is., *A.Hamilton*; holo: WELT 68607. Epithet from the Latin *contractus* (compressed, contracted), in reference to the inflorescence.

F. erecta d'Urv., *Mém. Soc. Linn. Paris* 4: 601 (1825) *non F. erecta* (Huds.) Wallr. (1822). T: Falkland Islands, Isla Soledad, *J.S.C.D.d'Urville 24*; holo: P.

Tufts stiff, erect, dense, blue-green, 8–40 cm tall; culms ridged, finely scabrous along ridges. Leaves rigid, narrow, acute, inrolled; sheath shining; ligule 0.5–1 mm long, truncate. Panicle contracted, 3–12 cm long, purplish-green; branchlets erect, angled, finely scabrous on angles. Spikelets c. 12 mm long including awns. Glumes with strong mid-nerve, acute, scabrous near tip. Lemma rounded on back, entire, finely scabrous throughout; awn terminal, short, fine. Anthers c. 0.5 mm long. *2n* = c. 170, D.M.Moore, *Bot. Not.* 113: 187 (1960).

Macquarie Is. Common throughout the island in dry or wet peat, from near sea level in places on steep sheltered slopes (E coast) to at least 350 m altitude on some higher peaks (R.D.Seppelt *pers. comm.*). Flowers Oct.–Jan. Also on Kerguelen Is., South Georgia, Falkland Is., Tierra del Fuego and Patagonia.

M.Is.: Watersupply Ck, 20 Nov. 1948, *N.R.Laird* (HO); Gentoo Flat, 13 Dec. 1980, *D.Montgomery & G.Leaman* (HO); Green Gorge, *R.D.Seppelt 11988* (HO); 300 m S of Red R., SE end of Red River Valley, *R.D.Seppelt 12398* (CHR, HO); Mt Ifould, SE side of summit ridge, *R.D.Seppelt 12583* (CHR, HO).

J.R.B.Tallowin & R.I.Lewis Smith (*Brit. Antarct. Surv. Bull.* 45: 69, 1977) reported cleistogamous flowering in *F. contracta*.

2. PUCCINELLIA

Puccinellia Parl., *Fl. Ital.* 1: 366 (1848) *nom. cons.*; commemorating the Italian professor B.Puccinelli (1808–1850).

Type: *P. distans* (L.) Parl.

Perennial, biennial or annual. Leaf lamina flat, folded or convolute; sheath open; ligule

membranous. Inflorescence an open or contracted panicle. Spikelets 3- to many-flowered, laterally compressed or almost cylindric; rachilla breaking above glumes and between florets, glabrous, produced beyond florets. Glumes usually unequal, obtuse, 1–3-nerved, shorter than lemma. Lemma usually oblong, obtuse, entire, awnless, 5-nerved, rounded on back. Palea ±equal to lemma, 2-keeled. Lodicules 2. Stamens 3. Caryopsis oblong; hilum subbasal, punctiform.

About 30 species of temperate regions, usually growing in coastal salt marshes or inland on saline soils near brackish water; 2 native and 3 naturalised species in Australia; 1 endemic species on Macquarie Is.

Puccinellia macquariensis (Cheeseman) Allan & Jansen, *Trans. & Proc. Roy. Soc. New Zealand* 69: 268 (1939)

Triodia macquariensis Cheeseman, *Vasc. Fl. Macquarie Is.* 34 (1919). T: Macquarie Is., *H.Hamilton*; lecto: AK 1732, *fide* E.Edgar, *Fl. Australia* 50: 572 (1993). Named from the locality of collection of the type.

Tufts perennial, 4–25 cm tall; culms completely enclosed by leaf-sheaths, erect or geniculate at base. Leaves narrow, obtuse, folded or involute, smooth, glabrous, soft, overtopping panicles; sheath whitish green, much wider than lamina; ligule 0.7–1.5 mm long, erose. Panicle 1.5–6 cm long, narrow, with few, short, erect, angled branches. Spikelets few, 4–5 mm long. Glumes 1.5–3.5 mm long. Lemma 3–3.5 mm long, elliptic-oblong, obtuse with scarious tip. Callus sometimes with a few minute hairs. Palea with long-ciliate keels. Anthers 0.4–0.7 mm long. *2n* = 28, D.M.Moore, *Bot. Not.* 113: 187 (1960). Fig. 80.

Macquarie Is. Endemic. Common in dense patches on coastal rock stacks and cliffs. Flowers Nov.–June.

M.Is.: Half Way Hill, 29 Dec. 1950, *B.W.Taylor* (MEL); W end of isthmus, *N.R.Laird* (HO); Watersupply Ck, 7 Feb. 1949, *N.R.Laird* (HO); Hasselborough Bay, *R.D.Seppelt 12198* (CHR, HO); 2 km N of Sandy Bay, *R.D.Seppelt 12405* (CHR, HO).

Very closely related to *P. chathamica* (Cheeseman) Allan & Jansen of Auckland, Campbell, Antipodes and Chatham Islands but is a softer grass, with obtuse, membranous-tipped lemmas, whereas the lemmas in *P. chathamica* are more acute with firmer tips.

A grass collected S of Mt Haswell at c. 180 m, on peat in a broad valley at the edge of erosion gutters, may prove to be another species of *Puccinellia*. It has not been seen in flower.

3. POA

Poa L., *Sp. Pl.* 1: 67 (1753); *Gen. Pl.* 5th edn, 31 (1754); from the Greek *poa* (grass).

Type: *P. pratensis* L.

Tzvelevia Alekseev, *Bjull. Moskovsk. Obsc. Isp. Prir., Otd. Biol.* 90(5): 103 (1985). T: *T. kerguelensis* (Hook.f.) Alekseev

Annual or perennial. Leaf lamina flat or convolute; ligule membranous. Inflorescence a lax or contracted panicle. Spikelets laterally compressed, 2–10-flowered; rachilla breaking above glumes and between florets, exceeding florets. Florets bisexual, or unisexual in dioecious plants. Glumes keeled, membranous, 1–3-nerved. Lemma usually 5–7-nerved, entire, keeled, awnless, rarely mucronate. Callus glabrous or with a tuft of crimped, tangled hairs. Palea 2-keeled. Lodicules 2. Stamens 3. Caryopsis ellipsoidal to ovoid-oblong; hilum basal, punctiform.

Cosmopolitan, of about 300 species; 34 native and 6 naturalised species in Australia; 3 native and 1 naturalised species on Macquarie Is.; 2 native species and 1 naturalised species on Heard Is.

Poa is well represented on the islands of the Southern Ocean where a number of species are

widespread, in particular the massive tussock species that are dominant in many coastal areas, often on cliffs, from sea-level to about 300 m. Among these coastal *Poa* tussock grasses there are 3 principal species, each occupying a particular group of islands of the Southern Ocean: *P. foliosa* on the subantarctic islands to the S of New Zealand and on Macquarie Is.; *P. cookii* (Hook.f.) Hook.f. on Kerguelen Is., Heard Is., other islands of the southern Indian Ocean, and occurring with *P. foliosa* on Macquarie Is.; *P. flabellata* (Lam.) Raspail in Fuegia and the islands to the SW of S America as far as Gough Is. The 3 species are similar in habit and habitat preference. They are highly palatable, with very wide, flat leaves which taper to a fine point, but the ligule in *P. foliosa* is entire, whereas it is laciniate in *P. cookii* and *P. flabellata*. All 3 species have a large contracted panicle but they differ in reproductive biology. *Poa foliosa* is dioecious and related to gynomonoecious *P. novae-zelandiae* Hack. and dioecious *P. subvestita* (Hack.) Edgar of alpine New Zealand. *Poa cookii* is gynomonoecious and allied to *P. ramosissima* Hook.f. of Auckland and Campbell Islands (E.Edgar, *New Zealand J. Bot.* 24: 433, 1986). *Poa flabellata* is bisexual and has an elongated stigma which is unbranched and sparsely papillate, in contrast to the abundantly branched multipapillate stigma in all other species of *Poa*. The monotypic genus *Parodiochloa* was erected by C.E.Hubbard (E.W.Groves, *Bull. Brit. Mus.* (*Nat. Hist.*) 8: 395, 1981) based on *Poa flabellata*, distinguished from *Poa* by the finely pointed leaf tip and cuspidate or awned lemma as well as the unbranched elongated stigma, but these characters seem of insufficient generic consequence.

E.B.Alekseev (*Byull. Mosk. Obschch. Ispyt. Prir. Biol.* 90(5): 103, 1985) erected the genus *Tzvelevia* based on *P. kerguelensis*, differentiating it from *Poa* by the ventrally furrowed caryopsis and linear hilum. However, mature caryopses observed in a specimen from Heard Is. (HO 19838) were ventrally rounded and had a punctiform hilum as is usual in *Poa*.

W.M.Ellis, B.T.O.Lee & D.M.Calder, A biometric analysis of populations of *Poa annua* L., *Evolution* 25: 29–37 (1971); W.M.Ellis, B.T.O.Lee & D.M.Calder, Chromosome pairing in *Poa annua* L., *Canad. J. Genet. Cytol.* 15: 549–551 (1973); E.W.Groves, Vascular plant collections from the Tristan da Cunha group of islands, *Bull. Brit. Mus.* (*Nat. Hist.*), *Bot.* 8: 333–420 (1981); E.B.Alekseev, Novye rody zlakov, (New genera of grasses), *Byull. Mosk. Obschch. Ispyt. Prir. Biol.* 90(5): 102–109 (1985); H.E.Connor & E.Edgar, Australasian alpine grasses: diversification and specialization, in B.A.Barlow, *Fl. & Fauna Alpine Austral.* 413–434 (1986); J.J.Scott, New records of vascular plants from Heard Island, *Polar Record* 25(152): 37–42 (1989).

1 Panicle contracted or spike-like, 4–25 cm long

2 Ligule deeply laciniate (M.Is., H.Is.) **2. P. cookii**

2: Ligule entire

3 Lamina flat; ligule 1–3 mm long, tapered (M.Is.) **1. P. foliosa**

3: Lamina inrolled; ligule c. 0.5 mm long, truncate (M.Is.) **3. P. litorosa**

1: Panicle open or spike-like, up to 2 cm long

4 Lemma uniformly hairy in lower half (H.Is.) **4. P. kerguelensis**

4: Lemma hairy on nerves with internerves glabrous (M.Is., H.Is.) **5. P. annua**

1. Poa foliosa (Hook.f.) Hook.f., *Handb. New Zealand Fl.* 338 (1864)

Festuca foliosa Hook.f., *Fl. Antarct.* 1: 99, t. 55 (1845). T: Auckland Islands, Dec. 1840, *J.D.Hooker*; holo: K. Epithet from the Latin *folium* (a leaf) and *-osa* (abundance).

Illustrations: B.W.Taylor, *ANARE Reports* ser. B, Bot. 2: pl. 4 (1955); D.H.Ashton, *Proc. Roy. Soc. Victoria* 79: between pp 234 & 235, pl. 27, figs 2, 3 (1965).

Tussock massive, to 1.5 m or occasionally more high, lush green, with densely packed shoots covered at base by abundant fibrous remains of sheaths, dioecious; culms erect, smooth. Leaves flat, smooth-margined; ligule 1–3 mm long, tapered, entire. Panicle 8–18 cm long, dense, with ±smooth branchlets. Spikelets many, 6–10 mm long. Glumes narrow, long-acuminate. Lemma acute to shortly excurrent; nerves densely ciliate below; internerves

usually minutely scabrous. Male florets with anthers 2–2.5 mm long; gynoecium absent. Female florets with staminodes less than 1 mm long; gynoecium 2–2.5 mm long. *2n* = 28, 29, D.M.Moore, *Bot. Not.* 113: 187 (1960).

Macquarie Is. Widespread from sea level to 300 m, in moist to very moist peat, also in or alongside streams, on rock stacks and scree slopes, occasionally on shallow peat on windswept ridges. Flowers Oct.–Jan. A widespread subantarctic species found also on Antipodes Is., Auckland Is., Campbell Is., and on islands off Stewart Is.

M.Is.: Camp Hut–Isthmus, 24 Nov. 1948, *N.R.Laird* (CHR, HO); Garden Cove, E of ANARE station, *R.D.Seppelt 12125* (CHR, HO); Hasselborough Bay, *R.D.Seppelt 12193* (CHR, HO); Rookery Ck, The Nuggets, *R.D.Seppelt 12238* (HO); Finch Ck, Sandy Bay, *R.D.Seppelt 12670* (HO).

Very palatable, and much grazed by introduced rabbits.

In habit and habitat *Poa foliosa* resembles *P. flabellata* (Lam.) Raspail of southern S America on South Georgia, and Falkland and Gough Islands; some differences between them are outlined in the notes to the genus above.

2. **Poa cookii** (Hook.f.) Hook.f., *Philos. Trans.* 168: 22 (1879)

Festuca cookii Hook.f., *Fl. Antarct.* 2: 382, t. 139 (1846). T: Christmas Harbour, Kerguelen Is., May–Aug. 1840, *J.D.Hooker*; lecto: K, *fide* E.Edgar, *New Zealand J. Bot.* 24: 433 (1986). Epithet in honour of James Cook who visited Isles de Kerguelen in 1776.

P. hamiltonii Kirk, *Trans. & Proc. New Zealand Inst.* 27: 353 (1895). T: Macquarie Is., 1894, *A.Hamilton*; holo: K.

Tussock to 50 cm tall, deep green, with wide, spreading leaves overtopping or scarcely reaching top of panicles, with fibres from older leaf-sheaths in tangled mass at plant base, gynomonoecious; culms erect, smooth. Leaves flat; ligule deeply laciniate. Panicle contracted, 4–25 cm long. Spikelets 5–11 mm long. Glumes acuminate. Lemma long-acuminate, shortly hairy near base, and often to lower third. Spikelets with 1 to 4 lower florets bisexual, and upper florets female. Bisexual florets: anthers 2–3 mm long; gynoecium c. 1.5 mm long. Female florets: staminodes c. 0.5 mm long; gynoecium c. 1.5 mm long. Figs 89E, 65, 81.

Macquarie Is., Heard Is. On Macquarie Is. grows among rocks from near sea-level to 200 m on slopes and flats in moist to wet peat or on creek edges, often thriving near penguin colonies with *Poa foliosa*. On Heard Is. it is common in moist sandy places near the shore and on peat flats with *Azorella selago*. Flowers Nov.–Feb. Also on Kerguelen, Prince Edward, Marion, Crozet and Macdonald Islands.

M.Is.: Rookery Ck, The Nuggets, *R.D.Seppelt 12237* (CHR, HO); Green Gorge, *R.D.Seppelt 12305* (CHR, HO). H.Is.: near Macaroni penguin rookery, Shag Is., *A.McGregor 10* (HO); near former ANARE base camp, Atlas Cove, *J.M.B.Smith 768* (HO).

Poa hamiltonii was originally described as endemic on Macquarie Is. but its similarity to *P. cookii* from Kerguelen Is. and Heard Is. was noted by V.D.Zotov, *Rec. Domin. Mus.* 5: 114, 126 (1965), and it was treated as a synonym of *P. cookii* by E.Edgar in *New Zealand J. Bot.* 24: 433 (1986). Spikelets in plants from Macquarie Is. are less hairy than those from Heard Is. and, on average, slightly shorter, though the range of length of spikelets is similar for both islands. The leaves in Macquarie Is. plants are somewhat narrower than in plants from Heard Is. and usually overtop the culm. In many plants of *P. cookii* the leaves do not reach the top of the culm, but the type specimen from Kerguelen Is. has leaves reaching the top of the culm and overtopping it.

3. **Poa litorosa** Cheeseman, *Man. New Zealand Fl.* 1156 (1906)

Festuca scoparia Hook.f., *Fl. Antarct.* 1: 98 (1845) *non Poa scoparia* Kunth (1832). T: Dea's Head, Auckland Islands, Nov. 1840, *J.D.Hooker*; holo: K. Epithet from the Latin *litoralis* (pertaining to the seashore).

Tussock stiff, wiry, to 60 cm tall, straw-coloured, with leaves overtopping culms; culms erect, slightly scabrous above. Leaves acicular, inrolled, coriaceous; sheath long, straw-

coloured; ligule c. 0.5 mm long, truncate, entire, ciliate across top and abaxially. Panicle contracted, 10–12 cm long, with few, short, erect, scabrous branches. Spikelets 10–12 mm long, light green, brown-tipped. Glumes subacute, prominently nerved; nerves scabrous above. Florets bisexual. Lemma elliptic-oblong, obtuse, scabrous. Anthers c. 2.5 mm long.

Macquarie Is. Occurs on raised beach terrace and at about 180 m on peat between Handspike Corner and Handspike Point. Abundant on Antipodes, Auckland and Campbell Islands.

M.Is.: between Handspike Corner and Handspike Point, 15–20 m, *R.D.Seppelt 12460* (CHR, HO); between Handspike Corner and Handspike Point, *R.D.Seppelt 15154* (CHR).

P. litorosa has only recently been recognised on Macquarie Is. between Handspike Corner and Handspike Point. It is closely related to *P. cita* Edgar, (the silver tussock of New Zealand, long known as *P. caespitosa* Spreng.), from which it differs in the contracted panicles and larger spikelets. J.B.Hair & E.J.Beuzenberg, *Nature* 189: 160 (1961), recorded a chromosome count of *2n* = c. 266 for *P. litorosa* from Auckland Is., the highest chromosome count yet recorded in the Poaceae or in the monocotyledons as a whole. H.E.Connor & E.Edgar (B.A.Barlow, *Fl. & Fauna Alpine Australas.* 415–416, 1986) commented on a polyploid series: *P. cita 2n* = 12-ploid = 84, *P. cockayneana* Petrie (a South Island higher alpine derivative) *2n* = 16-ploid = 112, and the subantarctic derivative, *P. litorosa 2n* = 38-ploid = c. 266.

4. **Poa kerguelensis** (Hook.f.) Steud., *Syn. Pl. Glum.* 1: 257 (1854)

Triodia kerguelensis Hook.f., *Fl. Antarct.* 2: 379, t. 138 (1846), as *Poa*; *Festuca kerguelensis* (Hook.f.) Hook.f., *Philos. Trans.* 168: 22 (1879); *Tzvelevia kerguelensis* (Hook.f.) Alekseev, *Byull. Mosk. Obschch. Ispyt. Prir. Biol.* 90(5): 103 (1985). T: Christmas Harbour, Kerguelen Is., May 1840, *J.D.Hooker*; holo: K. Epithet from the type locality.

Hummocks to 8 cm high and 15 cm diam; culms scarcely overtopping leaves, slender, smooth. Leaves folded, keeled, smooth except margins, curved at apex; margins inrolled, scabrous; sheath greenish to brownish, smooth, keeled; ligule to 1.5 mm long, tapered, often slightly fimbriate. Panicle contracted, spike-like, 10–20 mm long, 5 mm wide; branchlets densely, finely scabrous. Spikelets 3–4 mm long. Glumes smooth to minutely scaberulous. Florets bisexual. Lemma with short silky hairs in lower half, scabrous above. Anthers 0.3–0.8 mm long.

Heard Is. Sand-trapping hummocks in rocky areas or on exposed bare soil. Also on Kerguelen Is.

H.Is.: near former ANARE base camp, Atlas Cove, *J.M.B.Smith 769* (HO); Azorella Peninsula, *A.McGregor 13* (HO); c. 200 m N of old ANARE station, Atlas Cove, *G.R.Copson 111* (HO); Compton Moraine, 29 Dec. 1987, *J.J.Scott* (HO); Schmidt Valley, 1 Feb. 1988, *J.J.Scott* (HO).

On Heard Is., pollen-sterile plants intermediate in size between *P. kerguelensis* and *P. cookii* were collected between Dec. 1987 and Feb. 1988 by J.J.Scott, *Polar Rec.* 25(152): 37 (1989). These plants usually occurred as small individual clumps in semi-fellfield vegetation in nearly all major ice-free areas, often alongside *P. kerguelensis*, J.J.Scott (*pers. comm.*). They are considered to be the hybrid *P. cookii* x *P. kerguelensis*. The leaves resemble those of *P. cookii* in colour, type of ligule and in the papillose-scabrous adaxial surface of the lamina, but the lemma in the putative hybrid has short silky hairs in the lower half as in *P. kerguelensis*. Within each spikelet in the hybrid the anthers of the lowermost floret were 1–1.4 mm long and pollen-sterile, with anthers in the upper florets of the spikelet being reduced to staminodes as in *P. cookii*.

5. ***Poa annua** L., *Sp. Pl.* 1: 68 (1753)

T: Europe; ?holo: LINN *n.v.* Epithet from the Latin *annus* (a year), in reference to the annual growth form.

Tufts, erect or shortly creeping, 5–35 cm tall, gynomonoecious; culms ±compressed, smooth. Leaves flat or folded when young, soft, smooth, often transversely wrinkled, blunt; sheath keeled; ligule 0.5–2 mm long. Panicle open, ±pyramidal, 2–10 cm long; branches

devoid of spikelets in lower half. Spikelets 4–5 mm long. Glumes ±acute. Lemma prominently 5-nerved; nerves usually densely hairy; internerves glabrous. Spikelets with 2 lower florets bisexual, and upper 1 or 2 florets female. Bisexual florets: anthers 0.7–1 mm long; gynoecium 1–1.5 mm long. Female florets: staminodes 0–0.2 mm long; gynoecium c. 1.5 mm long. *n* = 14, W.M.Ellis *et al.*, *Canad. J. Genet. Cytol.* 15: 550 (1973). *Annual Meadow Grass*.

Macquarie Is., Heard Is. Widespread on Macquarie Is. On Heard Is. it occurs on moraine outwash. Flowers Sept.–June. Native to Europe but now almost cosmopolitan. Established on many subantarctic islands including Antipodes, Auckland, Campbell, Kerguelen, Marion, Gough and Falkland Islands, and South Georgia.

M.Is.: northern lower slopes of plateau, 20 Jan. 1949, *N.R.Laird* (CHR, HO); Hasselborough Bay, *R.D.Seppelt 12256* (CHR, HO); 500 m S of North Mtn, *R.D.Seppelt 12741* (CHR, HO). H.Is.: Winston Lagoon, 6 Dec. 1987, *J.J.Scott* (HO); Stephenson Lagoon, 17 Dec. 1987, *J.J.Scott* (HO).

Introduced to Macquarie Is. by sealers prior to 1880 but not recorded for Heard Is. until 1989 by J.J.Scott (*Polar Record* 25(152): 40–42, 1989). Scott considered it likely that *P. annua* was on Heard Is. before 1947.

Though *P. annua* is generally annual in temperate regions, perennial forms are known, and it is perennial on Macquarie Is. (B.W.Taylor, *ANARE Reports* ser. B. Bot. 2: 151 (1955); W.M.Ellis *et al.*, *Evolution* 25: 35 (1971)).

Trib. AVENEAE

4. DESCHAMPSIA

Deschampsia P.Beauv., *Ess. Agrostogr.* 91 (1812); commemorating the French naturalist L.A.Deschamps (1765–1842).

Type: *D. caespitosa* (L.) P.Beauv.

Perennial, usually caespitose. Leaf lamina flat or setaceous; ligule often elongated, membranous. Inflorescence a lax or contracted panicle. Spikelets rather small, membranous, laterally compressed, 2- or sometimes 3-flowered; rachilla breaking above glumes, exceeding florets. Glumes subequal, shorter than, almost equalling or much exceeding florets, 1–3-nerved. Florets bisexual. Lemma truncate, irregularly toothed at apex, obscurely 5-nerved, with dorsal, sometimes almost terminal awn, or awnless. Palea as long as lemma, 2-keeled. Lodicules 2. Stamens 3. Caryopsis oblong; hilum punctiform or shortly elliptic.

About 40 species from temperate and circumpolar regions of both hemispheres, and in the tropics at high altitudes; 1 native species in Australia; 2 native species on Macquarie Is., 1 native species on Heard Is.

D.M.Moore, Studies in *Colobanthus quitensis* (Kunth) Bartl. and *Deschampsia antarctica* Desv.: II. Taxonomy, distribution and relationships, *Brit. Antarct. Surv. Bull.* 23: 63–80 (1970).

1 Glumes much shorter than spikelet; lemma minutely awned near tip or awnless; rachilla glabrous (M.Is.) **1. D. chapmanii**

1: Glumes ±equalling spikelet; lemma dorsally awned; rachilla silky-hairy

2 Awn appressed to and not exceeding lemma (M.Is.) **2. D. caespitosa**

2: Awn projecting from and overtopping lemma (H.Is.) **3. D. antarctica**

1. Deschampsia chapmanii Petrie, *Trans. & Proc. New Zealand Inst.* 23: 401 (1891)

T: Auckland Is., Jan. 1890, *F.R.Chapman*; holo: WELT 69437. Epithet in honour of F.R.Chapman who collected the type.

Tufts slender, erect, leafy, to 30 cm tall, with delicate, shining panicles. Leaves involute, acute, smooth, glabrous; ligule 3–6 mm long, long-tapered. Panicle slender, 2–12 cm long, with long, filiform, erect scaberulous branches with few spikelets at tips. Spikelets 2.5–5 mm long, green to purplish. Glumes unequal, shorter than spikelet; lower very narrow; upper wider, ±ovate. Lemma ovate-oblong, irregularly 3- or 4-toothed, sometimes with minute subterminal awn. Callus with minute hairs. Rachilla glabrous. Anthers 0.3–0.4 mm long, purple. Fig. 89B.

Macquarie Is. Occurs from sea level to 150 m in moist to very wet peat. Flowers Dec.–March. Also on Auckland, Campbell and North and South Islands of New Zealand.

M.Is.: Nuggets Ck, E coast, 7 Feb. 1951, *B.W.Taylor* (HO); 300 m S of Red R., SE end of Red River valley, *R.D.Seppelt 12397* (CHR, HO); SW slopes of Green Gorge, *R.D.Seppelt 12596* (CHR, HO); SE side of Square Lake, *R.D.Seppelt 12634* (HO); 300 m S of Brothers Lake, *R.D.Seppelt 12685* (CHR, HO).

D.M.Moore (*Bot. Not.* 113: 187, 1960) recorded *2n* = 28 for Macquarie Is. material, but F.Albers (*pers. comm.*) reported that all New Zealand species of *Deschampsia* which he investigated, including *D. chapmanii*, had *2n* = 26. *Deschampsia chapmanii* and other endemic species of *Deschampsia* in New Zealand form a distinct group within the genus in which the glumes are shorter than the florets and the lemmas mucronate to muticous (see W.D.Clayton & S.A.Renvoize, *Genera Graminum* 130, 1986).

2. Deschampsia caespitosa (L.) P.Beauv., *Ess. Agrostogr.* 91, t. 18, fig. 3 (1812)

Aira caespitosa L., *Sp. Pl.* 1: 64 (1753). T: Europe; holo: LINN *n.v.*, microfiche CHR. Epithet from the Latin *caespitosus* (growing in tufts).

D. penicillata Kirk, *Trans. New Zealand Inst.* 27: 354 (1895). T: Macquarie Is., *A.Hamilton*; holo: WELT 69438.

Tufts stiff, leafy, to 30 cm tall, with rigid but delicate panicles on erect culms well overtopping leaves. Leaves wiry, folded, smooth; ligule 2.5–3 mm long, tapered. Panicle 3–8 cm long with erect, finely ciliate branches. Spikelets 3.5–4 mm long, brownish. Glumes ±equal, slightly overtopping or equalling florets. Lemma oblong, 2.5–3 mm long, shortly 4-toothed; awn mid-dorsal, 0.5–1 mm long, appressed to and shorter than lemma, minutely scabrous. Callus with long hairs to c. 1/3 of lemma. Rachilla finely silky-hairy. Anthers c. 0.8 mm long, without pollen (in Macquarie Is. plants).

Macquarie Is. Grows in very wet peat or boggy mires on exposed sites from 150 to 350 m altitude usually with *Juncus scheuchzerioides* and *Agrostis magellanica*, rarely with *Pleurophyllum hookeri*; sometimes aquatic at the margin of small ponds or tarns. A cosmopolitan, very polymorphic species, from temperate and arctic regions; in the subantarctic it has been found in South Georgia and on Auckland Is.

M.Is.: probably NE sector of island, 1950–1951, *B.W.Taylor* (MEL); 0.8 km SE of Scobles Lake, 12 Feb. 1951, *B.W.Taylor* (HO); 700 m N of Island Lake, *R.D.Seppelt 12779* (CHR, HO); 500 m N of Mt Power, *R.D.Seppelt 12789* (CHR, HO).

In his original description of *D. penicillata*, based on two small specimens, T.Kirk noted that he had considered it might be a reduced state of *D. caespitosa*. He had not seen the fine awns appressed to the lemma and so allied his species *D. penicillata* with awnless species from New Zealand. The Macquarie Is. plants, however, differ from other New Zealand species in having glumes equalling and not shorter than the spikelet and in the awn arising mid-dorsally on the lemma rather than almost terminally. Though Macquarie Is. plants are small, their spikelets resemble those of plants of *D. caespitosa* from southern New Zealand and from South Georgia in all respects, but no polliniferous specimens have been seen. B.W.Taylor, (*ANARE Reports* ser. B, Bot. 2: 147, 1955) noted that *D. penicillata* did not flower in exposed sites but that it was much larger and flowered when growing in the shelter of *Pleurophyllum hookeri*.

The relationship of *D. caespitosa*, *D. penicillata* and *D. antarctica* was discussed by D.M.Moore (*Brit. Antarct. Surv. Bull.* 23: 74, 76, 1970), who tabulated the principal distinguishing characters. He had not seen the awns on Macquarie Is. specimens and gave the lower glumes as 3-nerved, whereas they are 1-nerved.

3. Deschampsia antarctica E.Desv. in J.E.Gay, *Fl. Chil.* 6: 338 (1853)

Aira antarctica Hook.f., *Hooker's Icon. Pl.* 2, pl. 150 (1837) *non* G.R.Forst. (1786). T: New South Shetland Islands, *J.Eights*; holo: K *n.v.*, *fide* D.M.Moore, *Brit. Antarct. Surv. Bull.* 23: 72 (1970). Epithet from the region in which the species is native.

Illustration: D.M.Moore, *Fl. Tierra del Fuego* 301, fig. 245 (1983).

Tufts to 14 cm tall, stoloniferous. Leaves involute with fine tip, curved, smooth, glabrous; ligule 1.5–5 mm long, tapered. Panicle 3–6 cm long, with many, delicate, scaberulous ±erect branchlets. Spikelets pale greenish to brownish, 4–6 mm long, excluding fine, projecting awns. Glumes equalling florets; keels finely scabrous. Lemma shortly 4-toothed; awn exceeding lemma, dorsal from below middle, very fine, straight or curved above. Callus with long hairs to c. 1/3 of lemma. Rachilla silky-hairy towards tip. Anthers 0.5 mm long.

Heard Is. Grows in damp meadow vegetation and seepages. Also on South Georgia, Antarctic Peninsula, Fuegia, Patagonia and Falkland, South Sandwich, Crozet and Kerguelen Islands.

H.Is.: Skua Beach, *A.McGregor 8* (HO); Spit Bay to Dovers Moraine, 12 Feb. 1988, *J.J.Scott* (HO); Stephenson Lagoon, 15 Feb. 1988, *J.J.Scott* (HO).

5. ANTHOXANTHUM

Anthoxanthum L., *Sp. Pl.* 1: 28 (1753); *Gen. Pl.* 5th edn, 17 (1754); from the Greek *anthos* (a flower) and *xanthos* (yellow), in reference to the exserted yellow anthers that cover the panicle at anthesis.

Type: *A. odoratum* L.

Perennial or annual, fragrant with coumarin. Leaves flat, usually ±flaccid; ligule membranous. Inflorescence a narrow spike-like panicle. Spikelets 3-flowered, the lower 2 sterile, the third much shorter, bisexual; rachilla breaking above glumes and not exceeding upper floret. Glumes unequal, the lower shorter, membranous, 1–3-nerved, keeled. Lemmas of sterile florets equal, keeled, hairy, dorsally awned. Lemma of fertile floret hyaline, 1–7-nerved. Palea 1-nerved. Lodicules absent. Stamens 2 in bisexual floret.

About 20 species of temperate and tropical regions; 1 species naturalised in Australia, occurring also on Macquarie Is.

*Anthoxanthum odoratum L., *Sp. Pl.* 1: 28 (1753)

T: Europe; holo: LINN *n.v.*, microfiche CHR. Epithet from the Latin *odoratus* (scented).

Tufted perennial to 50 cm tall. Culms slender but stiff, erect. Leaves glabrous to sparsely hairy; ligule c. 2 mm long, truncate. Panicle cylindrical, to 9 cm long, with smooth, short, erect branchlets and ciliate pedicels. Spikelets 7–8 mm long. Glumes acute, keeled, loosely hairy, membranous; lower half length of upper, 1-nerved; upper equalling spikelet, 3-nerved. Sterile florets: lemma shorter than upper glume, oblong, 2-lobed; lower lemma with short straight awn; upper lemma with stronger geniculate awn. Bisexual floret: lemma rotund, smooth, shining; anthers c. 4 mm long. *Sweet Vernal*.

Macquarie Is. Doubtfully established. Known from only one locality on well-drained ridge slope at edge of walking track, Finch Creek, Sandy Bay, first recorded in 1984. In 1989 G.R.Copson (*pers. comm.*) removed all plants from the locality. Native to Europe and naturalised in many temperate countries; in the subantarctic also on Auckland and Campbell Islands.

M.Is.: Finch Ck, Sandy Bay, Feb. 1985, *G.R.Copson* (HO).

6. AGROSTIS

Agrostis L., *Sp. Pl.* 1: 61 (1753); *Gen. Pl.* 5th edn, 30 (1754); from the Greek *agrostis*, a name for a field grass.

Type: *A. canina* L.

Perennial or annual. Leaf lamina flat or setaceous, often flaccid; ligule membranous. Inflorescence a lax or contracted panicle with capillary, whorled branches. Spikelets small, laterally compressed, 1-flowered; rachilla breaking above glumes, not exceeding floret. Glumes membranous, equalling spikelet, keeled, 1-nerved. Floret 1, bisexual. Lemma usually shorter than glumes, membranous or hyaline, truncate, 3–5-nerved; lateral nerves often excurrent; awn, if present, fine, geniculate, dorsal. Palea shorter than lemma, or minute or absent, 2-nerved or nerveless. Lodicules 2. Stamens 3. Caryopsis oblong; hilum punctiform or shortly elliptic.

About 150–200 species of temperate regions, especially in the Northern Hemisphere; about 20 native and 4 naturalised species in Australia; 1 native species on Macquarie Is.

Agrostis magellanica Lam., *Tabl. Encycl.* 1: 160 (1791)

T: Magellanes, Chile, *P.Commerson*; holo: P. Epithet from the type locality.

Illustration: E.G.Nicora, *Fl. Patagonica* III: 390, fig. 261 (1978).

Tufted leafy perennial, very variable in size, 5–45 cm tall, usually ±erect, but occasionally with prostrate culms. Culms with purple nodes. Leaves wiry, involute, acute; sheath pale; ligule 1.5–3 mm long, irregularly toothed across top. Panicle contracted, 2–12 cm long, with many shining, hyaline, greenish purple, distinctly awned spikelets. Spikelets c. 4 mm long; glumes acuminate, shortly scabrous along keel. Lemma c. 2 mm long, excluding awn, truncate and shortly 4-toothed; awn very fine, ±straight, 2.5–5 mm long. Anthers c. 0.5 mm long. $2n = 72$, D.M.Moore, *Bot. Not.* 113: 187 (1960).

Macquarie Is. Very common throughout the island in dry to very wet peat, sand, free water, mosses, *Colobanthus muscoides* and *Azorella selago* cushions, and as scattered small plants in fellfield. Flowers Nov.–Mar. A circumpolar species also found on Auckland, Antipodes, Campbell and South Islands of New Zealand, S America from Chile to Tierra del Fuego, and Falkland, Kerguelen, Crozet and Marion Islands.

M.Is.: northern lower slopes of plateau, 14 Jan. 1949, *N.R.Laird* (HO); Nuggets Ck, 15 Feb. 1949, *N.R.Laird* (HO); SW slopes of Mt Tulloch, *R.D.Seppelt 12631* (CHR, HO); coastal slopes E of Boiler Rocks, *R.D.Seppelt 12518* (CHR, HO); N end summit ridge of North Mtn, *R.D.Seppelt 12739* (CHR, HO).

Recorded from Heard Is. by B.W.Taylor (*ANARE Reports* ser. B, Bot. 2: 145, 1955), but no specimens have been seen. The chromosome count of $2n = 72$, for *A. magellanica* from Macquarie Is., recorded by D.M.Moore (*loc. cit.*) does not fit well with the basic number for *Agrostis*, for which $x = 7$. For *A. magellanica* from Campbell Is., $n = 42$ was recorded by E.J.Beuzenberg and J.B.Hair (*New Zealand J. Bot.* 21: 14, 1983).

Subfam. ARUNDINOIDEAE

Trib. ARUNDINEAE

7. ARUNDO

Arundo L., *Sp. Pl.* 1: 81 (1753); *Gen. Pl.* 5th edn, 35 (1754); from the Latin *harundo* (a reed), applied especially to the type species of this genus which is common in the Mediterranean region of Europe.

Type: *A. donax* L.

Tall, reed-like, rhizomatous grasses. Leaf lamina broad; ligule membranous with ciliolate margin. Inflorescence a large, plume-like panicle. Spikelets with 1–4 successively smaller florets. Glumes subsimilar, slender, ±as long as spikelet, glabrous. Lemma densely long-hairy, entire or bidentate with a straight awn between the teeth, membranous. Palea much shorter than the lemmas.

A genus containing 3 species distributed from Europe to SE Asia as far as China, and widely introduced elsewhere; 1 species introduced on Christmas Is. They mainly occur in damp places, such as on river banks and along drainage ditches.

***Arundo donax** L., *Sp. Pl.* 1: 81 (1753)

T: Herb. A. van Royen 912, 356–80, 392, 393; syn: probably L *n.v.* Epithet from the Greek *donein* (to wave), as this tall species sways in the wind.

Illustration: C.-C.Hsu, *Taiwan Grasses* 224 (1975).

Robust, clump-forming, reed-like grass, to c. 3 m tall, spreading by rhizomes; culms c. 2 cm diam. Leaves alternate, glaucous; lamina 35–75 cm long, 2–4 cm wide. Panicle very large, to 70 cm long, much-branched, feathery. Spikelets 12–14 mm long, containing 3 or 4 florets. Glumes subsimilar, 11–13 mm long, slender, acuminate, glabrous, membranous, often purplish. Lemma with many long, silky hairs especially towards base; apex with 2 short, slender teeth and a longer awn between. Palea short. *Giant Reed*.

Christmas Is. Introduced, probably by the Chinese community who use the soft inflorescences as household brushes. It occurs mainly around Settlement and Drumsite, forming clumps in roadside ditches. Widely distributed from Europe to SE Asia, and introduced in the New World, the Pacific, Africa and elsewhere.

Ch.Is.: no precise locality, *D.A.Powell* 574 (K).

The canes may be used for basketry, matting, light construction and for paper-making. Reeds for woodwind instruments are obtained from this species. It is a strong, resilient species, forming good wind-breaks and helping to stabilise erosion.

Subfam. CHLORIDOIDEAE

Trib. ERAGROSTIDEAE

8. ERAGROSTIS

Eragrostis Wolf, *Gen. Pl.* 23 (1776); from the Greek *eros* (love) and *agrostis*, for a type of grass, of obscure derivation but perhaps alluding to the elegance of the species.

Type: *E. minor* Host

Small to medium-sized, tufted grasses, often glandular. Leaf lamina narrow, usually rough above; ligule usually a rim of hairs. Inflorescence usually a much-branched panicle. Spikelets with 2–several successively slightly reduced florets, the rachilla breaking up at

maturity or not. Glumes usually of different sizes (the upper larger), much shorter than the spikelet. Lemma usually membranous, sometimes coriaceous. Palea almost as large as lemma, sometimes ciliate or winged on the veins. *Love Grasses*.

A genus of c. 350 species distributed throughout the tropics, subtropics and warm-temperate regions; 2 species occur on Christmas Is., 1 of which appears to be native and also occurs on Cocos (Keeling) Is.; 1 species native on Ashmore Reef. They occur in many types of habitat but are especially frequent on open, disturbed ground, often in poor, dry soil.

1 Panicle with widely spreading fine branches; spikelets 4 mm or less long

2 Spikelets 1.5–2 mm long; palea margins long-ciliate (C.K.Is., Ch.Is.) **1. E. tenella**

2: Spikelets 3.5–4 mm long; palea margins with minute tooth-like hairs (Ch.Is.) **2. E. pilosa**

1: Panicle narrow, not finely branched; spikelets 4–18 mm long (A.R.) **3. E. elongata**

1. Eragrostis tenella (L.) P.Beauv. ex Roem. & Schult., *Syst. Veg.* 2: 576 (1817)

Poa tenella L., *Sp. Pl.* 1: 69 (1753). T: India, Herb. C.Linnaeus 87.33; holo: LINN, *fide* W.D.Clayton & S.A.Renvoize in R.M.Polhill (ed.), *Fl. Trop. E. Africa,* Gramineae 2: 206 (1974). Epithet from the Latin *tenellus* (delicate), in reference to the finely branched panicle and small spikelets.

Poa plumosa Retz., *Obs. Bot.* 4: 20 (1786); *Eragrostis plumosa* (Retz.) Link, *Hort. Reg. Bot. Berol.* 1: 192 (1827). T: India, *K.Koenig*; holo: LD *n.v.*, *fide* W.D.Clayton & S.A.Renvoize, *op. cit.* 207.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 72, fig. 8 (1971).

Small, delicate, tuft-forming grass, 5–35 cm tall. Leaves scattered along culm, glabrous except a tuft of long hairs at base; lamina 1.5–9 cm long, 1–3.5 mm wide; sheath rounded. Panicle 3.5–15 cm long, very finely much-branched, with tufts of long, white hairs at major branching points. Spikelets 1.5–2 mm long, containing 4–6 florets; rachilla breaking up at maturity. Glumes short, the upper c. 0.8 mm long, the lower slightly shorter, acute, keeled, often purplish. Lemma closely resembling glumes, c. 1 mm long, obtuse. Palea enclosed by lemma, except a fringe of long cilia which clasps floret above. *Love Grass*.

Christmas Is., Cocos (Keeling) Is. On Christmas Is. it is frequent in disturbed sites such as on road- and track-sides, railways, in lawns and around habitation. On Cocos (Keeling) Is. it is a rare weed of disturbed open areas in coralline sand. A pantropical and subtropical ruderal species.

Ch.Is.: no precise locality, Sept.-Oct. 1887, *J.J.Lister* (K); Smith Point, *H.N.Ridley 4* (K); beside railway line at Camp 4, *B.A.Mitchell 108* (CBG, K); roadside near Waterfall, *R.Shivas 890 & 914* (PERTH). C.K.Is.: settlement, West Is., *I.R.Telford 9947 & C.Howard* (AD, CBG, K, MEL, PERTH).

H.N.Ridley (*J. Straits Branch Roy. Asiat. Soc.* 45: 243–244, 1906) noted this species on Christmas Is. as '... forming large tufts, very abundant in dry, open places ... and doubtless indigenous'.

2. *Eragrostis pilosa (L.) P.Beauv., *Ess. Agrostogr.* 71, 162, 175 (1812)

Poa pilosa L., *Sp. Pl.* 1: 68 (1753). T: illustration of 'Gramen paniculis elagantissimis' in J.Scheuchzer, *Agrostogr.* 193–194, t. 4, fig. 3 (1719). Epithet from the Latin *pilosus* (covered with hair), in reference to those at the base of the leaf lamina and at inflorescence branching points.

Illustration: C.-C.Hsu, *Taiwan Grasses* 414 (1975).

Slender, tuft-forming grass, 20–65 cm tall; culms erect or suberect. Leaves scattered along culm, rough on adaxial surface, glabrous or with very few basal hairs on abaxial surface; lamina 5–25 cm long, 1–3 mm wide; sheath rounded. Panicle 8–22 cm long, finely much-branched; branches ±in whorls, sometimes with few white hairs at branching points. Spikelets 3.5–4 mm long, containing 6–8 florets; rachilla zigzag, persistent after spikelet has broken up. Glumes very short, the upper c. 0.8 mm long, the lower c. 0.3 mm long, acute. Lemma 1–1.5 mm long, acute, keeled, grey-green. Palea fringed with minute, tooth-like hairs. *Indian Love Grass*. Fig. 90A–B.

Figure 90. **A–E**, POACEAE. **A–B**, *Eragrostis pilosa*. **A**, flowering culm X0.25 (R.Shivas 912, PERTH); **B**, spikelet X10 (D.Powell 532, K). **C–D**, *Sporobolus fertilis*. **C**, flowering culms X0.25; **D**, spikelet X10 (D.Powell 341, K). **E**, *Dactyloctenium aegyptium*, flowering culm X0.25 (D.Powell 472, K). **F–G**, ORCHIDACEAE: *Corybas dienemus*. **F**, flowering plant from side X1; **G**, section through part of dorsal sepal, labellum and column X2.5 (J.Croft 10445, CBG). **A–E** drawn by E.Catherine. **F–G** drawn by D.Boyer.

Christmas Is., common along roadsides and sometimes occurs on cleared or mined areas among other vegetation. A native of southern Europe and the tropics and subtropics of the Old World, and introduced elsewhere.

Ch.Is.: Toms Ridge, edge of haulage road, *D.A.Powell 532* (K); edge of track from Waterfall to main road, *R.Shivas 912* (PERTH); old mine site, 0.5 km N of airport, *R.Shivas 931* (PERTH).

3. Eragrostis elongata (Willd.) J.Jacq., *Ecl. Gram. Rar.* t. 3 (1813)

Poa elongata Willd., *Enum. Pl.* 108 (1809). T: cultivated in Berlin, from the East Indies; *n.v.* Epithet is the Latin for elongated, in reference to the inflorescence.

Annual tufted herb; culms decumbent to erect; flowering culms to 45 cm tall. Leaves glabrous or sparsely hairy above, densely so towards base; lamina 4–18 cm long, 1.5–4 mm wide; sheath 3–6 cm long; ligule very short, truncate, shortly ciliate. Panicle narrow, interrupted, to 30 cm long, the spikelets imbricate. Spikelets 3–15 mm long, containing 6–25 florets; rachilla zig-zag, jointed, breaking at maturity. Glumes ±equal, acuminate, 1–2 mm long. Lemmas 1.5–2 mm long, acuminate to acute. Palea ±equal to lemma, scabrous on keels.

Ashmore Reef. Common in herbfield with *Digitaria mariannensis* in calcareous sand on West Is. Widespread through tropical and warm temperate Australia.

A.R.: West Is. *N.Sarti 10* (PERTH); West Is., *K.F.Kenneally 6356* (PERTH); East Is., 16 Jan. 1984, *J.Hicks* (CBG); East Is., 12 Mar. 1986, *A.Grant* (CBG).

9. ELEUSINE

Eleusine Gaertn., *Fruct. Sem. Pl.* 1: 7 (1788); from *Eleusis*, a Greek town and the earthly home of Demeter, the ancient Greek goddess of agriculture, where the Eleusinian mysteries (concerning crop growth) were celebrated.

Type: *E. coracana* (L.) Gaertn. (*Cynosurus coracanus* L.)

Tufted grasses with flattened culms. Leaf lamina often folded; ligule a membranous rim. Inflorescence of several racemes ±clustered towards culm apex, sometimes in a terminal whorl; racemes with spikelets arranged in 2 overlapping rows on one side of rachis. Spikelets of several successively smaller florets, breaking up between florets at maturity. Glumes unequal, the upper larger and similar to the spikelet. Lemma ovate, strongly keeled, entire, not awned, membranous, glabrous. Palea slightly smaller than lemma.

A genus of 9 species, mainly African; 1 species is S American; 1 cosmopolitan, ruderal species occurs on Christmas Is. and Cocos (Keeling) Is. *Eleusine coracana* (L.) Gaertn. (*Finger Millet*, *Ragi*) is widely grown as a cereal in Africa and Asia.

S.M.Phillips, A survey of the genus *Eleusine* Gaertn. (Gramineae) in Africa, *Kew Bull.* 27: 251–270 (1972).

*Eleusine indica (L.) Gaertn., *Fruct. Sem. Pl.* 1: 8 (1788)

Cynosurus indicus L., *Sp. Pl.* 1: 72–73 (1753). T: illustration of 'Gramen Dactyloides spicis deorsum aristatis' in J.Burman, *Thesaurus Zeylanicus* 106, t. 47/1 (1737); lecto, *fide* S.M.Phillips, *Kew Bull.* 27: 259 (1972). Epithet from the Latin *indicus* (from India), indicating the origin of the plant described by C.Linnaeus in the type description.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 79, fig. 10 (1971).

Loosely tufted grass, 25–60 cm tall; culm bases sometimes decumbent with branches at lower nodes. Leaves scattered, often folded, glossy, with white-hairy margins near base; lamina to c. 30 cm long, 3–5 mm wide; sheath sharply keeled. Racemes 7–9 cm long, 1–5 in a terminal whorl, sometimes with 1 or 2 on lower culm. Spikelets overlapping in 2 rows along one side of rachis, 4–5 mm long, with 4 or 5 florets. Glumes unequal, the upper 2–4 mm long, the lower 1–1.5 mm long, narrow, acute. Lemmas 2–3.5 mm long, acute, keeled,

glabrous, grey-green. Palea apex lacerated. Seeds with conspicuous wrinkles. *Goose Foot Grass, Crab Grass, Rumput Sambau*.

Christmas Is., Cocos (Keeling) Is. A weed of cleared or cultivated or disturbed sites throughout Christmas Is., especially around habitation, on road- and track-sides. On Cocos (Keeling) Is. grows as a weed of disturbed open areas and roadsides in calcareous sand. A common pantropical and subtropical weed.

Ch.Is.: alongside railway line at Camp 4, *B.A.Mitchell 114 & 115* (CBG, K); entrance to golf course, *R.Shivas 832* (PERTH); edge of road to Waterfall, *R.Shivas 896A* (PERTH). C.K.Is.: c. 4 km SE of settlement, West Is., *I.R.Telford 9995 & C.Howard* (AD, CBG, K, PERTH); E verge of airstrip, West Is., *D.G.Williams 99* (CBG).

Already well established on the shore cliffs when first collected by C.W.Andrews in 1900, but H.N.Ridley (*J. Straits Branch Roy. Asiat. Soc.* 45: 243, 1906) noted that it was confined to cultivated land and was an 'evidently introduced' species.

In W Malaysia, this species is incorporated in a ceremonial brush used at weddings, rice ceremonies, and to invoke the help of spirits in healing the sick.

10. DACTYLOCTENIUM

Dactyloctenium Willd., *Enum. Pl.* 1029 (1809); from the Greek *dactylos* (a finger) and *ktenion* (a small comb), from the digitate arrangement of the inflorescence, and the comb-like appearance of the individual racemes.

Type: *D. aegyptium* (L.) Willd., as *D. aegyptiacum*

Tufted to stoloniferous grasses. Leaf lamina flat; ligule a membranous rim. Inflorescence of 2–several whorled racemes radiating from culm apex; spikelets densely arranged in 2 overlapping rows on 1 side of rachis; rachis exceeding spikelets. Spikelets of 2–4 successively smaller florets, breaking up above glumes. Glumes unequal, keeled, the upper larger and stiffly awned, shorter than spikelet. Lemma ovate, keeled, acute or acuminate. Palea usually 2-keeled and bilobed. Seeds rugose.

A genus of c. 13 species distributed around the Indian Ocean from Africa to India, and 1 in Australia; 1 widespread tropical and subtropical species has been introduced on Christmas and Cocos (Keeling) Islands. Species occur mainly in dry, sandy soil, and some are adapted to sandy and saline seashore habitats.

***Dactyloctenium aegyptium** (L.) Willd., *Enum. Pl.* 1029 (1809), as *D. aegyptiacum*

Cynosurus aegyptius L., *Sp. Pl.* 1: 72 (1753). T: Herb. C.Linnaeus 91.11: ?syn: LINN, *fide* S.M.Phillips, *Fl. Trop. E. Africa*, Gramineae 2: 252 (1974). Epithet from the Greek *Aigyptius* and Latin *Aegyptus* (Egypt), indicating the provenance of Linnaeus' type specimen.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 82, fig. 11 (1971).

Spreading perennial grass 15–45 cm tall; culms rooting at lower nodes. Leaves scattered along culm, sparsely white-hairy; lamina 4–18 cm long, 3–6 mm wide; margins ±ciliate; sheath keeled. Racemes 4–6 in a terminal, flat whorl, each 1.5–3.5 cm long, robust, bristly, often brownish; rachis extended as a short point. Spikelets in 2 overlapping rows along one side of rachis, 4 mm long, very broad, flattened, each with 3 florets. Glumes unequal, keeled, the upper c. 4 mm long including a short, stiff awn, the lower shorter and acute. Lemma 3–3.5 mm long, keeled, aristate. Palea bidentate, with 2 narrowly winged keels. *Finger Grass*. Fig. 90E.

Christmas Is., Cocos (Keeling) Is. A common, introduced species on Christmas Is., where it occurs in cultivated land, around habitation and on roadsides among colonising vegetation. On Cocos (Keeling) Is., grows as a weed in cleared and grassland areas in calcareous sand. An Old World species, widely distributed elsewhere.

Ch.Is.: no precise locality, *D.A.Powell 472* (K); entrance to golf course, *R.Shivas 830* (K). C.K.Is.:

settlement, West Is., *I.R.Telford 9950 & C.Howard* (AD, CBG, K); settlement, West Is., *R.Shivas 830* (K).

The creeping, densely hairy variant occurring on sandy sea-shores is sometimes separated as *D. ctenioides* (Steud.) Bosser, but has not been recorded from Christmas Is. or Cocos (Keeling) Is.

11. DESMOSTACHYA

Desmostachya (Hook.) Stapf in W.T.Dyer, *Fl. Cap.* 7: 316 (1898); from the Greek *desmos* (a chain) and *stachys* (a spike), in reference to the inflorescence.

Eragrostis sect. *Desmostachya* Hook., *Fl. Brit. India* 7: 324 (1897). T: *Eragrostis cynosuroides* (Retz.) P.Beauv. = *Desmostachya bipinnata* (L.) Stapf

Stapfiola Kuntze in T.E. von Post & C.E.O.Kuntze, *Lex. Gen. Phan.* 532 (1903). T: *S. bipinnata* (L.) Kuntze

Perennial tufted grass; culms erect. Leaves distichous, linear; ligule a dense line of hairs. Inflorescence of many racemes on a long central axis, the spikelets densely imbricate, purple. Spikelets sessile, strongly compressed, with 6–18 florets. Glumes very unequal, acute. Lemmas ovate, acute, keeled, membranous to chartaceous, glabrous. Palea 2-keeled, shorter than lemma. Caryopsis ovoid.

A monotypic genus from tropical NE Africa to W Asia; naturalised on Cocos (Keeling) Is.

***Desmostachya bipinnata** (L.) Stapf in W.T.Dyer, *Fl. Cap.* 7: 632 (1898)

Briza bipinnata L., *Syst. Nat.* 10th edn 2: 875 (1759); *Uniola bipinnata* (L.) L., *Sp. Pl.* edn 2: 104 (1762); *Stapfiola bipinnata* (L.) Kuntze in T.E. von Post & C.E.O.Kuntze, *Lex. Gen. Phan.* 532 (1903). T: Egypt; *n.v.* Epithet refers to the arrangement of the racemes.

Robust grass; flowering culms to 120 cm tall. Leaf blades 25–40 cm long; sheath 7–10 cm long. Panicle narrow, to 40 cm long; spikes 1–2 cm long. Spikelets c. 5 mm long, with up to 18 florets, usually purplish.

Cocos (Keeling) Is. Recorded as naturalised in 3 sites on West Is. in disturbed grassy areas in coralline sand.

C.K.Is.: N end of airstrip, West Is., *D.G.Williams 11* (BRI, CBG, K); outside W boundary fence of Quarantine Station, West Is., *D.G.Williams 114* (CBG, PERTH).

Trib. SPOROBOLEAE

12. SPOROBOLUS

Sporobolus R.Br., *Prodr.* 169 (1810); from the Greek *sporos* (a seed) and *ballein* (to throw), because the pericarp of the seed swells when wetted, ejecting the seed from the floret.

Type: *S. indicus* (L.) R.Br.

Usually erect, densely tufted grasses, sometimes rhizomatous. Leaf lamina often narrow and inrolled or folded; ligule a rim of short hairs. Inflorescence a panicle, sometimes condensed with the branchlets not spreading but remaining erect and parallel to the central axis. Spikelets small, fusiform, with a single floret, breaking up above the glumes when mature. Glumes unequal, obtuse to acute, concave, very short to as long as the spikelets. Lemma glabrous, not awned. Palea almost as long as the lemma. *Drop-seeds, Rat-tail Grasses*.

A large, mainly pantropical and subtropical genus containing c. 160 species; 2 species are present on Christmas Is., 1 of which also on Cocos (Keeling) Is., the other also on Ashmore Reef and the Coral Sea Is. Species often occur in dry or stony, disturbed soil in open grassland, but a distinctive group of species is adapted to saline habitats. There are several

clusters of closely related species in the genus, within which the recognition of taxa can be difficult, often with intermediate specimens occurring.

W.D.Clayton, Sporoboleae, *Kew Bull.* 19: 287–296 (1965).

Flowering shoots 50–90 cm long; leaves mostly crowded near culm base, the lamina 15–40 cm long, the apex not stiff; panicle 15–30 cm long; spikelets c. 1.8 mm long, the upper glume much shorter than the floret (Ch.Is., C.K.Is.) **1. S. fertilis**

Flowering shoots 15–30 cm tall; leaves distichous along culms, the lamina 3–8 cm long, with a rather stiff and sharp apex; panicle 2–8 cm long; spikelets c. 3 mm long, the upper as long as and enclosing the floret (Ch.Is., A.R., C.S.Is.) **2. S. virginicus**

1. Sporobolus fertilis (Steud.) Clayton, *Kew Bull.* 19: 291 (1965)

Agrostis fertilis Steud., *Syn. Pl. Glum.* 1: 170 (1854). T: Japan, *coll. unknown*; holo: ?L *n.v.* Epithet is the Latin word for fruitful or prolific, as all spikelets in the type specimen were observed to be fertile.

Robust, tufted grass 50–90 cm tall. Leaves mostly crowded near culm base, usually inrolled; lamina 15–40 cm long, 2–3.5 mm wide; sheath keeled, loose. Panicle long-stalked, raceme-like, 15–30 cm long, slender; branchlets 1–3.5 cm long, erect and remaining ±appressed to central axis, not widely spreading. Spikelets c. 1.8 mm long, ±terete, each with 1 floret. Glumes short; upper glume usually 1 mm long, acute, reaching about half-way up the floret; lower glume 0.5 mm long, obtuse; both glumes occasionally shorter than above and broadly obtuse. Lemma c. 1.8 mm long, acute, grey-green. Palea ±equalling lemma. *Rat-tail Grass*. Fig. 90C–D.

Christmas Is., Cocos (Keeling) Is. Common on Christmas Is. on any cleared or disturbed land, and on mined areas where sufficient soil remains. On Cocos (Keeling) Is. grows in disturbed open sites in coralline sand. This SE Asian species occurs from India and Sri Lanka, to China, Japan, Malesia, the Philippines and Micronesia.

Ch.Is.: common in any cleared area, *D.A.Powell 341* (K); Flying Fish Cove, *D.A.Powell 476* (K); old mine site, 0.5 km N of airport, *R.Shivas 944A* (PERTH). C.K.Is.: Home Is., *I.R.Telford 10074 & C.Howard* (AD, CBG, K, NSW); outside W boundary of Quarantine Station, West Is., *D.G.Williams 118* (BISH, BRI, CBG, PERTH).

One Christmas Is. specimen (*D.A.Powell 476*, K) is unusual in the shape of its glumes which are very obtuse or mucronulate and much shorter than in the more common variant, the upper glume reaching only about 1/3 the length of the floret. There are no other apparent characters separating these 2 variants, and both have 3 anthers, distinguishing them from the very similar *S. diander* (Retz.) Beauv. which only has 2. W.D.Clayton (*Kew Bull.* 19: 293, 1965) noted that similar variation in glume shape is encountered thoughout most of the range of *S. fertilis*, but he did not regard this character as sufficient to distinguish separate taxa.

2. Sporobolus virginicus (L.) Kunth, *Rev. Gram.* 1: 67 (1829)

Agrostis virginicus L., *Sp. Pl.* 1: 63 (1753). T: Virginia, America, *J.Clayton 507*; syn: BM; Herb. C.Linnaeus 84.30; syn: LINN. Epithet is a Latinisation of Virginia, [U.S.A.], indicating the origin of the type specimen of this species.

Illustrations: F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 333, fig. 55(7, 8) (1980); A.B.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 183 (1985).

Rather small, erect, tufted grass 15–30 cm tall; rhizomes tough, yellow. Leaves distichous along culm, usually tightly inrolled, rather stiff, almost pungent; base usually somewhat hairy; lamina 3–8 cm long, 1.5–3 mm wide; sheath rounded. Panicle 2–8 cm long, slender, raceme-like; branchlets 0.5–1.5 cm long, erect and remaining appressed to central axis, not spreading. Spikelets c. 3 mm long, ±terete, each with 1 floret. Glumes long; upper glume 2.9 mm long, narrowly ovate, acute, as long as and enclosing floret; lower glume shorter. Lemma c. 2.5 mm long, similar to glumes. Palea c. 2.3 mm long. *Salt Couch Grass*, *Coastal Rat-tail Grass*.

Christmas Is., Ashmore Reef, Coral Sea Is. Infrequent around the coast of Christmas Is., occurring behind the sea cliffs in crevices in the limestone, within the spray zone. On

Ashmore Reef and the Coral Sea Is. it grows in herbfield, often in rank stands, in coralline sand. A pantropical and subtropical coastal species.

Ch.Is.: E coast, Norris Point, *D.A.Powell 470* (K). A.R.: East Is., *J.Hicks 62* (CANB). C.S.Is.: Middle Is., Willis Group, *K.Keith 1* (CANB); NE Cay, Herald Cays, *J.Hicks 1* (BISH, CANB, CBG); SE Cay, Magdelaine Cays , Oct. 1987, *T.Scotney & W.Jeffs* (CBG).

Sterile plants are similar to *Lepturus repens*. The latter is easily distinguished by its distinctive, unbranched inflorescence, and can be identified in the vegetative state by its less strictly distichous and more erect leaves, and its stoloniferous rather than rhizomatous habit.

Trib. LEPTUREAE

13. LEPTURUS

Lepturus R.Br., *Prodr.* 207 (1810); from the Greek *leptos* (slender) and *oura* (a tail), in reference to the slender inflorescence.

Type: *L. repens* (G.Forst.) R.Br.

Erect, tufted grasses, sometime stoloniferous. Leaf lamina often inrolled; ligule a short, membranous rim. Inflorescence a slender, cylindrical raceme; spikelets distichous and embedded in rachis; rachis breaking up at maturity. Spikelets with 1 fertile floret, often with a reduced, sterile floret. Upper glume enclosing floret in a cavity in the rachis, often acuminate or awned, coriaceous; lower glume absent or much reduced, except in the terminal floret where the glumes are subequal. Lemma concave, membranous, not awned, smaller than glume. Palea hyaline.

A distinctive genus of c. 8 species which occur in sandy and saline, coastal habitats, from E Africa and the Indian Ocean islands, through Indo-China and Malesia to Australia and the Pacific islands (Polynesia and Micronesia); 1 species on Christmas Is., Cocos (Keeling) Is., Ashmore Reef and the Coral Sea Is.

Lepturus repens (G.Forst.) R.Br., *Prodr.* 207 (1810)

Rottboellia repens G.Forst., *Fl. Ins. Austr.* 9 (1786). T: Tahiti, *J.G.Forster s.n.*; syn: K. Epithet is the Latin for creeping, in reference to the stolons.

[*L. filiformis auct. non* Trin.: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 244 (1906)]

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 84, fig. 12 (1971).

Tufted grass, 10–35 cm tall, with creeping stolons. Leaves scattered along slender culm, usually inrolled, rather stiff, acute, glabrous, glaucous; lamina 2–10 cm long, 2.5–4 mm wide; sheath keeled. Raceme erect, very slender, 3–10 cm long, inconspicuous; spikelets embedded, distichous along rachis; rachis fragmenting below each spikelet at maturity. Glume enclosing floret cavity 6–8 mm long, narrowly ovate, with a rigid, finely acuminate apex, coriaceous, glaucous, usually ±appressed to rachis, but spreading at anthesis. Lemma c. 3 mm long, obtuse, concave, membranous. Palea enclosed by lemma. *Stalky Grass*. Fig. 91F–G.

Christmas Is., Cocos (Keeling) Is., Ashmore Reef, Coral Sea Is. Native on Christmas Is., occurring rather sparsely in crevices among limestone pinnacles in the spray zone immediately behind the sea cliffs. Further back from the cliff it is shaded out by stronger vegetation such as *Pandanus nativitatis* and *Scaevola taccada*. On Cocos (Keeling) Is. grows in open areas, in herbfield and at tops of beaches with *Stenotaphrum micranthum*, *Ipomoea pes-caprae* and *Triumfetta repens* in coralline sand. On Ashmore Reef grows in herbfield on foredunes of the three cays in coralline sand. On the Coral Sea Is. it is recorded as dominant in foredune herb communities and grows in herbfield with *Boerhavia albiflora* and *Achyranthes aspera*. An Old World, tropical, coastal species distributed from eastern Africa, the Indian Ocean islands, Sri Lanka and Malesia to northern Australia (N.T., Qld)

and Polynesia.

Ch.Is.: Waterfall, *H.N.Ridley 96* (K); between the pinnacles, Andrews Point, *D.A.Powell 519* (K). C.K.Is.: North Keeling Is., *I.R.Telford 10013 & C.Howard* (CBG, K, NSW). A.R.: West Is., *K.F.Kenneally 6356* (CANB, PERTH). C.S.Is.: SE Cay, Magdelaine Cays, 6 Oct. 1987, *T.Scotney & W.Jeffs* (BRI, CBG).

The species is dispersed by the sea, the seed being enclosed in a cavity between a section of the buoyant rachis and the glume. The glume is also minutely toothed at the apex, allowing animal dispersal. The inflorescence is reminiscent of *Rottboellia* which is, however, a much larger grass. It is vegetatively similar to *Lepturopetium* but that genus has an inflorescence usually of 2 racemes.

Trib. CYNODONTEAE

14. CHLORIS

Chloris Sw., *Prodr.* 25 (1788); after the ancient Greek goddess Chloris, the beautiful goddess of flowers, given to indicate the attractiveness of this genus of grasses.

Type: *C. cruciata* (L.) Sw.

Tufted to creeping grasses. Leaf lamina flat or folded; ligule short, membranous. Inflorescence of few to many racemes in a terminal whorl or cluster, with the spikelets in 2 rows along one side of rachis. Spikelets usually with 1 fertile and 1–several sterile florets, often truncate, breaking up above the persistent glumes at maturity. Glumes unequal; upper glume acute to awned; lower glume shorter, narrower, acute. Fertile lemma broad, keeled, usually ciliate along keel and margins, entire or bidentate, with a subapical awn. Sterile lemma sometimes awnless. Palea flat, membranous.

A genus of c. 55 tropical to warm-temperate grasses; 1 weedy species occurs on Christmas Is. and Cocos (Keeling) Is. They mainly occur in poor soil or disturbed sites and include several useful pasture grasses.

***Chloris barbata** Sw., *Fl. Ind. Occid.* 1: 200 (1797)

T: India, Herb. C.Linnaeus 1211.21; syn: LINN. Epithet from the Latin *barbatus* (bearded), in reference to the cilia on the fertile lemma.

Andropogon barbatus L., *Mant. Pl.* 302 (1771), *non* L. (1759), *nom. illeg.* T: as for *C. barbata* Sw.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: opp. 69, t. 2 (1971).

Loosely tufted grass, 40–80 cm tall; culm base sometimes decumbent, branching and rooting from nodes. Leaves mainly towards culm base; lower leaves with keeled sheath; lamina 7–25 cm long, 2.5–5 mm wide. Racemes 3.5–7 cm long, ascending, bristly, purplish, usually 8–20 in a terminal whorl. Spikelets in 2 rows along rachis, c. 2 mm long (excluding awns), of 1 fertile floret and 2 sterile lemmas; awns 3, conspicuous. Glumes narrow, acute, transparent, unequal, the upper c. 2 mm long. Fertile lemma c. 2 m long, obovate, keeled, ciliate, with a ±apical, purple awn c. 5 mm long. Sterile lemma c. 1 mm long, awned. Palea obovate. *Finger Grass*.

Christmas Is., Cocos (Keeling) Is. It is a frequent and conspicuous grass in any cleared or disturbed site on Christmas Is. On Cocos (Keeling) Is. it grows as a weed of open areas and disturbed sites in calcareous sand. A widespread, weedy species occurring throughout the tropics, on waste or disturbed ground, usually near the coast.

Ch.Is.: Waterfall area, *D.A.Powell 459* (K); alongside railway at Camp 4, *B.A.Mitchell 11* (CBG, K); entrance to golf course, *R.Shivas 827* (PERTH). C.K.Is.: settlement, West Is., *I.R.Telford 9949 & C.Howard* (AD, CBG, K); E verge of airstrip, West Is., *D.G.Williams 100* (CBG).

Easily recognised by its many bristly, purple, suberect racemes held in a whorl at the apex of the culm.

15. LEPTUROPETIUM

Lepturopetium Morat, *Adansonia* ser. 2, 20(4): 377 (1981); from *Lepturus* and *Oropetium*, two grass genera with close affinities.

Type: *L. kuniense* Morat

Perennial grass; culms decumbent, rooting at lower nodes. Leaf lamina very narrowly linear; ligule a rim of hairs. Inflorescence digitate; racemes 1–3, the spikelets compressed, of 2 or 3 florets, 1 or 2 fertile; glumes unequal, narrow, divergent, the lower 1-nerved, the upper 3–7-nerved; fertile lemma cartilaginous, weakly keeled, bidentate, awned; sterile lemma lanceolate. Fruit unknown.

A genus of 2 or 3 species, 1 from New Caledonia, 1 from the Marshall Is. and a problematic collection from Cocos (Keeling) Is.

A hybrid origin, with the putative parent genera *Chloris* and *Lepturus*, has been postulated for the genus by F.R.Fosberg & M.H.Sachet, *Micronesica* 18: 73 (1982).

Lepturopetium sp.

Flowering culms to 40 cm tall. Leaf lamina 3–7 cm long, c. 3 mm wide; sheath 2–4 cm long. Racemes usually 2, rarely 1 or 3, 4–7 cm long; spikelets 10–16; lower glume c. 2 mm long, the upper 4.5–6 mm long. Fertile florets: paleas with awns c. 3 mm long. Sterile floret with reduced lemma. Fig. 91A–B.

Cocos (Keeling) Is. Recorded from a single collection from West Is.

C.K.Is.: 1 km NW of settlement, West Is., *D.G.Williams 267* (BISH, BRI, CANB, CBG, NSW, PERTH, US).

Superficially similar to the common and widespread *Lepturus repens*, but readily distinguished by its inflorescence of usually 2 racemes. Both putative parent genera, *Lepturus* and *Chloris*, occur on the island; the former represented by *L. repens*, the latter by *C. barbata*.

16. CYNODON

Cynodon Rich. in C.H.Persoon, *Syn. Pl.* 1: 85 (1805), *nom. cons.*; from the Greek *kynos* (a dog) and *odous* (a tooth), from the tooth-shaped buds on the stolons.

Type: *C. dactylon* (L.) Pers.

Low-growing, rhizomatous and stoloniferous grasses. Leaf lamina often appearing subopposite, flat to inrolled; ligule a membranous, ciliolate rim. Inflorescence of several slender, whorled racemes radiating from culm apex, sometimes in several closely spaced whorls; racemes with spikelets in 2 overlapping rows on one side of rachis. Spikelets with 1 fertile, flattened floret, without awns, breaking up above the glumes at maturity. Glumes subequal, keeled, usually shorter than lemma, persistent. Lemma flattened, keeled, ciliolate on keel, somewhat coriacous. Palea subequalling lemma. *Star Grasses*.

A genus of c. 8 species in the Old World tropics, with 1 pantropical to warm-temperate species on Christmas Is., Cocos (Keeling) Is. and the Coral Sea Is., and another on Cocos (Keeling) Is. They occur around habitation, in short grassland and in open, disturbed sites.

W.D.Clayton & J.R.Harlan, The genus *Cynodon* L.C.Rich. in Tropical Africa, *Kew Bull.* 24: 185–189 (1970); M.Lazarides, A revision of Australian Chlorideae (Gramineae), *Austral. J. Bot. Suppl.* 5: 35–41 (1972).

Racemes 4 or 5 per inflorescence, 2–4.5 cm long; leaf blades 1–7 cm long, less than 3 mm wide (Ch.Is., C.K.Is., C.S.Is.) **1. C. dactylon**

Racemes 5–7 per inflorescence, 7–8 cm long; leaf blades 7–15 cm long, 3–5 mm wide (C.K.Is.) **2. C. arcuatus**

1.*Cynodon dactylon (L.) Pers., *Syn. Pl.* 1: 85 (1805)

Panicum dactylon L., *Sp. Pl.* 1: 58 (1753). T: South-western Europe (Lusitania), Herb. C.Linnaeus 80.35; syn: LINN. Epithet from the ancient Latin plant name for this species, *dactylos* (from the greek *daktylos*, a finger), indicating the digitate inflorescence.

Illustrations: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 91, fig. 13 (1971); M.Lazarides, *op. cit.* 38, fig. 16a–d.

Perennial, short, fine, extensively creeping grass, stoloniferous and rhizomatous, often forming spreading mats; flowering culms 10–30 cm tall. Leaves mostly towards culm base, glaucous; base shortly hairy; lamina 1–7 cm long, 1–3 mm wide; sheath slightly keeled, 1–3.5 cm long. Racemes usually 4 or 5 in a terminal whorl, each 2–4.5 cm long, slender. Spikelets c. 2 mm long, narrowly elliptic, acute, flattened, sometimes purplish. Glumes subequal, keeled, c. 1.8 mm long; lower glume curved around floret. Lemma c. 2 mm long, acute, very broad, flattened and keeled, minutely hairy along keel. Palea slender, hyaline. *Bermuda Grass*, *Couch Grass*.

Christmas Is., Cocos (Keeling) Is., Coral Sea Is. Common along roadsides and around habitation on Christmas Is., often collected for use in lawns. It has a certain degree of salt-tolerance, making it especially useful in gardens near the coast. On Cocos (Keeling) Is. grows as a weed of grassland areas and gardens in coralline sand. On the Coral Sea Is., recorded from 1 cay from herbfield in coralline sand. A pantropical and warm-temperate species occurring throughout Australia.

Ch.Is.: roadside at Norris Point, *D.A.Powell 471* (K); road to Waterfall, *R.Shivas 902A* (PERTH). C.K.Is.: community vegetable garden, Home Is. (Pulu Selma), *D.G.Williams 206* (BRI, CBG, PERTH); E verge of airstrip, West Is., *D.G.Williams 95* (CBG). C.S.Is.: Wreck Reef, Bird Is., *K.Keith 24* (CANB).

This is a valuable fodder grass, and is one of the most widely used lawn grasses in the tropics, especially in sandy soil. The creeping, mat-forming habit and fine foliage make it a desirable species for this purpose.

2. *Cynodon arcuatus J.Presl & C.Presl in C.Presl, *Reliq. Haenk.* 1: 290 (1825–1830)

T: 'Hab. in Luzonia' [Philippines, Luzon], *coll. unknown*; *n.v.* Epithet Latin for curved like a bow, perhaps in reference to the racemes.

Illustration: M.Lazarides, *Austral. J. Bot. Suppl.* 5: 38, fig. 16e–h (1972).

Perennial stoloniferous herb; flowering culms to 30 cm tall. Leaves mostly towards culm base; lamina 7–17 cm long, 3–5 mm wide; sheath 1–6 cm long. Racemes 5–7 in a terminal whorl, usually curved, 7–8 cm long. Spikelets c. 2 mm long. Glumes ±equal, c. 1 mm long. Lemma c. 2 mm long, ciliolate on keel and on lateral nerves. Palea slender, hyaline.

Cocos (Keeling) Is. Grows as a weed of open grassed areas in coralline sand. Native of SE Asia, Malesia to tropical N Australia (N.T.).

C.K.Is.: E verge of airstrip, West Is., *D.G.Williams 2* (CBG, PERTH); settlement, West Is., *D.G.Williams 97* (BRI, CBG, K).

H.B.Gilliland, *A revised Flora of Malaya* 3. *Grasses of Malaya* 92 (1971) claimed that *C. arcuatus* appears to be a luxuriant form of *C. dactylon* but the species is maintained by M.Lazarides, *op. cit.* 40.

17. ZOYSIA

Zoysia Willd., *Ges. Naturf. Freund Berl. Neue Schriften* 3: 440–441 (1801), *nom. cons.*; named after Baron Karl von Zois (1756–1800), an Austrian amateur botanist and plant collector.

Type: *Z. pungens* Willd.

Low-growing, rhizomatous grasses. Leaf lamina often stiff and pointed; ligule a minute, ciliolate, membranous rim. Inflorescence a single, erect, cylindrical raceme of spirally arranged, appressed, short-stalked spikelets, or rarely a single spikelet. Spikelets with a

single fertile floret, falling entire at maturity. Lower glume minute or absent; upper glume exceeding and completely enclosing floret, acute, mucronate or awned. Lemma hyaline, ±keeled. Palea hyaline or absent.

An Asiatic and Australasian genus of c. 10 species, with 1 species possibly endemic in Australia; 1 species introduced to Christmas Is. and native on Cocos (Keeling) Is. They occur mainly in coastal, sandy soil, and also on grazed or disturbed inland sites. Several species are used as lawn grasses.

P.C.Goudswaard, The genus *Zoysia* (Gramineae) in Malesia, *Blumea* 26: 169–175 (1980).

Zoysia matrella (L.) Merr., *Philippine J. Sci., Bot.* 7: 230 (1912)

subsp. **matrella**

Agrostis matrella L., *Mant. Pl.* 185 (1771). T: *J.G.Koenig 56* in Herb. C.Linnaeus 84.11; syn: LINN; Leiden Herb. 909.67–176; syn: L *n.v.* Epithet from the Latin *mater* (a mother), perhaps indicating the growth habit of a succession of small, tufted shoots being produced at intervals along the rhizome.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 110, fig. 19 (1971).

Fine, extensively creeping, mat-forming grass; flowering culms usually to 10, rarely to 40 cm tall. Leaves stiff, usually inrolled, glaucous, rather sharp; base with a few white hairs; lamina c. 1–5 cm long, 1–2 mm wide; sheath keeled. Raceme slender, 0.7–2.5 cm long. Spikelets spirally arranged, appressed to rachis, shortly stalked, 2.5–3 mm long (excluding awn), sometimes purplish, with 1 floret. Glume solitary, c. 2.5 mm long, concave, keeled towards apex, acute or with an apical awn up to 1 mm long, completely enclosing floret, coriaceous. Lemma c. 2 mm long, hyaline. Palea c. 1 mm long, hyaline. *Manila Grass*, *Siglap Grass*.

Christmas Is., Cocos (Keeling) Is. Apparently introduced on Christmas Is., common as a roadside plant and in lawns around Settlement, Drumsite and the golf course. Apparently native on Cocos (Keeling) Is., growing in open areas and herbfield with *Ipomoea pes-caprae*. This tropical and subtropical SE Asian species has been introduced in Africa, America and Australia as a lawn grass.

Ch.Is.: roadsides throughout Settlement and Drumsite, *D.A.Powell 682* (K); entrance to golf course, *R.Shivas 839* (PERTH); lawn grass in the Nursery, overlooking Settlement, *R.Shivas 963* (PERTH). C.K.Is.: Home Is., *I.R.Telford 10075 & C.Howard* (CBG, K, NSW, PERTH); between North Lagoon and ocean beach, West Is., *I.R.Telford 9978 & C.Howard* (AD, CBG, K, MEL).

Easily propagated from rhizomes, and is collected for use in lawns. *Zoysia matrella* is easily confused, in the vegetative state, with *Cynodon dactylon* and *Sporobolus virginicus*. They share a creeping habit, have very similar, glaucous, short leaves and shoots and occupy similar habitats. *Cynodon dactylon* can be readily distinguished when fertile by its 4 or 5, whorled, 1-sided racemes; *S. virginicus* by its branched inflorescence.

Taxonomically, *Zoysia* is a problem genus with some species difficult to separate, such as this species and the supposed Australian endemic *Z. macrantha* Desv.

Subfam. PANICOIDEAE

Trib. PANICEAE

18. OPLISMENUS

Oplismenus P.Beauv., *Fl. Oware* 2: 14 (1810), *nom cons.*; from the Greek *hoplismenus* (armed), or *hoplon* (armour), in reference to the awned spikelets.

Type: *O. africanus* P.Beauv.

Trailing, stoloniferous grasses; culms ascending, often with stilt roots from lower nodes. Leaf lamina relatively broad; sheath margin ciliate; ligule a membranous, ciliate rim.

Inflorescence panicle-like, of several racemes scattered along a central axis; spikelets usually paired along rachis. Spikelets with a single fertile floret subtended by a second, sterile lemma, falling entire at maturity. Glumes subequal, shorter than floret; lower glume long-awned; upper glume awned or not. Sterile lemma enclosing floret; fertile lemma ±coriaceous. Palea acute.

A genus of 5 pantropical and subtropical species, mainly in shaded or semi-shaded forest habitats; 1 species on Christmas Is. The awns are either barbed or viscid, the latter being an unusual adaptation in grasses for animal dispersal.

J.C.Davey & W.D.Clayton, Some mutiple discriminant function studies on *Oplismenus* (Gramineae), *Kew Bull.* 33: 147–157 (1978).

Oplismenus compositus (L.) P.Beauv., *Ess. Agrostogr.* 54, 169 (1812)

Panicum compositum L., *Sp. Pl.* 1: 57 (1753). T: Sri Lanka, Herb. P.Hermann 42, vol. 3, fol. 45; holo: BM. Epithet from the Latin *compositus* (compound), to indicate a divided or branched structure, in this case the inflorescence.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 170, fig. 34 (1971).

Decumbent grass forming loose mats, 20–40 cm tall; culms wiry, rooting from lower nodes. Leaves scattered along culm, often undulating, dark green; lamina 4–13 cm long, 5–15 mm wide; sheath rounded. Racemes 2–6 cm long, combined into a sparse inflorescence. Spikelets paired or solitary, along 1 side of rachis, c. 3 mm long (excluding awns), with 1 fertile floret. Glumes c. 2 mm long, hairy; lower glume with a viscid awn 5–8 mm long; upper glume shortly awned. Sterile lemma c. 3 mm long, enclosing floret; fertile lemma c. 2.5 mm long, subcoriaceous. Palea hyaline. *Creeping Beard Grass*. Fig. 93G–H.

Christmas Is. Common on the western and southern sides of Christmas Is., in the terrace forests from South Point to North West Point, often on infrequently used tracks through the forest. A widely distributed species in the Old World tropics, including eastern Africa, India, Indo-China, Malesia to Australia (Qld, N.T.) and Polynesia. It also occurs in Venezuela, Ecuador and Mexico.

Ch.Is.: Phosphate Hill, *H.N.Ridley 8* (K); western shore terrace, *D.A.Powell 385* (K); along walk to West White Beach, on lower terrace, *R.Shivas 917* (PERTH); National Park, Drill Line 118, *D.J. & B.P.Du Puy CI49* (CBG, K); western shore terrace, North West Point, *D.J. & B.P.Du Puy CI72* (CBG, K).

H.N.Ridley (*J. Straits Branch Roy. Asiat. Soc.* 45: 243, 1906) noted that this used to be 'perhaps the most abundant grass' on Christmas Is., growing all through the more open forest, and was regularly collected as fodder for horses and cattle. It is now rather less common, and the more weedy, introduced grasses are far more abundant due to the large amount of waste and cleared land following mining operations.

19. PANICUM

Panicum L., *Sp. Pl.* 1: 55 (1753); *Gen. Pl.* 5th edn, 29 (1754); an old Latin name for the common millet, *Setaria italica* (L.) P.Beauv.

Type: *P. milliaceum* L.

Tufted to creeping grasses. Leaf lamina ovate to filiform; ligule usually a short, ciliate rim. Inflorescence usually an open, much-branched panicle, sometimes contracted. Spikelets solitary at tips of slender branchlets, spherical, ovoid or ellipsoidal, with a single fertile floret subtended by a male or sterile floret, usually falling entire at maturity. Lower glume usually shorter than spikelet, often sheathing, often separated from upper glume by a short internode. Upper glume and lower lemma truncate to shortly awned, membranous, subequal, as long as spikelet, enclosing fertile floret. Fertile lemma crustaceous; margins inrolled, pale. Palea flat.

A genus of c. 470 species distributed throughout the tropics and extending into warm-temperate regions; 1 species naturalised on Christmas Is.; 1 species probably native on

Cocos (Keeling Is.). The species occupy diverse habitats, from exposed and arid conditions to swampy land and shaded forest. Some species have been developed into minor cereal crops.

This genus can be difficult to separate from *Brachiaria* (Trin.) Griseb., although most specimens can be recognised by their paniculate inflorescence, rather than having several racemes inserted along a central axis.

R.D.Webster, *Austral. Paniceae* (*Panicum*) 118–146 (1987).

Leaf blade 2–6 cm long (Ch.Is.) **1. P. trichoides**

Leaf blade to 20 cm long (C.K.Is.) **2. P. repens**

1. *Panicum trichoides Sw., *Prodr.* 24 (1788)

T: Jamaica, Hispaniola, *O.Swartz*; holo: S *n.v.*, *fide* W.D.Clayton & S.A.Renvoize in R.M.Polhill (ed.), *Fl. Trop. E. Africa*, Gramineae 3: 497 (1982). Epithet from the Greek *trichos* (a hair) and *-oides* (indicating resemblance), in this case referring to the fine, hair-like branchlets of the panicle.

P. andrewsii Rendle in C.W.Andrews, *Monogr. Christmas Is.* 192–193, t. 18 (1900). T: Christmas Is., 1898, *C.W.Andrews s.n.*; holo: BM.

Illustration: A.B.Rendle in C.W.Andrews, *loc. cit.*, as *P. andrewsii*.

Decumbent to ascending grass, 10–30 cm tall; culm base often with aerial roots. Leaves scattered along culms, ovate, acuminate; base unequal-sided, ±cordate, with scattered hairs; lamina 2–6 cm long, 5–14 mm wide; sheath rounded, hairy. Panicle finely branched, 3–15 cm long, glabrous, sometimes not fully exserted from leaf sheath; branchlets many, very slender. Spikelets c. 1.5 mm long, ovate. Lower glume sheathing spikelet and c. 1/2 the length, acute. Upper glume and lower lemma obtuse, glabrous, as long as spikelet, enclosing fertile floret. Fertile lemma and palea c. 1.3 mm long, crustaceous, pale.

Christmas Is. Both C.W.Andrews and H.N.Ridley collected this species on Christmas Is., the latter giving the locality as in dry soil on the basalt outcrop above Flying Fish Cove. It has not been recorded since then. This species is probably native to tropical America, but has been introduced into Africa, SE Asia and Australia, occurring as a locally common grass in Indo-China, Malesia and the Philippines. It prefers a partially shaded position in forest or scrubland.

Ch.Is.: no precise locality, 1897, *C.W.Andrews* (BM); volcanic rocks above Cove, *H.N.Ridley 135* (K).

A.B.Rendle described the specimens from Christmas Is. as a new species, *P. andrewsii*, also occurring on Timor. He compared it with *P. ovalifolium* Poir., now considered to be conspecific with *P. brevifolium* L., from which it differs in its shorter lower glume (only half as long as the spikelet) and the glabrous, rather than hairy main axis of the inflorescence. These characters indicate that *P. andrewsii* should be included in *P. trichoides*. This species, in other regions, often has a pubescent upper glume and lower lemma but these are glabrous in specimens from Christmas Is. Similarly glabrous variants are not uncommon in Malesia.

2. Panicum repens L. *Sp. Pl.* edn 2, 2: 87 (1762)

T: Hispania [Spain], ?*Alstroemer*; holo: LINN *n.v.*, *fide* W.D.Clayton & S.A.Renvoize in R.M.Polhill (ed.), *Fl. Trop. E. Africa*, Gramineae 3: 482 (1982). Epithet the Latin for crawling or creeping, referring to the habit of the species.

Illustrations: H.B.Gilliland, *Fl. Malaya (Grasses)* 3: 136, fig. 25 (1971); W.D.Clayton & S.A.Renvoize in R.M.Polhill (ed.), *Fl. Trop. E. Africa*, Gramineae 3: 483, fig. 121 (1982).

Perennial monoecious herb; culms decumbent to erect, rooting at lower nodes; flowering culms to 90 cm tall. Leaves scattered along culms; sheaths 5–10 cm long; lamina to 20 cm long, 6–12 mm wide; ligule c. 4 mm long. Panicle finely branched, to 25 cm long; lower racemes in groups of 2 or 3; spikelets many, c. 3 mm long. Lower glume sheathing spikelet, truncate, c. 0.8 mm long, 3-nerved. Upper glume acute, c. 3 mm long, 7–9-nerved. Lower floret male with lemma similar to upper glume. Upper floret bisexual with lemma acute, c.

2.2 mm long, indurated, white; palea c. 2 mm long.

Cocos (Keeling) Is. Recorded from a single collection in strand forest in coralline sand near the kampong. Also in Africa, India and SE Asia, usually in damp sites and on sand dunes.

C.K.Is.: Home Is., *I.R.Telford 10058 & C.Howard* (CBG, K).

20. ECHINOCHLOA

Echinochloa P.Beauv., *Ess. Agrostogr.* 53 (1812), *nom. cons.*; from the greek *echinos* (a hedgehog, sea urchin) and *chloa* (a grass), after the rather stiff and sharp hairs of the type species.

Type: *E. crusgalli* (L.) P.Beauv.

Tufted to creeping grasses. Leaf lamina flat; ligule frequently absent. Inflorescence of few to several racemes scattered along a central axis, becoming reduced towards apex; spikelets usually paired, forming 4 rows along one side of rachis. Spikelets often plump, mucronate to awned, usually hairy, with a single fertile floret subtended by a sterile or male floret, falling entire at maturity. Lower glume much shorter than spikelet, sheathing. Upper glume and lower lemma subequal, as long as spikelet, enclosing fertile floret, the lemma sometimes awned. Fertile lemma crustaceous, pale, glossy, with inrolled margins, shortly beaked. Palea tip slightly exserted.

A pantropical to warm-temperate genus containing c. 30 species; 1 species has been recorded from Christmas Is. The species are typically found in damp or seasonally inundated places, and as weeds of cultivated and disturbed land, especially rice fields. This genus includes several variable species complexes with confused taxonomy.

This genus is difficult to distinguish from *Brachiaria* (Trin.) Griseb., the most constant character being the recurved, slightly exserted upper palea tip in *Echinochloa*.

*Echinochloa colona (L.) Link, *Hort. Berol.* 2: 209 (1833)

Panicum colonum L., *Syst. Nat.* 10th edn, 2: 870 (1759). T: Jamaica, *P.Browne*, Herb. C.Linnaeus 80.23; syn: LINN. Epithet from the Latin *colonus* (belonging to a farm), indicating that this species often occurs in cultivated land.

Illustrations: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: t. 10 (1971); W.D.Clayton & S.A.Renvoize in R.M.Polhill (ed.), *Fl. Trop. E. Africa*, Gramineae 3: 558, fig. 134 (1982).

Suberect, ±tufted grass, to 60 cm tall; culms ascending, sometimes rooting from lower nodes. Leaves scattered along culm; lamina 6–15 cm long, 3–5 mm wide; sheath ±keeled; ligule absent. Racemes 0.5–3 cm long, combined into branched inflorescences 5–10 cm long, the upper racemes gradually reduced; rachis with a few long, basal setae. Spikelets paired, forming 4 rows along 1 side of rachis, c. 2.5 mm long, ellipsoidal, pubescent, not awned. Lower glume c. 1/3 the length of the spikelet, obtuse, sheathing. Upper glume and lower lemma c. 2.5 mm long, shortly mucronate, pubescent, enclosing fertile floret. Fertile lemma and palea c. 1.5 mm long, coriaceous, glossy, pale.

Christmas Is. Recorded by H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 242 (1906), as an introduced, weedy species on Christmas Is., occasionally occurring around the settlement at Flying Fish Cove but has not been collected recently. A widespread species throughout the tropics and subtropics, especially in the Old World as weedy species of open or partially shaded sites, especially in seasonally wet sites, roadsides and disturbed land.

Ch.Is.: no precise locality, *C.W.Andrews 204* (BM).

21. BRACHIARIA

Brachiaria (Trin.) Griseb. in C.L.Ledebour, *Fl. Ross.* 4: 469 (1853); from the Latin *brachium* (an arm, used also for a tree branch), after the branching pattern of the inflorescence.

Panicum sect. *Brachiaria* Trin., *Mem. Acad. Sci. Petersb.* ser. 6, 3: 194 (1834).

T: *Panicum caucasicum* Trin. = *B. eruciformis* (Sm.) Griseb.

Loosely tufted to creeping grasses; culm bases decumbent, rooting at lower nodes, sometimes stoloniferous. Leaf lamina rather broad, the base broad and rounded; ligule a line of hairs. Inflorescence of few to several racemes scattered along a central axis, panicle-like; spikelets single or paired, in 2 rows along one side of rachis; rachis often flattened. Spikelets often plump, awnless, with 1 fertile floret subtended by a sterile lemma, falling entire at maturity. Lower glume shorter than spikelet, sheathing. Upper glume and sterile lemma subequal, as long as spikelet, enclosing fertile floret. Fertile lemma and palea coriaceous, usually rugulose, whitish. *Panic Grasses*.

A large, pantropical and subtropical genus containing c. 100 species, with greatest diversity in Africa; 4 species have been introduced on Christmas Is.; 1 species introduced on Cocos (Keeling) Is. They occupy a wide range of habitats, from marshland to semi-deserts. Several species are used as pasture grasses.

W.D.Clayton & S.A.Renvoize in R.M.Polhill (ed.), *Brachiaria*, *Fl. Trop. E. Africa*, Gramineae 3: 575–600 (1982).

1 Spikelets c. 2 mm long; racemes up to 2 cm long; leaf lamina 1.5–4 cm long; a small, creeping grass with flowering culms usually less than 15 cm tall (Ch.Is.) **1. B. reptans**

1: Spikelets c. 3 mm long; racemes mostly longer than 2.5 cm; leaf lamina usually much larger, 5–20 cm long; medium or large, suberect to creeping grasses with flowering culms usually taller than 15 cm

2 Spikelets (glumes and sterile lemma) pubescent; lower glume c. 1/2 the length of the spikelet; leaf lamina softly pubescent

3 Racemes 6–10 per inflorescence (Ch.Is.) **3. B. ramosa**

3: Racemes fewer than 5 per inflorescence (C.K.Is.) **5. B. brizantha**

2: Spikelets glabrous; lower glume c. 1/4–1/3 the length of the spikelet; leaf lamina glabrous

4 Pedicel of spikelet glabrous; lower glume c. 1/3 the length of the spikelet, broad, obtuse, completely sheathing spikelet base; spikelets all solitary; racemes usually 4 or 5 per inflorescence (Ch.Is.) **2. B. subquadripara**

4: Pedicel of spikelet with a few long, spreading hairs; lower glume c. 1/4 the length of the spikelet, narrow, acute, not completely enclosing the spikelet base; spikelets paired towards base of larger racemes; racemes usually 7–15 per inflorescence (Ch.Is.) **4. B. mutica**

1.*Brachiaria reptans (L.) C.Gardner & C.E.Hubb., *Hooker's Icon. Pl.* 34: sub. t. 3363 (1938)

Panicum reptans L., *Syst. Nat.* 10th edn, 2: 870 (1759). T: Jamaica, *P.Browne*, Herb. C.Linnaeus 80.52, upper part; syn: LINN. Epithet from the Latin *reptans* (creeping), descriptive of the creeping growth habit of this species.

Small, sprawling or creeping grass, 4–15 cm tall; culms prostrate at base, rooting from nodes. Leaves scattered along culms, glabrous; lamina 1.5–4 cm long, 2–4 mm wide; sheath rounded. Racemes 0.5–2 cm long, c. 3–5 combined into a branched inflorescence, the upper racemes shorter. Spikelets solitary or paired, in 2 rows along one side of rachis, ellipsoidal, c. 2 mm long, glabrous. Lower glume c. 1/3 the length of the spikelet, obtuse, glabrous. Upper glume and sterile lemma c. 2 mm long, glabrous. Fertile lemma and palea c. 1.8 mm

long, coriaceous, rugulose, white. *Creeping Panic Grass*.

Christmas Is. A fairly widespread, introduced species occurring along roads and especially around the populated areas of Settlement and Drumsite. A tropical Asian species which has been introduced throughout the tropics, including Australia (W.A., N.T., Qld).

Ch.Is.: cleared area at Drumsite, *D.A.Powell 477* (K); roadside at Drumsite, *D.A.Powell 782* (K).

In other parts of its distribution, this species can reach larger dimensions than described above. The short spikelets are diagnostic.

2. *Brachiaria subquadripara (Trin.) A.Hitchc., *Lingnan Sci. J.* 7: 214 (1931)

Panicum subquadriparum Trin., *Gram. Pan.* 145 (1826); *Sp. Gram. Icon.* 2: t. 186 (1828). T: Guam, *coll. unknown*; holo: probably LE *n.v.*, *fide* W.D.Clayton & S.A.Renvoize, *Fl. Trop. E. Africa*, Gramineae, 3: 584 (1982). Epithet from the Latin *sub-* (not quite, close to), *quadri-* (four-) and *pars* (a part), referring to the spikelets with 4 major parts (upper glume, 2 lemmas, palea), the lower glume being short.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 177, fig. 36 (1971), as *B. distachya*.

Long-creeping grass, 10–35 cm tall; culms prostrate, rooting at nodes; flowering shoots ascending. Leaves scattered along culms, glabrous; lamina 3.5–15 cm long, 5–10 mm wide; sheath rounded. Racemes 2.5–4 cm long, 4 or 5 racemes combined into a sparsely branched inflorescence, the upper racemes only slightly shorter than the lower. Spikelets all solitary, in 2 rows along one side of rachis, narrowly elliptic, 3–3.5 mm long, glabrous. Lower glume c. 1/3 the length of the spikelet, obtuse, glabrous. Upper glume and sterile lemma 3–3.5 mm long, glabrous. Fertile lemma and palea c. 3 mm long, rugulose, whitish.

Christmas Is. An introduced species and is now not uncommon along roadsides and in waste ground around Drumsite to Settlement and Waterfall. A tropical and subtropical species occurring in SE Asia, Malesia and Australia (W.A., N.T., Qld), and also introduced in several African countries, occurring in humid woodlands and coastal grasslands.

Ch.Is.: Settlement to Waterfall road, *D.A.Powell 751* (K); Drumsite, Nursery, overlooking Settlement, *R.Shivas 989* (PERTH).

This species is often included in *B. distachya* (L.) Stapf, but is maintained as a distinct species here, following W.D.Clayton & S.A.Renvoize (*Fl. Trop. E. Africa*, Gramineae 3: 577, 584, 1982), distinguished by its longer spikelets, its larger inflorescence with more racemes, and its larger leaves. This species is a good fodder grass.

3. *Brachiaria ramosa (L.) Stapf in D.Prain, *Fl. Trop. Africa* 9: 542 (1919)

Panicum ramosum L., *Mant. Pl.* 29 (1767). T: from India, cult. at Uppsala, Herb. C.Linnaeus 80.44; syn: LINN. Epithet from the Latin *ramosus* (branching), indicating the branched inflorescence.

Illustration: C.A.Backer, *Weed Fl. Javanese sugar-cane fields* t. 76 (1929).

Loosely tufted grass, 40–50 cm tall; culms decumbent at base, rooting at lower nodes. Leaves scattered along culms, softly pubescent; lamina 6–12 cm long, 6–11 mm wide; sheath rounded. Racemes 1–6 cm long, 6–10 combined into a sparse, panicle-like inflorescence, the upper racemes shorter. Spikelets mostly solitary, paired near bases of longer racemes, in 2 rows along 1 side of rachis, broadly elliptic, c. 3 mm long, pubescent (on Christmas Is.). Lower glume c. 1/2 length of spikelet, subacute, pubescent. Upper glume and sterile lemma c. 3 mm long, pubescent. Fertile lemma and palea c. 2.5 mm long, coriaceous, rugulose, white.

Christmas Is. Recorded once from a site on the E coast, N of Waterfall, about 100 m behind the sea cliff. An Old World tropical species distributed from Africa, through SE Asia to Malesia and introduced in Australia (N.T., Qld).

Ch.Is.: S of Norris Point, *D.A.Powell 304* (K).

4. *Brachiaria mutica (Forssk.) Stapf, *Fl. Trop. Africa* 9: 526 (1919)

Panicum muticum Forssk., *Fl. Aegypt.-Arab.* 20 (1775). T: Egypt, Rosetta, *P.Forsskal*; holo: probably C *n.v.* Epithet from the Latin *muticus* (without a point, blunt), indicating the lack of awns or mucros in this species.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: opp. 178, t. 12 (1971).

Coarse, sprawling grass c. 50 cm tall; culms prostrate, rooting from nodes. Leaves scattered along culms, glabrous; lamina 10–20 cm long, 5–15 mm wide; sheath rounded. Racemes 2–9 cm long, 7–15 combined into a panicle-like inflorescence, the apical racemes slightly shorter, with a few long, spreading hairs on pedicels. Spikelets paired or solitary, in 2 rows along one side of rachis, narrowly elliptic, c. 3 mm long, glabrous. Lower glume c. 1/4 the length of spikelet, acute, glabrous. Upper glume and sterile lemma c. 3 mm long, glabrous. Fertile lemma and palea c. 2.5 mm long, coriaceous, rugulose, white. *Para Grass.*

Christmas Is. It prefers moist habitats, either in or near water, and therefore has a very restricted occurrence on Christmas Is., where it is only known from an area immediately north of Waterfall. A pantropical and subtropical species, perhaps originating in N Africa, but widely cultivated as a pasture grass and naturalised in warmer regions.

Ch.Is.: N of Waterfall, *D.A.Powell 469* (K).

5. *Brachiaria brizantha (Hochst. ex A.Rich.) Stapf in D.Prain, *Fl. Trop. Africa* 9: 531 (1919)

Panicum brizanthum Hochst. ex A.Rich., *Tent Fl. Abyss.* 2: 363 (1850). T: from Abyssinia [Ethiopia], *coll. unknown*; *n.v.* Eipthet from *Briza* (another grass genus) and the Greek *anthos* (a flower), in reference to a resemblance to that genus.

Illustration: W.D.Clayton, *Fl. Trop. W. Africa* 3(2): 441, fig. 442 (1972).

Perennial; culms clumped on short rhizomes; flowering culms to 100 cm tall. Leaves scattered along culm; lamina 6–20 cm long, 6–10 mm wide; sheath 5–18 cm long. Racemes 5–10 cm long, 2–5 per inflorescence, each of 30–40 spikelets. Spikelets in one row, 4–5.5 mm long, glabrous. Lower glume c. 1/2 length of spikelet.

Cocos (Keeling) Is. Recorded from one island as a rare, roadside weed in coralline sand. Native of tropical Africa.

C.K.Is.: Sydney Hwy, 50 m N of Rumah Baru turn-off, West Is., *D.G.Williams 106* (BRI, CBG, PERTH).

22. ERIOCHLOA

Eriochloa Kunth in F.W.H.A.Humbolt, A.J.A.Bonpland & C.S.Kunth, *Nova Gen. Sp.* 1: edn quart. 94, edn fol. 78 (1816); from the Greek *erios* (wool), and *chloa* (a grass), in reference to the hairiness of some specimens.

Type: *E. distachya* Kunth

Annual or perennial monoecious grasses; culms creeping at base then erect. Leaf lamina flat or rolled; ligule a short fringe of hairs. Inflorescence paniculate; racemes secund. Spikelets solitary or paired, pedicellate, articulate. Lower glume small, forming with the thickened axis a bead-like base to the spikelets. Upper glume as long as spikelet. Lower floret sterile or male; lemma similar to upper glume. Upper floret bisexual; lemma obscurely 5-nerved.

A genus of 20 species of tropical and subtropical regions; 1 species naturalised on Cocos (Keeling) Is.

***Eriochloa meyeriana** (Nees) Pilg. in H.G.A.Engler & K.A.E.Prantl, *Nat. Pflanzenfam.* 2, 14e: 56 (1940)

Panicum meyerianum Nees, *Fl. Afr. Austral. Ill.* 1: 32 (1841). T: Omsamculo, South Africa, *Drège*; iso: K *n.v., fide* W.D.Clayton & S.A.Renvoize, *Fl. Trop. E. Africa*, Gramineae 3: 569 (1982); *n.v.* Eponymy of epithet not known.

Perennial; flowering culms to 150 cm tall. Leaf lamina 6–20 cm long, 3–6 mm wide; sheaths 6–12 cm long. Panicle 8–16 cm long. Spikelets 3–3.5 mm long, purplish; lower glume 0.2–0.3 mm long, translucent; upper glume and lower lemma c. 3.5 mm long, sparsely hairy or glabrous.

Cocos (Keeling) Is. Recorded from one island as a rare weed of disturbed sites in coralline sand. Native of tropical and subtropical Africa and islands of the W Indian Ocean.

C.K.Is.: on bank of rifle range, West Is., *D.G.Williams 81* (BRI, CBG).

23. THUAREA

Thuarea Pers., *Syn. Pl.* 1: 100 (1805); honouring the French botanist Louis du Petit-Thouars (1758–1831).

Type: *T. sarmentosa* Pers. = *T. involuta* (G.Forst.) R.Br. ex Roem. & Schult.

Thuaria R.Hedw., *Gen.* 43 (1806), *orth. var.*

Perennial stoloniferous monoecious grasses; flowering culms short, erect. Leaf lamina flat; ligule a hairy rim. Inflorescence spike-like, partly enclosed by a spathe-like leaf, with a single row of 2-flowered spikelets on 1 side of compressed axis. Spikelets distally male, basally bisexual or female. Bisexual spikelet: lower glume absent or minute; upper glume as long as spikelet; lower floret male or sterile with lemma ±similar to upper glume; palea shorter; upper floret female with indurated lemma and palea. Male spikelets deciduous, with no lower glume; upper glume shorter than spikelet; upper floret with lemma and palea not indurated. Fruit included in the enlarging inflorescence axis.

A genus of 2 species of maritime habitats; 1 from Madagascar, the other from the N Indian and W Pacific Oceans including Cocos (Keeling) Is. and the Coral Sea Is., also mainland Australia and adjacent islands.

Thuarea involuta (G.Forst.) R.Br. ex Roem. & Schult., *Syst. Veg.* 2: 808 (1817)

Ischaemum involutum G.Forst., *Fl. Ins. Austr.* 73 (1786). T: Society Is., *n.v.* Epithet from the Latin *involutus* (rolled inwards), probably in reference to the spathe-like leaf subtending the inflorescence.

Illustrations: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: colour pl. 18, t. 21b (1971); A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 185 (1985).

Stolons long-creeping; flowering culms to 10 cm tall. Leaves narrowly ovate; lamina 1.5–5 cm long, 3–10 mm wide; sheaths 1–2 cm long. Inflorescence subtended by spathe-like upper leaf; axis 10–15 mm long; 1 or 2 bisexual or female spikelets at base, 4–6 male above. Bisexual spikelets c. 5.5 mm long; upper glume 5–7-nerved; lower floret male or sterile with lemma c. 5 mm long, 5–7-nerved, ciliolate; palea hyaline; upper floret female with lemma c. 4.5 mm long, obscurely 5–nerved; palea 4 mm long. Male spikelets c. 4 mm long; upper glume, 3–5-nerved; lower floret shorter than upper. *Bird's Beak Grass*. Fig. 91C–E.

Cocos (Keeling) Is., Coral Sea Is. On Cocos (Keeling) Is. grows at the tops of beaches in herbfield or shrub communities in coralline sand. On the Coral Sea Is. recorded only for Turtle Is., Lihou Reef in herbfield with *Lepturus repens* and *Achyranthes aspera* in coralline sand. Widespread on coasts through the tropical Indian and Pacific Oceans including mainland Australia and adjacent islands.

C.K.Is.: c. 1 km SW of settlement, West Is., *I.R.Telford 9997 & C.Howard* (AD, CBG, K); 1 km NW of settlement, West Is., *D.G.Williams 89* (CBG).

The inflorescence axis and peduncle enlarge and interlock, forming a buoyant false fruit which detaches with its 'spathe' and is dispersed by floating.

Listed as occurring on Lihou Reef by K.Hindwood *et al.*, Birds of the South-West Coral Sea, C.S.I.R.O. Div. of Wildlife Research Technical Paper 3: 44 (1963), and *Lihou Reef*

Figure 91. **A–I**, POACEAE. **A–B**, *Lepturopetium* sp. **A**, habit X0.5; **B**, part of inflorescence showing 2 spikelets X2.5 (**A–B**, D.Williams 267, CBG). **C–E**, *Thuarea involuta*. **C**, habit X0.5; **D**, inflorescence X2.5; **E**, 'fruit' X2 (**C–E**, D.Williams 89, CBG). **F–G**, *Lepturus repens*. **F**, habit X0.5; **G**, part of inflorescence showing 2 spikelets X2.5 (**F–G**, S.Hogg 41, CBG). **H–I**, *Stenotaphrum micranthum*. **H**, habit X0.5; **I**, part of inflorescence showing spikelets, one removed from rachis groove X2.5 (**H–I**, G.Shaughnessy 7, CBG). Drawn by D.Boyer.

National Nature Reserve Plan of Management 24 ANPWS (1980), and on the Coral Sea Is. by H.Heatwole, *Report on Fauna and Flora of the Islands of the Coral Sea Islands Territory* (1979), unpublished ANPWS report, but no specimen has been located.

24. UROCHLOA

Urochloa P.Beauv., *Ess. Agrostogr.* 52 (1812); from the Greek *oura* (a tail) and *chloa* (a grass), in reference to the long mucro on the fertile lemma of species in this genus.

Type: *U. panicoides* P.Beauv.

Tufted to creeping grasses; culm bases often rooting at lower nodes. Leaf lamina rather broad, rounded at base; ligule a line of hairs. Inflorescence of few to several racemes scattered along a central axis, panicle-like; spikelets single or paired, in 2 rows along one side of rachis. Spikelets compressed, apex acuminate, with 1 fertile floret subtended by a sterile lemma, falling entire at maturity. Lower glume shorter than spikelet. Upper glume and sterile lemma subequal, acuminate to cuspidate, as long as spikelet, enclosing the fertile floret. Fertile lemma and palea coriaceous, the lemma long-mucronate.

This genus contains c. 10–12 species in the Old World tropics, all native to Africa; 1 species has been introduced on Christmas Is. They occur in grassland and open woodland.

This genus is closely related to *Brachiaria* (Trin.) Griseb., and there are some intermediate species. They can usually be distinguished by the flattened spikelets, acuminate to cuspidate spikelet tip (upper glume and sterile lemma), and the long-mucronate fertile lemma. R.D.Webster (*Austral. Paniceae* (*Poaceae*) 228–255, 1987) combined the two genera under *Urochloa*.

*Urochloa mosambicensis (Hack.) Dandy, *J. Bot.* 69: 54 (1931)

Panicum mosambicensis Hack., *Bol. Soc. Brot.* 6: 140 (1888). T: Mozambique, *M.R.P. de Carvalho*; iso: K. Epithet named from Mozambique, indicating the country of origin of the type specimen.

Illustration: J.C.Tothill & J.B.Hacker, *Grasses SE Queensland* 276 (1973).

Coarse, sprawling grass, 30–60 cm tall; culms decumbent, rooting at lower nodes. Leaves scattered along culms; lamina 6–18 cm long, 4–12 mm wide; margin long-ciliate; sheath rounded, hairy. Racemes 3.5–5 cm long, 3–8 in a branched inflorescence. Spikelets mostly paired, in 2 rows along one side of rachis, ovate, flattened, 4–4.5 mm long, hairy. Lower glume c. 3/4 the length of spikelet, obtuse. Upper glume and sterile lemma c. 4 mm long, silky-hairy; apex cuspidate. Fertile lemma and palea c. 2.5 mm long, flattened, coriaceous, rounded at apex, the lemma with a slender mucro c. 1 mm long.

Christmas Is. Introduced (probably from Australia) but uncommon, occurring on roadsides in the E of the island. A native, tropical African species, introduced elsewhere in the tropics, including Australia (W.A., N.T., Qld) as a fodder grass, but uncommon in Malesia.

Ch.Is.: edge of airport road, *D.A.Powell 503* (K); cleared area, seaward side of road, 1 mile N of Waterfall, *D.A.Powell 683* (K).

25. PASPALUM

Paspalum L., *Syst. Nat.* 10th edn, 855 (1759); from the ancient Greek name *paspalos*, for a type of millet.

Type: *P. dimidiatum* L., *nom. illeg.* = *Paspalum dissectum* (L.) L., *Panicum dissectum* L.

Tufted to creeping grasses, sometimes stoloniferous. Leaf lamina linear, flat; ligule a short, membranous rim. Inflorescence of 1–several narrow racemes in an apical whorl, or scattered along a central axis; spikelets single or paired in 2 or 4 rows along 1 side of a flattened rachis. Spikelets suborbicular to ovate, awnless, flattened on one side, with a single fertile

floret subtended by a sterile lemma, falling entire at maturity. Lower glume absent or minute. Upper glume and sterile lemma subequal, membranous, as long as spikelet, enclosing fertile floret. Fertile lemma and palea coriaceous, pale.

This mainly New World genus contains c. 330 species, with some widespread in the tropics and subtropics; 1 widespread species has been introduced on Christmas Is. and 1 species is native to Cocos (Keeling) Is. They occur in grassland and forest margins, in damp places and occasionally in coastal salt marshes.

This genus contains several important pasture grasses.

Leaves mostly towards base of culm; racemes 9–15 cm long (Ch.Is.) **1. P. conjugatum**

Leaves scattered along culm; racemes 1.5–2.5 cm long (C.K.Is.) **2. P. vaginatum**

1. *Paspalum conjugatum Bergius, *Acta Helv. Phys.-Math.* 7: 129, fig. 8 (1772)

T: Surinam; type not located. Epithet from the Latin *conjugatus* (joined, connected), in reference to the paired racemes of this species.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 181, fig. 37 (1971).

Long-creeping, stoloniferous grass, 30–50 cm tall; flowering shoots flattened, erect. Leaves mostly towards culm base; lamina 3–20 cm long, 5–12 mm wide; margin shortly ciliate; sheath keeled, often purple. Racemes 9–15 cm long, very slender, paired at culm apex, spreading; spikelets overlapping in 2 rows along one side of rachis; rachis extended as a short point. Spikelets subcircular, obtuse, c. 1.7 mm long, flattened on one side, ciliate, yellow-green. Lower glume absent. Upper glume and sterile lemma c. 1.7 mm long, thinly membranous, the glume margin long-hairy. Fertile lemma and palea coriaceous. *Sour Grass*.

Christmas Is. A common, introduced species in open, rather humid situations, often among other vegetation, in cleared areas, on roadsides, along forest margins and in natural clearings. Widespread in tropical America, and throughout the Old World tropics and subtropics, including Australia. One of the most common grasses in lowland Malesia.

Ch.Is.: natural clearings, Murray Hill, *D.A.Powell 339* (K); alongside railway line at Camp 4, *B.A.Mitchell 116* (CBG, K); disturbed site, NE coast road to Waterfall, *R.Shivas 902B* (PERTH); edge of a recently mined area S of Wharton Hill, *D.J. & B.P.Du Puy CI79* (CBG, K).

H.N.Ridley (*J. Straits Branch Roy. Asiat. Soc.* 45: 241, 1906) recorded that this species had been recently introduced on Christmas Is., and had 'hardly established itself yet', occurring near the wharf and one of the houses in Flying Fish Cove. It has since spread to most disturbed areas on the island.

2. Paspalum vaginatum Sw., *Fl. Ind. Occid.* 21 (1797)

T: Jamaica, *coll. unknown*; *n.v., fide* W.D.Clayton & S.A.Renvoize, *Fl. Trop. E. Africa*, Gramineae 3: 609 (1982). Epithet Latin for sheathed, presumably referring to the leaf sheath.

Illustration: F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 331 fig. 54(8, 9) (1980), as *P. distichum*.

Perennial stoloniferous herb; erect culms to 35 cm. Leaves scattered along culm; margin smooth; lamina 5–12 cm long, 3–6 mm wide; sheath obscurely keeled, green to slightly purplish at base, 1–3.5 cm long with few bulbous-based hairs at apex at ligule. Inflorescence 2.5–5 cm long, of 2 or 3 racemes, each 1.5–2.5 cm long, with spikelets overlapping in 2 rows alternately on lower side. Spikelets c. 3.5 mm long, acute; lower glume absent; upper glume and lower lemma c. 3.5 mm long. Upper lemma and palea indurated, c. 3 mm long. *Salt Water Couch*.

Cocos (Keeling) Is. Grows in moist depressions in herbfields with *Sesuvium portulacastrum* in coralline sand on North Keeling Is. lagoon margins, sometimes inundated at high tide. Widespread through the tropics and warm temperate regions, including mainland Australia.

C.K.Is.: lagoon margin, North Keeling Is., *I.R.Telford 10033 & C.Howard* (AD, BRI, CBG, K, MEL, NSW, PERTH); sand spit at lagoon entrance, North Keeling Is., *D.G.Williams 38* (BISH, BRI, CBG).

26. AXONOPUS

Axonopus P.Beauv., *Ess. Agrostogr.* 12, 154 (1812); from the Greek *axon* (an axis) and *pous* (a foot), in reference to the rachises which in some species arise from a central point, as the spikes of a wheel.

Type: *A. compressus* (Sw.) P.Beauv.

Tufted to creeping, stoloniferous grasses. Leaf lamina flat to involute; ligule a minute, membranous rim. Inflorescence of 2–several slender racemes in an apical whorl or scattered along a short axis; spikelets single, in 2 rows on two sides of a narrow, 3-sided raceme. Spikelets elliptic, acute, awnless, compressed, sometimes bristly or hairy, with 1 fertile floret subtended by a sterile lemma, falling entire at maturity. Lower glume absent. Upper glume and sterile lemma subequal, as long as the spikelet, enclosing the fertile floret. Fertile lemma and palea coriaceous, pale.

A large genus containing c. 110 species from tropical and subtropical America, 1 from Africa and 1 from Easter Is.; 1 species, used widely as a lawn grass in the humid tropics, has been introduced on Christmas Is.

*Axonopus compressus (Sw.) P.Beauv., *Ess. Agrostogr.* 154, 167 (1812)

Milium compressum Sw., *Prodr.* 24 (1788). T: Jamaica, *R.Shakespear*; iso: BM. Epithet from the Latin *compressus* (flattened), descriptive of the shoots.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 188, fig. 39 (1971).

Creeping, stoloniferous grass, 15–40 cm tall; flowering shoots flattened, ascending. Leaves mostly towards culm base, blunt, tapering at base; margins usually ciliate, often undulate; lamina 3–17 cm long, 5–10 mm wide; sheath keeled. Inflorescences often several on one shoot; racemes 3–9 cm long, very slender, 3 or occasionally 2, with one raceme inserted on culm below the terminal pair; spikelets well-spaced, in single rows tending towards one side of rachis. Spikelets small, narrowly elliptic, acute, c. 2.5 mm long, compressed, finely pubescent, yellowish. Glume and sterile lemma c. 2.5 mm long, pubescent. Fertile lemma and palea c. 2 mm long, coriaceous. *Carpet Grass*.

Christmas Is. Introduced as a lawn grass and common in the settled areas in the E of the island, especially along roads, often forming spreading circular patches. It also occurs elsewhere on forest margins and cleared areas. A native tropical and subtropical species from America and the West Indies, now widely grown in wet, tropical areas as a pasture and lawn grass, often becoming naturalised. It occurs in Australia (Qld, N.S.W.), and is an abundant species in Malesia.

Ch.Is.: cleared areas, *D.A.Powell 481* (K); no precise locality, *D.A.Powell 766A* (K); entrance to golf course, *R.Shivas 829* (PERTH); central plateau, in forest at edge of Natl Park, *R.Shivas 964* (PERTH).

The low, mat-forming habit and general toughness of this species make it suitable for lawns, although it is rather coarse.

27. SETARIA

Setaria P.Beauv., *Ess. Agrostogr.* 51, 178 (1812), *nom. cons.*; from the Latin *seta* (a bristle, a stiff hair), in reference to the one or more bristles inserted below the spikelets.

Type: *S. viridis* (L.) P.Beauv., *typ. cons.*

Often tufted grasses, sometimes stoloniferous or decumbent. Leaf lamina sometimes ribbed or inrolled; ligule ±ciliate. Inflorescence a panicle, often with spikelets remaining ±appressed around main branchlets, or around central axis; spikelets solitary or sometimes clustered, mostly subtended by 1 to many persistent bristles. Spikelets oblong to ovate, awnless, with 1 bisexual floret above a male or sterile floret, falling entire at maturity. Glumes usually shorter than spikelet, unequal, the lower glume shorter. Lower lemma

shorter than or as long as spikelet, clasping fertile lemma, usually membranous. Fertile lemma crustaceous; margins inrolled.

A pantropical and subtropical genus of c. 100 species; 2 species recorded from Christmas Is., but only 1 has been confirmed with a specimen. H.N.Ridley (*J. Straits Branch Roy. Asiat. Soc.* 45: 242, 1906) also recorded *S. glauca* P.Beauv., now known as *S. pumila* Roem. & Schult., a widespread, weedy species of disturbed sites in the Old World, and introduced in America. He recorded collecting a single plant on Phosphate Hill, in an area cultivated by the Chinese community, but it has not been recorded again. This genus can generally be recognised by the bristles below the spikelets, considered to be reduced inflorescence branchlets which no longer carry a spikelet.

Setaria italica (L.) P.Beauv. (Foxtail Millet) is cultivated as a cereal in China, and the heads are sold as food for caged birds in Europe and elsewhere.

P.Jansen, Notes on Malaysian Grasses I, *Reinwardtia* 2: 339–343 (1953).

Setaria clivalis (Ridl.) Veldkamp, *Misc. Pap. Landbouwhogeschool* (*Wageningen*) 19: 315–320 (1980)

Panicum clivale Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 242 (1906). T: Toms Ladder, Flying Fish Cove, Christmas Is., Sept.–Nov. 1904, *H.N.Ridley 99*; holo: SING *n.v.*; iso: BM. Epithet from the Latin *clivus* (a hill, a slope), reflecting the habitat from which the type specimen was collected.

S. laxa var. *navitatis* Jansen, *Reinwardtia* 2: 343 (1953) [in error for '*nativitatis*']. T: Christmas Is., *H.N.Ridley 99*; holo: SING *n.v.*; iso: BM.

Illustration: J.F.Veldkamp, *Misc. Pap. Landbouwhogeschool* (*Wageningen*) 19: 317, fig. 1 (1980).

Loosely tufted grass, 15–30 cm tall; flowering culms slender, ±ascending, bent at lower nodes. Leaves mostly towards culm base, flat, glabrous; lamina 4–9 cm long, 2–4 mm wide; sheath rounded. Panicle lax, 5–9 cm long; branchlets slender, flexuose; spikelets mostly solitary, remaining ±appressed to main branchlets. Spikelets small, elliptic, acute, c. 3 mm long, glabrous, purplish, subtended by a slender bristle 2–7 mm long. Glumes ovate, membranous, shorter than spikelet; lower glume c. 1 mm long, sheathing spikelet base; upper glume c. 2 mm long. Lower lemma as long as spikelet. Upper lemma c. 3 mm long, ±coriaceous, with inrolled margins.

Christmas Is. H.N.Ridley, *loc. cit.*, recorded this species as growing in 'the dry earth above Tom's Ladder', but it has not been collected since then. The above description is based on the rather small specimen collected by H.N.Ridley. An uncommon, Malesian species with a restricted distribution in Christmas Is., Java and the Lesser Sunda Islands to Timor, and also recorded in the Philippines (Luzon) and Sumatra. It occurs in shady sites in forest or scrubland, and in coastal areas, preferring areas with a seasonal climate.

Ch.Is.: Toms Ladder, *H.N.Ridley 99* (BM).

This species was long known as *S. laxa* Merr., but J.F.Veldkamp, *loc. cit.*, pointed out that the name *Panicum clivale* Ridl. also referred to this species and that the publication date preceeded that of *S. laxa* by 6 months, hence the correct name is *S. clivale*.

P.Jansen, *loc. cit.*, distinguished H.N.Ridley's specimen from Christmas Is. as a distinct variety of *S. laxa*, on the basis of its glabrous laminas and sheaths, its flat (not involute) laminas, its solitary (not clustered) spikelets, its small panicles and its very long bristles below the spikelets. J.F.Veldkamp, *op. cit.* 320, argued that it was a smaller, rather depauperate specimen of *S. laxa*, and this opinion is followed here.

28. STENOTAPHRUM

Stenotaphrum Trin., *Fund. Agrost.* 175 (1822); from the Greek *steno* (narrow), and *taphros* (a trench), in reference to the depressions along the inflorescence axis.

Type: *S. glabrum* Trin. = *S. dimidiatum* (L.) Brongn.

Annual or perennial stoloniferous monoecious herbs. Leaf lamina flat or folded; ligule a hairy rim. Inflorescence axillary or terminal, spike-like, of racemes partially immersed in depressions and alternating on opposite sides of the thickened axis. Spikelets: lower glume small, nerveless; upper glume longer, 7-nerved. Florets: lower floret male or sterile, the upper bisexual, the lower lemma obtuse, nerveless, the upper longer, acute, 3–5-nerved; palea shorter than lemmas, 2-nerved, margins translucent.

A genus of 7 species of tropical and subtropical coasts; 1 species on Cocos (Keeling) Is. and the Coral Sea Is., also in mainland Australia and adjacent islands.

J.D.Sauer, *Brittonia* 24 (2): 202–222 (1972).

Stenotaphrum micranthum (Desv.) C.E.Hubb. in C.E.Hubbard & R.E.Vaughan, *Grasses of Mauritius and Rodriguez* 73 (1940)

Ophiurinella micrantha Desv., *Opusc. Sci. Phys. Nat.* 75 t. 5 fig. 4 (1831). T: Bourbon [Reunion Is.]; *coll. unknown*; *n.v.* Epithet from the Latin *micro* (small) and *anthos* (a flower), in reference to the small spikelets.

Illustrations: F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 320, fig. 21(8, 9) (1980); A.B.Cribb & J.W.Cribb, *Pl. Life Great Barrier Reef & Adjacent Shores* 184 (1985).

Annual or perennial herb; flowering culms to 50 cm tall. Leaves scattered along culms, narrowly ovate; lamina 3–12 cm long, 4–10 mm wide; sheath 1–5 cm long. Inflorescence 5–15 cm long. Spikelets many, 3–3.5 mm long, in short racemes of 1–6 immersed in depressions of axis; upper glume as long as spikelet, membranous. Florets: lower lemma as long as spikelet; upper lemma and palea leathery. Fig. 91H–I.

Cocos (Keeling) Is., Coral Sea Is. Grows in herbfield and at top of beaches often with *Lepturus repens* in coralline sand. Widespread on coasts through the tropical Indian and Pacific Oceans, including Australia.

C.K.Is.: top of lagoon beach, North Keeling Is., *I.R.Telford 10012 & C.Howard* (AD, CBG, K); settlement, top of beach, West Is., *I.R.Telford 9985 & C.Howard* (CBG, K, PERTH). C.S.Is.: Georgina Cay, Lihou Reef, *S.Hogg 51* (BRI, CBG, K, MEL); Turtle Is., Lihou Reef, 12 Dec. 1979, *K.McNamara & A.Stokes* (CANB).

29. RHYNCHELYTRUM

Rhynchelytrum Nees in J.Lindley, *Nat. Syst.* 2nd edn, 378, 446 (1836), as *Rhynchelythrum*, corrected by C.G.D.Nees, *Fl. Afr. Austral.* errata (1841); from the Greek *rhynchos* (a beak) and *elytron* (a covering, a wrapping), in reference to the beaked and awned upper glume and lower lemma in the type species.

Type: *R. dregeanum* Nees

Tufted to clump-forming grasses with suberect to erect culms. Leaf lamina flat; ligule a ring of cilia. Inflorescence a panicle. Spikelets compressed, often awned, long-hairy to glabrous, with 1 fertile floret subtended by a male or sterile lemma, falling entire at maturity. Lower glume very small. Upper glume and lower lemma similar, often tapering to an apical beak, often awned, often covered in silky hairs, as long as spikelet and enclosing the fertile floret. Fertile lemma and palea subcoriaceous, ±glabrous, pale.

An African genus containing c. 14 species, with 1 species widely introduced elsewhere in the tropics and subtropics, including Christmas Is. and Australia. They mainly occur in open grassland and in disturbed sites.

***Rhynchelytrum repens** (Willd.) C.E.Hubb., *Kew Bull.* 1934: 110 (1934)

Saccharum repens Willd., *Sp. Pl.* 1: 322 (1798). T: Guinea [Ghana], *P.E.Isert*; holo: B, photograph seen (K). Epithet from the Latin *repens* (creeping), suggesting a creeping growth habit, which is, however, inappropriate to this species.

Illustration: W.D.Clayton & S.A.Renvoize in R.M.Polhill (ed.), *Fl. Trop. E. Africa*, Gramineae 3: 516, fig. 125 (1982).

Medium-sized, loosely tufted grass, 40–80 cm tall; culms erect or ascending. Leaves scattered along culm, slender, tapering at base; lamina 7–20 cm long, 2–5 mm wide; sheath rounded, sparsely hairy. Panicle 10–15 cm long, feathery and soft, usually purple-pink, occasionally silvery-white; branchlets whorled. Spikelets 7–8 mm long, including indumentum of long, straight, purplish hairs. Lower glume minute, c. 1 mm long, purple-hairy. Upper glume and lower lemma c. 3 mm long, beaked and awned; awn inconspicuous among many soft, usually purplish hairs c. 5 mm long. Fertile lemma and palea c. 2 mm long, ±coriaceous, pale. *Red Top Grass*.

Christmas Is. Apparently introduced relatively recently and appears to be spreading along roadsides, where it can form extensive stands. Also capable of colonising cleared and mined areas. It is most common in the E of the island, around the airport, and along the roads around Drumsite and Settlement. A native of tropical to warm-temperate southern Africa, its distribution now greatly extended to most tropical and subtropical countries, Malesia, and Australia (W.A., N.T., Qld, N.S.W., Vic.).

Ch.Is.: along roads, *D.A.Powell 222* (K); alongside railway at Camp 4, *B.A.Mitchell 112* (CBG, K); at edge of railway track, opposite Australian National Parks and Wildlife Service building, Drumsite, *R.Shivas 884* (PERTH); recently mined area, south of Wharton Hill, *D.J. & B.P.Du Puy CI80* (CBG, K).

An attractive, conspicuous species, with purple-pink inflorescences that are particularly striking in the morning or evening sunshine.

30. DIGITARIA

Digitaria Haller f., *Hist. Stirp. Helv.* 2: 244 (1768), *nom. cons.*, *non* Heister ex Fabricius (1759); from the Latin *digitus* (a finger), alluding to the whorled, digitate inflorescence of some of the species in this genus.

Type: *D. sanguinalis* (L.) Scop.

Tufted to stoloniferous grasses. Leaf lamina narrowly ovate to linear, rolled in bud; ligule membranous. Inflorescence usually of 2–several racemes in an apical whorl, or scattered along a central axis; spikelets usually 2 or 3 together, often on unequal pedicels, appressed, in 2 rows along the ±flattened rachis. Spikelets narrowly ellipsoidal, acute, with 1 fertile floret subtended by a sterile lemma, falling entire at maturity. Lower glume minute or absent. Upper glume often shorter than the spikelet, sometimes much reduced, usually hairy. Sterile lemma usually as long as spikelet, clasping the fertile floret, acute, usually hairy. Fertile lemma and palea thinly coriaceous.

A large and complex genus of c. 170–200 species, distributed mainly in tropical and subtropical regions, especially in Africa, extending into warm-temperate regions; 2 weedy species occur on Christmas Is., 1 of these is also on Cocos (Keeling) Is.; 1 species native on Ashmore Reef; 1 species native on the Coral Sea Is. Many species occur in grasslands and disturbed sites, often as pioneers. A few species are cultivated as minor cereal crops, and some as pasture grasses.

J.F.Veldkamp, A revision of *Digitaria* Haller (Gramineae) in Malesia, *Blumea* 21: 1–80 (1973).

1 Racemes usually 4–10, rarely 3, per inflorescence (C.K.Is., Ch.Is.) **1. D. setigera**

1: Racemes 2 or 3 per inflorescence

2 Lower lemma ciliate with rigid spreading yellow or brown bristles (C.S.Is.) **4. D. ctenantha**

2: Lower lemma lacking rigid coloured bristles

3 Plant stoloniferous, creeping (Ch.Is.) **2. D. radicosa**

3: Plant tufted (A.R.) **3. D. mariannensis**

1. Digitaria setigera Roth, in J.J.Roemer & J.A.Schultes, *Syst. Veg.* 2: 474 (1817)

T: India, *B.Heyne s.n.*; holo: probably B *n.v.* Epithet from the Latin *seta* (a bristle, a stiff hair) and *gerere* (to carry, to bear), in reference to the few bulbous-based bristles on the leaf sheaths.

[*Panicum sanguinale auct. non* L.: H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 241 (1906), as *sanguniale* var. *commutatum*]

[*D. sanguinalis auct. non* (L.) Scop.: C.W.Andrews, *Monogr. Christmas Is.* 192 (1900)]

Illustration: C.-C.Hsu, *Taiwan Grasses* 518 (1975).

Straggling, loosely tufted grass, 20–50 cm tall; culm base ±decumbent, sometimes rooting from lower nodes. Leaves scattered along culm; lamina 6–20 cm long, 4–8 mm wide; margin often minutely undulate; sheath rounded. Racemes 7–12 cm long, slender, 4–8 in an apical whorl, or often with some subapical racemes; spikelets paired, one pedicellate, in 2 rows along rachis. Spikelets narrowly ellipsoidal, acute, c. 3 mm long. Lower glume absent. Upper glume minute, less than 1/4 the length of spikelet, c. 0.5 mm long, ciliate. Sterile lemma c. 3 mm long, acute; margins with appressed, silky hairs. Fertile lemma and palea c. 2.5 mm long, glabrous. *Hairy Crab-grass*.

Christmas Is., Cocos (Keeling) Is. Not common on Christmas Is., occurring behind the sea cliffs on the east coast around South Point, and also colonising roadsides and disturbed land. On Cocos (Keeling) Is., grows in disturbed, open sites in coralline sand. A widespread species in tropical and subtropical SE Asia, from Sri Lanka, India and China through Indo-China and Malesia to northern Australia (W.A., Qld) and the Pacific islands. It also occurs rarely in Africa and Madagascar, and has been introduced in the West Indies.

Ch.Is.: no precise locality, *C.W.Andrews 25 p.p.* (K); shore terrace, South Point, *D.A.Powell 647* (K); entrance to golf course, *R.Shivas 822* (PERTH). C.K.Is.: at settlement, West Is., *I.R.Telford 9948 & C.Howard* (AD, CBG, K); E verge of airstrip, West Is., *D.G.Williams 91* (CBG, PERTH).

C.W.Andrews (*Monogr. Christmas Is.* 192, 1900) indicated that this species was common on the shore cliffs on Christmas Is., and H.N.Ridley (*J. Straits Branch Roy. Asiat. Soc.* 241, 1906) recorded its presence in 1890, just two years after settlement was established on the island. Although Ridley considered that it had been introduced, it seems possible that it is indigenous, originally as a plant of the sea cliffs. This species has also been known as *D. microbachne* (C.Presl) Henr. in SE Asia.

2. Digitaria radicosa (C.Presl) Miq., *Fl. Ind. Bat.* 3: 437 (1857)

Panicum radicosum C.Presl, *Rel. Haenk.* 1: 297 (1830). T: Luzon, Philippines, *T.P.X.Haenke s.n.*; holo: PR *n.v., fide* J.F.Veldkamp, *op. cit.* 35. Epithet from the Latin *radix* (a root), in reference to the creeping habit, with many roots forming at the nodes.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 199, fig. 41 (1971), as *D. timorense*.

Fine, creeping, mat-forming grass; flowering culms erect, 12–30 cm tall; stolons very slender. Leaves mainly towards culm bases; lamina 1–7 cm long, 1–4 mm wide; sheath rounded. Racemes 2 or 3 at culm apex, 3–9 cm long, slender; spikelets paired, one pedicellate, in 2 rows along one side of rachis. Spikelets narrowly ellipsoidal, c. 3 mm long, acute. Lower glume present, minute 0.1–0.3 mm long. Upper glume c. 1/2 length of spikelet, c. 1.4 mm long; margins ciliolate. Sterile lemma c. 3 mm long, acute; margins appressed-ciliolate. Fertile lemma and palea c. 2.5 mm long, glabrous.

Christmas Is. Common on roadsides and disturbed ground around the inhabited areas from Drumsite to Settlement, often forming low, bright green mats. An Old World species of the

humid tropics, distributed from Madagascar, India and China, through Indo-China and Malesia to the SW Pacific islands (Polynesia). It is rare in Australia (Qld), and has been recorded as introduced in Africa.

Ch.Is.: verges of roads, Drumsite, *D.A.Powell 761* (K); edge of railway track, Drumsite, *R.Shivas 883* (PERTH); in landscaped park known as Nursery, Drumsite, *R.Shivas 988* (PERTH).

H.N.Ridley (*J. Straits Branch Roy. Asiat. Soc.* 45: 241, 1906) recorded a dwarf variant of his *Panicum sanguinale* (*Digitaria setigera*), with 'narrow, bright green foliage, slender and few spikes and slightly ciliated glumes', which may refer to this species. It was recorded at Phosphate Hill, Flying Fish Cove and Waterfall, in dry, open localities. *Digitaria radicosa* is also commonly known as *D. timorensis* (Kunth) Balansa, in SE Asia, but *D. radicosa* is accepted here, following J.F.Veldkamp (*Blumea* 21: 37, 1973).

3. **Digitaria mariannensis** Merr., *Philipp. J. Sci., Bot.* 9: 54 (1914)

Syntherisma mariannensis (Merr.) Hosok., *Trans. Nat. Hist. Soc. Formosa* 24: 198 (1934). T: Marianas Is., *MacGregor 372*; holo: US; iso: K, *fide* J.F.Veldkamp, *Blumea* 21: 27 (1973). Epithet from the type locality, the Marianne Islands, and *-ensis*, the Latin suffix indicating place.

Illustration: J.F.Veldkamp, *op. cit.* 28, fig. 3a, b.

Annual tufted grass; culms much-branched, ascending; flowering culms to 60 cm tall. Leaves mainly towards culm base, narrowly ovate to linear; lamina 1.5–12 cm long, 2–6 mm wide; sheath 1–6 cm long, puberulous. Inflorescence of 2–8 racemes along up to 1 cm of common axis of culm apex; racemes 2–12 cm long. Spikelets solitary, sessile, 2.5–3.5 mm long. Lower glume absent or a minute scale. Upper glume a villous scale to 0.25 mm long; sterile lemma ±as long as spikelet, glabrous or puberulous, 9–13-nerved. Bisexual floret as long as spikelet. Fig. 4.

Ashmore Reef. Grows in herbfield in coralline sand. Occurs on strands through the NE Indian and W Pacific Oceans.

A.R.: Middle Is., *J.Hicks 22* (CBG); West Is., *K.F.Kenneally 6349* (CANB, PERTH); West Is., 26 Oct. 1987, *M.Hinchey* (BRI, CBG).

Elsewhere, 2 forms occur in populations – typical *D. mariannensis* as described above and 'subsp. *pectinata*' (J.F.Veldkamp, *op. cit.* 28–29) with sterile lemmas bearing yellowish bristles. This latter form has not been collected from Ashmore Reef.

4. **Digitaria ctenantha** (F.Muell.) Hughes, *Kew Bull. Misc. Inform.* 1923: 310 (1924)

Panicum ctenanthum F.Muell., *Fragm.* 8: 153 (1874). T: Sturt and Hooker Creek, [N.T.], *F.Mueller*; holo: MEL. Epithet from the Greek, *cten* (a comb) and *anthos* (a flower), in reference to the rigid bristles on the lemmas of some spikelets.

Annual or perennial tufted herb; culms decumbent to erect, rooting at lower nodes; flowering culms to 40 cm tall. Leaves mainly towards culm base, narrowly ovate to linear; lamina 3–10 cm long, 3–6 mm wide; sheath 2–5 cm long. Inflorescence of 2 or 3 racemes; racemes 3–9 cm long. Spikelets paired, 3.5–5.5 mm long, 1 short-pedicellate, 1 long-pedicellate. Lower glume absent or to c. 1 mm long. Upper glume c. 3/4 length of lower lemma. Lemma of short-pedicellate spikelet with short, soft hairs on margin. Lemma of long-pedicellate spikelet similar and ciliate with rigid bristles 1–1.5 mm long. *Comb Finger Grass*.

Coral Sea Is. Recorded from herbfield in coralline sand on two cays. Widespread across tropical Australia.

C.S.Is.: SW Is., Coringa Is., *S.Hogg 37* (CANB); SE Cay, Magdelaine Cays, Oct. 1987, *T.Scotney & W.Jeffs* (BRI, CBG); SE Cay, Magdelaine Cays, *S.Hogg 25* (CANB, CBG).

31. CENCHRUS

Cenchrus L., *Sp. Pl.* 2: 1049 (1753); *Gen. Pl.* 5th edn, 470 (1754); from the ancient Greek name *kenchros*, for millet, arbitrarily applied to this genus by C.Linnaeus.

Type: *C. echinatus* L.

Annual or perennial, erect to straggling grasses, sometimes rhizomatous or stoloniferous; culms usually decumbent, rooting at lower notes. Leaf lamina flat or involute, linear; ligule a fringe of hairs. Inflorescence a cylindrical, unbranched, false spike, the spikelets enclosed by many bristles or spines which are variously combined into a coriaceous cup, the complete unit forming a burr, these closely spaced around the central axis and falling entire at maturity. Spikelets ovate, acute to acuminate, compressed, with 1 fertile floret subtended by a sterile or male floret. Lower glume short or absent. Upper glume and lower floret ±as long as spikelet, enclosing fertile floret. Fertile lemma and palea firm to coriaceous. *Burr Grasses.*

A pantropical and subtropical genus containing c. 22 species, with greatest diversity in America and Africa; 3 endemic and 7 naturalised species in Australia; 1 species naturalised on Christmas Is., 2 species naturalised on Cocos (Keeling) Is. and 2 species naturalised on Ashmore Reef. The genus includes a few pasture grasses, and some species with spiny burrs are regarded as troublesome weeds.

D.G.De Lisle, Taxonomy and distribution of the genus *Cenchrus*, *Iowa State J. Sci.* 37: 259–351 (1963); A.S.Weston, The genus *Cenchrus* (Poaceae) in Australia, *Nuytsia* 1(4): 375–380 (1974).

1 Involucre with inner whorl fused for less than 1/3 length; barbs of bristles antrorse; leaf blades 2–5 mm wide (C.K.Is., A.R.) **3. C. ciliaris**

1: Involucre with inner whorl fused for more than 1/3 length; barbs of bristles retrorse; leaf blades 4–13 mm wide

2 Outer bristles ±equal to inner spines; inflorescence crowded (Ch.Is., A.R.) **1. C. brownii**

2: Outer bristles shorter than inner spines; inflorescence ±open (C.K.Is.) **2. C. echinatus**

1. *Cenchrus brownii Roem. & Schult., *Syst. Veg.* 2: 258 (1817)

C. inflexus R.Br., *Prodr.* 1: 195 (1810), *nom. illeg., non* Poir. (1804). T: Arnheim South Bay, [Caledon Bay, N.T.], 1803, *R.Brown*; holo: BM. Epithet after Robert Brown (1773–1858), the famous Scottish botanist who made important early collections and studies of the Australian flora.

Illustrations: D.G.De Lisle, *Iowa State J. Sci.* 37: 287, fig. 6A–E (1963); A.S.Weston, *Nuytsia* 1(4): 377 fig. 1D (1974).

Erect to straggling grass, 15–60 cm tall; culm bases sometimes decumbent and rooting at the nodes. Leaves scattered along culms; lamina 5–35 cm long, 5–12 mm wide; sheath keeled, 6–12 cm long. Inflorescence 3–12 cm long, with many densely crowded burrs. Burrs 3.5–4 mm diam.; outer whorl of slender, barbed bristles to 7 mm long, surrounding a rigid cup with intercrossing spines of similar length. Spikelets 2–4 per involucre, 4–5.5 cm long, acuminate, protruding among spines of the burr. Lower glume c. 1/2 length of spikelet. Upper glume and lower floret ±equal, enclosing coriaceous fertile floret. *Burr Grass*. Fig. 93E–F.

Christmas Is., Ashmore Reef. A frequent weedy species on Christmas Is. occurring along roads and railways, and in populated areas in the north and east. On Ashmore Reef recorded for East and Middle Is. in herbfield in coralline sand. A native of tropical and subtropical central and southern America and the West Indies, now widely naturalised in SE Asia, Malesia, the Philippines, Australia and the Pacific islands.

Ch.Is.: alongside railway at camp 4, *B.A.Mitchell 113* (CBG, K); entrance to golf course, *R.Shivas 836* (PERTH); trackside, near sea, Settlement, *D.J. & B.P.Du Puy, CI103* (CBG, K). A.R.: East Is., *J.Hicks 24* (CBG); Middle Is., 12 Mar. 1986, *A.Grant* (CBG).

The barbed bristles allow the burrs of this grass to cling tenaciously to the clothing of anyone brushing against them.

2. *Cenchrus echinatus L., *Sp. Pl.* 2: 1050 (1753)

T: from America; *n.v.* Epithet from the Greek *echinos* (a sea-urchin), in reference to the spiny involucre.

Illustrations: A.S.Weston, *Nuytsia* 1(4): 377, fig. 1AW (1974); F.R.Fosberg & S.A.Renvoize, *Fl. Aldabra, Kew Bull. Add. Ser.* 7: 321, fig. 51(1, 2) (1980).

Annual or perennial erect or straggling grass; flowering culms to 40 cm tall. Leaves scattered along culm; lamina 7–20 cm long, 4–8 mm wide; sheaths 6–8 cm long. Inflorescence 3–9 cm long, ±open. Burrs 4–7.5 mm diam., green to purplish; outer whorl of slender retrorsely barbed bristles; inner whorl of spines 4–8 mm long, fused for 1/3–1/2 length. Spikelets 1–6 per involucre, 4.5–6 mm long. Lower glume 1–3 mm long. Upper glume c. 3/4 length of spikelet. Lower floret male with lemma ±equal to spikelet. Upper floret with lemma as long as spikelet. *Mossman River Grass*.

Cocos (Keeling) Is. A weed of open areas in coralline sand. Native of tropical and warm temperate America, now widely naturalised, including mainland Australia (W.A., NT., Qld, N.S.W.).

C.K.Is.: settlement, West Is., *I.R.Telford 9944 & C.Howard* (AD, CBG, K); settlement, West Is., *D.G.Williams 197* (CBG).

A troublesome weed, easily distributed by its clinging burrs.

3. *Cenchrus ciliaris L., *Mant. Pl.* 302 (1771)

T: from America; *n.v.* Epithet from the Latin *cilium* (an eye-lash), in reference to the bristles on the burrs.

Erect perennial grass; flowering culms to 40 cm tall. Leaves scattered along culm; lamina 7–25 cm long, 2–5 mm wide; sheath 3–8 cm long. Inflorescence 2–10 cm long, dense. Burrs 3–5 mm diam. pale to purplish or black; outer whorl of slender antrorsely barbed bristles, pale to purplish black; inner whorl thickened, 3–9 mm long, fused at base for less than 1/3 length. Spikelets 1–3 per involucre, 2.5–5 mm long. Lower glume c. 1/2 length of spikelet. Upper glume 1/3–3/4 length of spikelet. Lower floret male or sterile, with lemma ±equal to spikelet. Upper floret with lemma as long as spikelet. *Buffel Grass*, *Black Buffel Grass*.

Cocos (Keeling) Is., Ashmore Reef. On Cocos (Keeling) Is. a weed of disturbed open areas. On Ashmore Reef recorded as not common around the wells on East Is. Native of N Africa and SW Asia, widely grown as a dry area fodder and widely naturalised, including all States of mainland Australia.

C.K.Is.: settlement, West Is., *I.R.Telford 9946 & C.Howard* (AD, CBG, K); rifle range, West Is., *D.G.Williams 82* (CBG). A.R.: near wells, East Is., *K.F.Kenneally 6367* (PERTH).

An apomictic variable species with several named cultivars used for pasture improvement in dry areas.

32. SPINIFEX

Spinifex L., *Mant. Pl.* 2: 163 (1771); from the Latin *spina* (a spine) and the suffix from e.g. *artifex* (a maker), in reference to the spine-like leaves of the type species.

Type: *S. squarrosus* L. = *S. littoreus* (Burm.f.) Merr.

Perennial stoloniferous grasses; dioecious. Leaf lamina inrolled or flat; ligule a dense rim of hairs. Male inflorescence a terminal cluster of racemes or spikes each of several 2-ranked spikelets and subtended by bracts, the inflorescence axis continuing beyond upper spikelets. Male spikelets: glumes ±equal, ovate, acute, 7- or 9-nerved; lemma 5- or 7-nerved; palea 2-nerved; florets both male. Bisexual inflorescence a globular head of sessile solitary spikelets subtended by a long bristle and several large bracts. Bisexual spikelet: lower

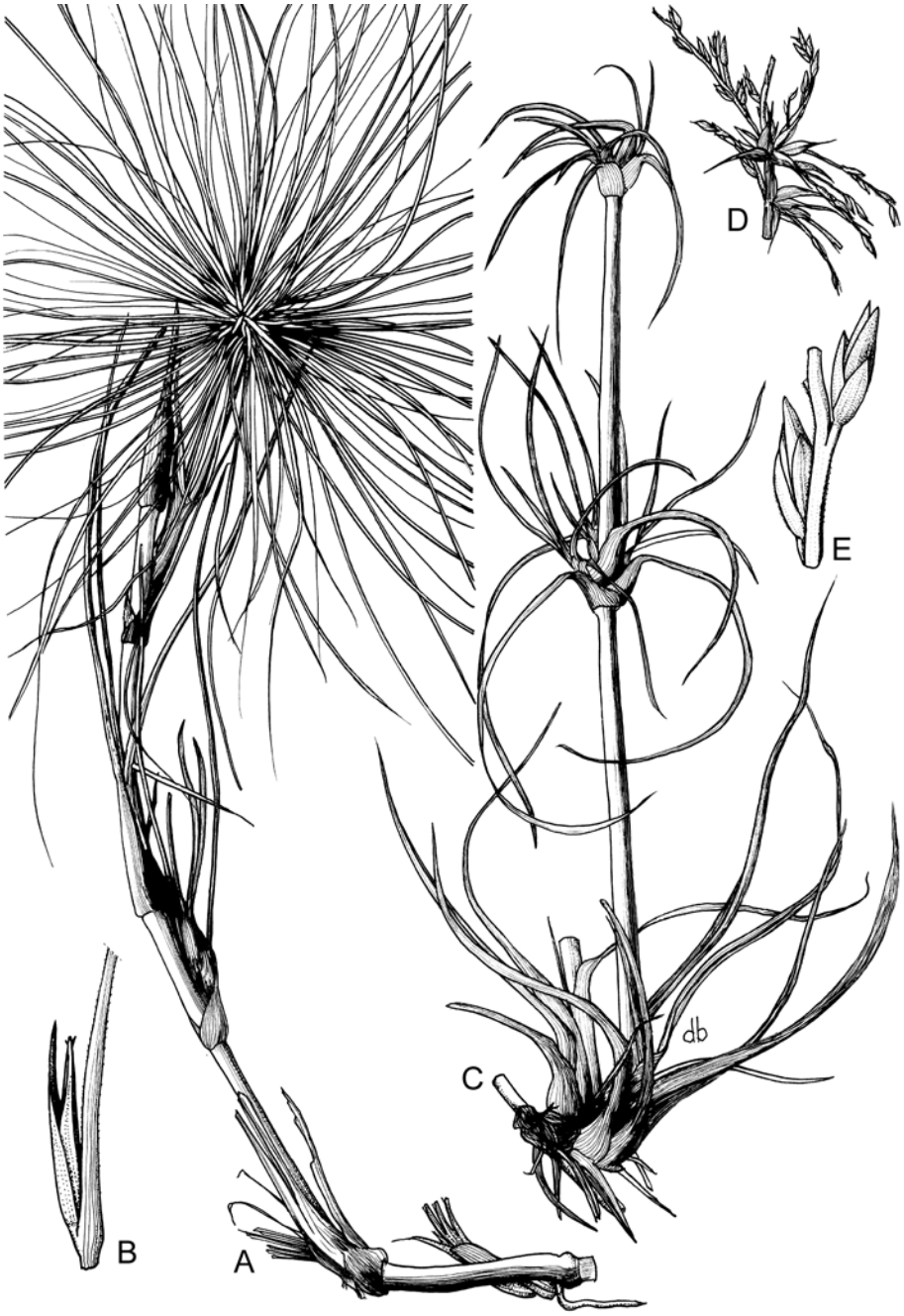

Figure 92. A–E, POACEAE: *Spinifex littoreus*. **A**, habit, showing an infructescence X0.5; **B**, fruiting spikelets X2.5 (**A–B**, M.Hinchey, Oct 1987, CBG). **C**, habit X0.5; **D**, male inflorescences X0.5; **E**, part of male inflorescence showing 2 spikelets X2.5 (**C–E**, M.Hinchey, Mar. 1988, CBG). Drawn by D.Boyer.

floret male or sterile, upper floret bisexual; glumes ovate, acute, the lower 9-nerved, the upper 7-nerved; lemma 5-nerved; palea ovate, acute, 5-nerved, absent from lower floret.

A genus of 4 species of the N and E Indian and W Pacific Ocean coasts including Australia; 1 species on Ashmore Reef; the 3 other species on mainland Australia. The inflorescence detaches intact, rolling and floating for seed dispersal.

Spinifex littoreus (Burm.f.) Merr., *Philipp. J. Sci., Bot.* 7: 229 (1912)

Stipa littorea Burm.f., *Fl. Ind.* 29 (1768). T: from India; *n.v.* Epithet Latin, pertaining to the sea-shore, referring to the beach habitat of the species.

Spinifex squarrosus L., *Mant. Pl.* 2: 163 (1771). T: from India; *n.v.*

Illustration: H.B.Gilliland, *Fl. Malaya* 3: 209, fig. 45 (1971).

Stolons long-creeping; culms erect, tufted, bushy, to 40 cm tall. Leaves inrolled, spine-like; lamina 3–20 cm long, 2–5 mm wide; sheath 1–5 cm long. Male inflorescences 3–10 cm long. Male spikelets c. 10 mm long; lower glume c. 5.5 mm long; upper glume c. 7 mm long. Bisexual inflorescences c. 30 cm diam.; bristles 8–15 cm long. Bisexual spikelet: glumes c. 9 mm long; lemma c. 9 mm long. *Beach Spinifex*. Fig. 92.

Ashmore Reef. Recorded from East and West Islands as common in tussocks in herbfield in coralline sand; also coasts of India, Sri Lanka, SE Asia and Indonesia.

A.R.: East Is., *J.Hicks 91* (CANB); West Is., 25 Oct. 1987, *M.D.Hinchey* (CBG, K, PERTH); West Is., 10 Mar. 1988, *M.D.Hinchey* (CBG).

33. SACCHARUM

Saccharum L., *Sp. Pl.* 1: 54 (1753); *Gen. Pl.* 5th edn, 28 (1754); from the Greek *saccharon* (sugar), indicating that the sap is sweet-tasting and rich in sugar.

Type: *S. officinarum* L., as *officinaram*

Large, erect grasses, sometimes rhizomatous and forming dense stands; basal culm nodes with 1–several rows of root initials. Leaf lamina often very broad; ligule membranous, sometimes hairy. Inflorescence a large, plumose panicle; spikelets paired along slender branchlets, which break up below each spikelet pair at maturity, the sessile spikelet falling with a small section of the branchlet, the pedicellate spikelet falling free. Spikelets with a whorl of long hairs from base, with 1 fertile and 1 sterile floret. Glumes subequal, membranous, enclosing florets. Sterile lemma and palea hyaline, shorter than spikelet. Fertile lemma hyaline, occasionally awned. Palea absent. *Sugar Canes*.

A pantropical and subtropical genus of some 35–40 species, usually in damp localities on river banks or valley floors, but also on open hillsides; 1 species has become naturalised on Christmas Is. *Saccharum officinarum* L., the true Sugar Cane, is the main source of commercial sugar and is grown throughout the tropics. It probably originated in New Guinea, as part of a complex of hybrids, based partially on *S. spontaneum*.

***Saccharum spontaneum** L., *Mant. Pl. Alt.* 183 (1771)

T: Malabar, India, *J.G.Koenig*, Herb. C.Linnaeus 77.1; holo: LINN. Epithet from the Latin *spontis* (voluntarily, of its own accord), but the reason for Linnaeus' choice is unclear.

Illustration: W.D.Clayton & S.A.Renvoize in R.M.Polhill (ed.), *Fl. Trop. E. Africa*, Gramineae 3: 705, fig. 161 (1982).

Robust, erect grass, to 3 m tall; culms to 2 cm thick, with 2 rows of root initials above lower nodes. Leaves alternating along culms, minutely serrulate; lamina to 150 cm long, 3 cm wide; sheath rounded. Panicle large, 20–50 cm long, feathery and soft; axis and branchlets silky-hairy; spikelets paired, one pedicellate. Spikelets c. 5 mm long, with many silky, white hairs c. 15 mm long from base. Lower and upper glumes 4–5 mm long, narrow, acute, membranous, enclosing florets. Lower floret an inconspicuous, hyaline lemma. Upper

floret with a hyaline lemma c. 3–5 mm long; palea absent. *False Sugar Cane*, *Tebu Salah*.

Christmas Is. Introduced by the Chinese community as a garden plant and now quite widespread in secondary vegetation. A variable species distributed from Africa, the Middle East, India and China, through Indo-China, Malesia to New Guinea and the Caroline Islands. It can form dense stands fringing rivers and lakes, but also occurs in forest margins and scrubland.

Ch.Is.: wayside plant, *D.A.Powell 587* (K); abandoned settlement at Camp 4, *R.Shivas 813* (PERTH).

The specimens from Christmas Is. have unusually broad leaves, suggesting some degree of hybridisation with *S. officinarum*, or some affinity with *S. arundinaceum* Retz. However, it can be distinguished from these species by its 2 rows of root initials above the culm nodes, its silky-hairy inflorescence axis and branchlets, and its very long spikelet hairs. The seeds are wind-dispersed, inside the fine-plumed spikelets. This is an attractive, strong-growing species that forms dense clumps and produces large silvery plumes, sometimes cultivated as a hedge plant. It is not cultivated for sugar on Christmas Is. but rather for its medicinal properties; the cane is crushed and the juice is made into a cool drink.

34. IMPERATA

Imperata Cirillo, *Pl. Rar. Neapol.* 2: 26 (1792); named after Ferrante Imperato (1550–1625), an Italian apothecary.

Type: *I. arundinacea* Cirillo, *nom. illeg.* = *I. cylindrica* (L.) P.Beauv.

Perennial erect grasses with creeping rhizomes, sometimes forming dense stands. Leaves mostly basal; lamina narrow, flat; ligule a scarious rim. Inflorescence a narrow, cylindrical, softly hairy, raceme-like panicle with appressed branchlets; spikelets paired, on unequal pedicels, falling entire at maturity. Spikelets small, narrow, awnless, with a whorl of long, silky hairs from base, with 1 fertile floret subtended by a sterile lemma. Glumes ±equal, membranous, long-hairy, as long as spikelet, enclosing fertile floret. Sterile lemma, fertile lemma and palea hyaline, shorter than spikelet. Palea enclosing grain.

A genus of c. 8 species distributed throughout the tropics and subtropics, extending into warm-temperate regions; 1 species introduced on Christmas Is. and Cocos (Keeling) Is. They occur in open, cultivated or disturbed land.

*Imperata cylindrica (L.) P.Beauv., *Nom. Bot.* 3rd edn, 10 (1797)

Lagarus cylindricus L., *Syst. Nat.* 10th edn, 2: 878 (1759). T: Herb. C.Linnaeus 96.2; syn: LINN. Epithet from the Latin *cylindrus* (a cylinder), descriptive of the cylindrical inflorescence.

Illustrations: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 221, fig. 48 (1971); W.D.Clayton & S.A.Renvoize in R.M.Polhill, *Fl. Trop. E. Africa*, Gramineae 3: 701, fig. 159 (1982).

Coarse, erect grass, 70–100 cm tall, forming extensive stands; rhizomes many, long-creeping, scaly; culm nodes hairy. Leaves mainly towards culm base, suberect, often inrolled; midvein whitish; lamina 20–70 cm long, 5–12 mm wide; sheath rounded. Panicle narrowly cylindrical, 10–16 cm long, silky hairy; spikelets mostly paired along branchlets; pedicels unequal. Spikelets 3–3.5 mm long, with many silky, white hairs at base; hairs 10-12 mm long. Glumes similar, narrow, membranous, sparsely long-hairy, as long as spikelet, enclosing florets. Lower lemma, and fertile lemma 1.5 mm long; apex lacerated, hyaline, fragile. Palea 1.2 mm long, hyaline. *Blady Grass*, *Lalang*.

Christmas Is., Cocos (Keeling) Is. Introduced for medicinal purposes by the Chinese community on Christmas Is., in two small patches. One of these patches, situated where the track to Grants Well crosses the railway line at Hanitch Hill, has been spread by bulldozing and now covers a large area. On Cocos (Keeling) Is. naturalised in one large roadside patch under Cocos plantation. Widely distributed in the Old World tropics, extending to the European Mediterranean, Australia (all States except W.A.), and Chile. It is a vigorous, invasive weed of cultivated and disturbed land.

Ch.Is.: no precise locality, *D.A.Powell 260* (K). C.K.Is.: c. 2.5 km NW of settlement, West Is., *I.R.Telford 9999 & C.Howard* (AD, CBG, K); 3 km N of kampong, W of Sydney Hwy, West Is., *D.G.Williams 22* (CBG, PERTH).

The amount of disturbance on Christmas Is. has left many habitats suitable for this weed. Only the young shoots are suitable as cattle fodder, and *Imperata* grassland is burned to provide grazing. This destroys any competing vegetation but does not damage the growing points of the grass. Species which could perhaps compete against it, and are already present on Christmas Is., include *Macaranga tanarius* (Euphorbiaceae), *Pipturus argenteus* (Urticaceae), *Muntingia calabura* (Ulmaceae), and *Leucaena leucocephala* (Mimosaceae). This grass is suitable for the manufacture of high quality paper. Beer is made from the rhizomes in western Malaysia. The rhizomes are used medicinally to prepare a tonic infusion, which also acts as a sedative and a diuretic.

35. SORGHUM

Sorghum Moench, *Meth. Pl.* 207 (1794), *nom. cons.*; from the Italian *sorgho*, for cultivated sorghum.

Type: *S. bicolor* (L.) Moench

Mostly robust, erect annual or perennial grasses, sometimes with rhizomes. Leaf lamina often broad; ligule usually a scarious rim. Inflorescence a large, much-branched panicle, with spikelets in dissimilar pairs, the sessile spikelet bisexual, broader than the male or sterile pedicellate spikelet, falling entire at maturity. Spikelets usually subtended by a whorl of short hairs, containing 1 fertile floret subtended by a sterile lemma, sometimes awned. Glumes as long as spikelet, enclosing floret, coriaceous; lower glume broader than the upper. Sterile lemma hyaline. Upper floret with hyaline lemma, which often has a long, bent awn projecting from spikelet.

The c. 20 species in this genus are native mainly to the Old World tropics and subtropics, with 1 endemic species in Mexico; 2 species have been recorded on Christmas Is., 1 of which also on Cocos (Keeling) Is. *S. bicolor* is an important tropical cereal, and with several other weedy species has been widely introduced elsewhere. The species occur on the fringes of forest and in open grassland, often on disturbed sites.

J.M.J.De Wet, Systematics and evolution of *Sorghum* sect. *Sorghum* (Gramineae), *Amer. J. Bot.* 65: 477–484 (1978).

Spikelets ellipsoidal, acute; lower glume pubescent, 3-toothed at apex; leaves c. 8–25 mm wide; rhizome present (Ch.Is.) **1. S. propinquum**

Spikelets subspherical, broadly obtuse or truncate; lower glume glabrous, with a ciliolate margin, not 3-toothed at apex; leaves up to 60 mm wide; rhizome absent (C.K.Is., Ch.Is.) **2. S. bicolor**

1. Sorghum propinquum (Kunth) Hitchc., *Lingnan Sci. J.* 7:249 (1929)

Andropogon propinquus Kunth, *Enum. Pl.* 502 (1833) & *Rev. Gram.* 2: (suppl.) 618 (1834); *A. affinis* C.Presl, *Rel. Haenk.* 1: 343 (1830), *nom. illeg., non* R.Br. (1810). T: without locality, *T.P.X.Haenke*; *n.v.* Originally described with the specific epithet *affinis* (neighbouring, allied to), indicating a close affinity to *S. halepense* (L.) Pers. but this epithet had already been applied to a different species, so Kunth substituted an epithet with a similar meaning, the Latin *propinquum* (near, adjacent, neighbouring).

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 230, fig. 50 (1971).

Robust, erect perennial grass, 1–1.5 m tall, with spreading rhizomes. Leaves scattered along culms; margins scabrid towards apex, smooth below; lamina 20–70 cm long, 8–25 mm wide; sheath rounded. Panicle 25–40 cm long, rather lax, the branchlets slender, with spikelets in dissimilar pairs. Spikelets with a basal whorl of short hairs; pedicellate spikelet 5.5–6 mm long, narrow, sparsely pubescent, usually male; sessile spikelet c. 5 mm long, broad, densely pubescent. Glume as long as spikelet, pubescent, coriaceous; lower glume 3-toothed; upper glume narrower, acuminate. Lower lemma fragile, hyaline. Lemma of upper

floret hyaline, occasionally with an awn to c. 10 mm long. *Wild Sorghum, Tebu Tikus*.

Christmas Is. Collected once on the edge of the main Drumsite to Settlement road, growing in the gutter. Native to SE Asia, from Sri Lanka, India and China, through Indo-China to Malesia and the Philippines.

Ch.Is.: Drumsite to Settlement road, *D.A.Powell 507* (K).

Closely related to *S. halepense* (L.) Pers., a species distributed from Eurasia to India, and widely introduced in warm-temperate regions, where it can become a serious weed. J.M.J.De Wet (*Amer. J. Bot.* 65: 477–484, 1978) indicated that they have different ploidy levels, *S. propinquum* being diploid and *S. halepense* tetraploid, but his descriptions do not adequately separate these two taxa on a morphological basis, and no key is given.

2. *Sorghum bicolor (L.) Moench, *Methodus* 207 (1794)

Holcus bicolor L., *Mant. Pl. Alt.* 301 (1771). T: Herb. Hort. Cliff. 468, *Holcus* 1; syn: BM. Epithet from the Latin *bis* (twice) and *color* (a colour), meaning bicoloured, descriptive of the dark glumes and light awns of the type specimen.

Illustration: J.W.Purseglove, *Trop. Crops – Monocotyledons* 1: 173, fig. 22 (1972).

Robust, erect annual grass 1–1.5 m tall, often single-stemmed, without rhizomes. Leaves scattered along culms, minutely but sharply serrulate; lamina 20–60 cm long, 20–60 mm wide; sheath rounded. Panicle large, 12–30 cm long, much-branched, dense, with spikelets in dissimilar pairs. Spikelet with a basal whorl of short hairs; pedicellate spikelet c. 4.5 mm long, narrow, sterile; sessile spikelet subspherical, c. 4 mm long. Glumes as long as spikelet, broadly obtuse or truncate, coriaceous, gaping at maturity; margins ciliolate. Lower lemma fragile, hyaline. Lemma of upper floret hyaline, usually with a twisted awn 4–6 mm long. *Grain Sorghum*.

Christmas Is., Cocos (Keeling) Is. Occurs occasionally on Christmas Is. outside cultivation, usually in disturbed ground. On Cocos (Keeling) Is., cultivated for stock feed and occurs as a sporadic escape.

Ch.Is.: Drumsite and the Central Area, *D.A.Powell 526* (K); roadside, 5 km S of airport, *R.Shivas 949* (PERTH). C.K.Is.: outside W boundary fence of Quarantine Station, West Is., *D.G.Williams 113* (CBG).

A cultivated cereal, probably developed in the Sudan but now an important cereal crop throughout the tropics for human and stock food. Numerous cultivars have been selected.

36. CHRYSOPOGON

Chrysopogon Trin., *Fund. Agrost.* 187–188 (1822), *nom. cons.*; from the Greek *chrysos* (golden) and *pogon* (a beard), in reference to the tufts of often golden hairs on the branchlets of the inflorescence, below the spikelets.

Type: *C. gryllus* (L.) Trin., *typ. cons.*

Tufted or occasionally creeping grasses. Leaf lamina rather broad; ligule often narrow, membranous. Inflorescence a narrow panicle of whorled branchlets; branchlets with 1 sessile, bisexual spikelet and 2 pedicellate, male spikelets. Sessile spikelet with a basal tuft of hairs extending along branchlet above the oblique line of articulation, falling entire at maturity, often with a basal hairy spinule. Spikelets narrow, containing 1 fertile floret subtended by a sterile lemma. Glumes as long as spikelet, enclosing floret, often aristate to shortly awned, membranous. Sterile lemma hyaline. Upper floret with a hyaline lemma, often long-awned in the sessile spikelet.

A mainly Old World genus of c. 26 species, distributed in tropical to warm-temperate zones, with greatest diversity in SE Asia and Australia; 1 species native to the New World; 1 widespread species introduced on Christmas Is. and Cocos (Keeling) Is. They occupy open, often disturbed positions in arid to humid habitats.

***Chrysopogon aciculatus** (Retz.) Trin., *Fund. Agrost.* 188 (1822)

Andropogon aciculatum Retz., *Obs. Bot.* 5: 22 (1789). T: illustration of *Gramen aciculatum* in G.E.Rumphius, *Herb. Amboin.* 6: 14, t. 5, fig. 1 (1750). Epithet from the Latin *acicula* (a small needle), after the slender, straight awn on the fertile lemma of the sessile spikelets.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 235, fig. 52 (1971).

Short, creeping grass with wiry, erect, flowering culms, 17–40 cm tall; mat-forming. Leaves clustered at culm base, often undulate; lamina 1–6 cm long, 3–5 mm wide; sheath weakly keeled. Panicle narrow, 5–9 cm long, purplish; whorled branchlets short, slender, ±erect, spreading only at anthesis, each branchlet with 3 spikelets. Spikelets subtended by a tuft of ginger hairs; pedicellate spikelets 2, male, c. 7 mm long, narrow, purple. Sessile spikelet bisexual, 4–5 mm long, pale. Glumes enclosing floret, ciliate, aristate, membranous. Sterile lemma hyaline, fragile. Fertile lemma hyaline, with a straight, yellow awn 6–7 mm long. *Golden Beard Grass*, *Temuchut*.

Christmas Is., Cocos (Keeling) Is. Probably introduced to Christmas Is. as a lawn grass at the former South Point Settlement, and now common in cleared areas, around habitation, and around the golf course. On Cocos (Keeling) Is., grows as a weed of open and grassed areas in coralline sand. A widely distributed tropical and subtropical grass, occurring from SE Asia, through Malesia to Australia (Qld) and the Pacific islands.

Ch.Is.: no precise locality, *D.A.Powell 478* (K). C.K.Is.: settlement, West Is., *I.R.Telford 10035 & C.Howard* (AD, CBG, K, PERTH); E verge of airstrip, West Is., *D.G.Williams 90* (CBG).

Used in the humid tropics as a lawn grass but usually considered a weed in lawns as it is rather coarse and the tough flowering culms are not efficiently cut by mowers.

The mature fertile spikelet separates from the branchlet at very oblique angle, forming a sharp, bearded barb which efficiently catches in the clothing of anyone who brushes against it. The spikelet becomes firmly embedded due to the cilia on the glumes, and the sharp base can become very irritant to the skin.

37. BOTHRIOCHLOA

Bothriochloa Kuntze, *Revis. Gen. Pl.* 2: 762 (1891); from the Greek *botherion* (a small hole or pit) and *chloe* (a grass), indicating the pitted glumes of some species.

Type: *B. anamitica* Kuntze

Perennial, rarely annual or biennial, mainly tufted grasses. Leaf lamina flat; ligule membranous. Inflorescence of few to many racemes in an apical whorl, or scattered along a short, central axis, occasionally with stalked groups of racemes; rachis fragmenting; spikelets paired; sessile bisexual florets conspicuously awned and sometimes larger than the pedicellate, male or sterile spikelets. Spikelets narrow, with sessile spikelets containing 1 fertile floret subtended by a sterile lemma, falling entire at maturity, attached to a small section of the rachis. Glumes as long as spikelet, enclosing floret, sometimes pitted. Sterile lemma hyaline. Fertile floret with a hyaline, long-awned lemma.

A pantropical genus of c. 35 species, usually occurring in open, grassy habitats; 1 species introduced on Christmas Is. and Cocos (Keeling) Is.

S.T.Blake, Studies in Gramineae 1, *Proc. Roy. Soc. Queensland* 80: 55–65 (1969)

***Bothriochloa bladhii** (Retz.) S.T.Blake, *Proc. Roy. Soc. Queensland* 80: 62 (1969)

Andropogon bladhii Retz., *Obs. Bot.* 2: 27 (1781). T: China, *P.J.Bladh*; holo: LD, photograph seen (K). Epithet after Peter K. Bladh (1746–1816), a Finnish employee of the Swedish East India Company, who collected plants in the Far East, especially around the major ports of China and Hong Kong.

Illustration: J.C.Tothill & H.B.Hacker, *Grasses SE Queensland* 84 (1973).

Erect, tufted grass, to c. 80 cm tall; culms grooved. Leaves slender, aromatic, scattered along culm, sparsely hairy; lamina 10–30 cm long, 2–5 mm wide; sheath ±rounded.

Inflorescence with several to many racemes scattered along a central axis, often with some racemes in stalked groups of 2–several; racemes 2–4.5 cm long, bristly with projecting awns; rachis and pedicels white-ciliate. Spikelets compressed, 3.5–4 mm long; spikelets awned, sessile, pubescent towards base. Glumes as long as spikelet, narrow, acute, somewhat coriaceous. Sterile lemma hyaline, fragile. Fertile floret lemma hyaline, with a twisted, yellow awn 9–13 mm long. *Blue Grass*.

Christmas Is., Cocos (Keeling) Is. Christmas Is., occurs on roadsides, cleared areas and occasionally on sea cliffs. On Cocos (Keeling) Is., occurs in open grassed areas in coralline sand. A widespread species in the Old World tropics, occurring from Africa, India and China, through Indo-China and Malesia to Australia (N.T., Qld) and the Pacific islands, preferring regions with a distinct dry season.

Ch.Is.: sea cliffs N of Waterfall, *D.A.Powell 443* (K); entrance to golf course, *R.Shivas 828* (PERTH); roadside, Central Plateau, *R.Shivas 928* (PERTH). C.K.Is.: c. 1 km N of settlement, West Is., *I.R.Telford 9969 & C.Howard* (AD, CBG, K); E verge of airstrip, West Is., *D.G.Williams 101* (BRI, CBG).

This species is part of a taxonomically confused group of species. It is also known as *B. intermedia* (R.Br.) A.Camus in SE Asia. It is sometimes difficult to distinguish from *B. pertusa* (L.) A.Camus, which can usually be recognised by its stoloniferous habit and sparse inflorescences with a short axis. Weaker specimens from Christmas Is. which would be placed in *B. pertusa* on the basis of the inflorescence are otherwise identical to more typical specimens of *B. bladhii*.

38. ISCHAEMUM

Ischaemum L., *Sp. Pl.* 2: 1049 (1753); *Gen. Pl.* 5th edn, 469 (1754); from the Greek *ischo* (to restrain, to check) and *haima* (blood), the ancient Greek name *ischaimon* being used for a grass with styptic properties, the seeds of the type species being reputed to arrest bleeding.

Type: *I. muticum* L.

Mostly decumbent to stoloniferous or rhizomatous grasses, occasionally tufted. Leaf lamina often abruptly narrowed at base; ligule membranous. Inflorescence usually of paired apical racemes, usually one-sided and appressed; spikelets paired; pedicellate spikelet often assymetrically compressed, sometimes reduced and with shorter awns, falling entire at maturity; sessile spikelet remaining attached to a section of rachis. Spikelets containing 2 florets. Glumes as long as spikelets ±coriaceous, often keeled, sometimes winged; upper glume often shortly awned. Lower floret often male; lemma and palea ±membranous. Upper floret usually bisexual, with hyaline lemma and palea; lemma awned to mucronate.

The c. 65 species in this genus occur mainly from SE Asia to the Pacific islands, with some in Australia, Africa and tropical America; 2 species on Christmas Is., 1 endemic, the other also on Cocos (Keeling) Is. They are tough grasses in a variety of habitats from damp and shady places to arid, exposed sites and in coastal sand, usually in poor soil.

P.Jansen, *Notes on Malaysian Grasses* 1: 292–301 (1953).

Spikelets not awned; a long-creeping, stoloniferous grass forming tangled mats (Ch.Is., C.K.Is.)	**1. I. muticum**
Spikelets with distinct awns c. 15 mm long; an erect, tufted grass (Ch.Is.)	**2. I. nativitatis**

1. Ischaemum muticum L., *Sp. Pl.* 2: 1049 (1753)

T: India, herb *C.Linnaeus 1214.1*; syn: LINN; Herb. C.Linnaeus (microfiche no. 406.17); syn: S, microfiche seen. Epithet from the Latin *muticus* (without a point), indicating the lack of awns in the spikelets.

Illustration: H.B.Gilliland, *Fl. Malaya* (*Grasses*) 3: 256, fig. 56A (1971).

Long-creeping, stoloniferous grass, 40 cm tall, forming extensive, tangled mats; stolons reddish. Leaves scattered along culm, rounded at base; margin rough; lamina 3–17 cm long, 5–15 mm wide; sheath rounded, with hairy margin. Racemes 2, appressed, appearing like a

solitary raceme, 2.5–5.5 cm long, sturdy, straw-yellow; pedicels and rachis stout, 3-angled, glabrous; spikelets paired, appressed to rachis. Spikelets c. 7 mm long, plump, coriaceous, not awned. Glumes coriaceous; lower glume with 2 submarginal, membranous wings; upper glume with a winged keel, aristate. Lower floret c. 7 mm long; lemma and palea ±coriaceous. Upper floret c. 6 mm long; lemma hyaline, aristate; palea hyaline. *Awnless Duck-Beak*.

Christmas Is., Cocos (Keeling) Is. The only known locality of this species on Christmas Is. is behind Dolly Beach, where it occurs in several patches beneath the *Cocos* (coconut) palm trees. On Cocos (Keeling) Is., known only from one island in the main atoll, in *Cocos* plantation in coralline sand. A widely distributed species in tropical and subtropical regions from Sri Lanka, India and China, through Indo-China, Malesia and the Philippines to Australia (Qld), Micronesia and Polynesia.

Ch.Is.: Dolly Beach, *D.A.Powell 404, 590* (K); fringing tidal sand at Dolly Beach, *B.A.Mitchell 136* (CBG, K); Dolly Beach, on foreshore in sand, *R.Shivas 945* (PERTH); on sand behind Dolly Beach, *D.J. & B.P.Du Puy CI110* (CBG, K). C.K.Is.: Horsburgh Is., *D.G.Williams 222* (BRI, CBG, K, PERTH).

May cover large areas with its tangled growth, sometimes scrambling over other vegetation.

2. Ischaemum nativitatis Jansen ex Renvoize, *Kew Bull.* 40: 447 (1985)

T: Christmas Is., 1904, *H.N.Ridley 6*; holo: K. Epithet from the Latin *nativitas* (nativity, birth) implying the Nativity of Christ, or Christmas, after Christmas Is., on which the species is endemic.

Erect, tufted grass, 25–70 cm tall; culms often branched; nodes glabrous. Leaves scattered along culm; margin smooth; lamina 3–11 cm long, 2.5–7 mm wide; sheath rounded, ±glabrous. Racemes 2, ±appressed, sometimes appearing as a single raceme, 1.5–5 cm long, bristly; pedicels and rachis long-hairy; spikelets paired, appressed. Sessile spikelets 4.5 mm long, distinctly awned. Glumes coriaceous at base; lower glume with 2 membranous wings in apical half, bidentate; upper glume with a winged keel towards apex and an awn c. 6 mm long. Florets with hyaline lemma and coriaceous palea c. 3.5 mm long; awn of upper lemma c. 15 mm long, twisted at base. *Christmas Island Duck-Beak*. Fig. 93A–D.

Christmas Is. An endemic species occurring sporadically on the northern and western coasts on exposed limestone pinnacles immediately behind the sea cliffs, in pockets of coralline sand, in front of the dense stands of *Pandanus nativitatis* and *Scaevola taccada*.

Ch.Is.: Flying Fish Cove, *C.W.Andrews 23* (BM, K); Smith Point, *H.N.Ridley 6A* (K); NW coastline, *D.A.Powell 666* (K); N coastline, *D.A.Powell 670* (K); behind sea cliff on W coast, *D.J. & B.P.Du Puy, CI111* (CBG, K).

This species has a rather convoluted taxonomic history. It was recorded, but not described, by C.W.Andrews, *Monogr. Christmas Is.* 192 (1900) and H.N.Ridley, *J. Straits Branch. Roy. Asiat. Soc.* 45: 243 (1906), as *I. foliosum* var. *leiophyllum* Hack. ex Rendle, a variety endemic on Christmas Is. This varietal name has not been validly published. O.Stapf later determined these Christmas Is. specimens as a distinct species, *I. nativitatis* Stapf, but again failed to effectively publish the name. P.Jansen (1953) tried to validate this name by publishing a full description, but omitted a Latin diagnosis, leaving the name still invalid under the *International Code of Botanical Nomenclature*. Finally, in 1985, S.A.Renvoize validated the name *I. nativitatis* by publishing a full Latin description.

Ischaemum nativitatis is closely related to *I. foliosum* Hack. from the New Hebrides and New Caledonia, which it closely resembles in general appearance. The presence of rather broad wings on the apical half of the lower glumes of the sessile spikelets, the longer hairs at the spikelet base, the glabrous nodes of the culms and the ±glabrous leaf sheaths and laminas of *I. nativitatis* can be used to distinguish these two species.

The winged lower glumes indicate an affinity with *I. indicum* (Houtt.) Merr., a very variable and widespread species from SE Asia to the Pacific islands. The culm nodes of this species have a tuft of hairs, and the upper glume has a much shorter awn, not longer than the spikelet. It is also usually a creeping, stoloniferous grass, the culms decumbent at least at the base, and rooting at the lower nodes.

Figure 93. **A–H**, POACEAE. **A–D**, *Ischaemum nativitatis*. **A**, flowering culms X0.2; **B**, paired apical racemes X0.5; **C**, sessile spikelet with awns X5; **D**, sessile spikelet showing winged lower glume X5 (**A–D**, D. & B.Du Puy CI111, K). **E–F**, *Cenchrus brownii*. **E**, flowering culms X0.2; **F**, burr containing several spikelets X5 (**E–F**, D. & B.Du Puy CI103, K). **G–H**, *Oplismenus compositus*. **G**, flowering culm X0.2; **H**, spikelet X5 (**G–H**, D. & B.Du Puy CI49, K). Drawn by E.Catherine.

39. APLUDA

Apluda L., *Sp. Pl.* 1: 82 (1753); *Gen. Pl.* 5th edn, 35 (1754); from the Latin *apluda* (chaff), in reference to the chaff-like spikelets.

Type: *A. mutica* L.

Perennial monoecious grasses; culms solid, creeping at base, then erect; stilt roots at lower nodes. Leaf lamina narrowly linear, flat; ligule a membrane. Pseudo-inflorescence a terminal leafy panicle of many reduced inflorescences of solitary racemes articulate on short peduncles, enclosed within a spathe-like upper leaf; racemes of 1 sessile and 2 pedicellate spikelets. Sessile spikelet with 2 florets, the lower male, the upper bisexual; upper lemma 3-nerved, notched, usually awned. Pedicellate spikelets: one similar to sessile spikelet or both florets male, the other spikelet reduced to a single linear glume.

A monotypic genus of the tropical W Pacific and Indian Oceans, including Cocos (Keeling) Is. and tropical Australia.

Apluda mutica L., *Sp. Pl.* 1: 82 (1753)

T: from India; *n.v.*

Illustration: H.B.Gelliland, *Fl. Malaya* (*Grasses*) 3: 274, fig. 58, t. 33b (1971).

Flowering culms to 2 m. Leaves scattered along culms; sheaths 3.5–6 cm long, usually glabrous except at nodes; lamina 7–40 cm long, 3–15 mm wide. Pseudo-inflorescence to 120 cm long. Sessile spikelet: lower glume narrowly ovate, c. 4.5 mm long, 11–13-nerved; upper glume c. 4.5 mm long, bifid, 7-nerved; lower lemma and palea c. 4 mm long, hyaline; upper lemma c. 3.5 mm long, usually awned; awn to c. 10 mm long. Pedicellate bisexual spikelet similar to sessile spikelet, the upper lemma entire, 3-nerved.

Cocos (Keeling) Is. Recorded only from the N of West Is. in regrowth on roadsides in coralline sand. Widespread through the Indian and W Pacific Oceans from Mauritius and Socotra to Formosa and New Caledonia including tropical Australia (Torres Strait islands, Qld).

C.K.Is.: Ujong Tanjong, West Is., *I.R.Telford 10005 & C.Howard* (CBG, K); Sydney Hwy, 1 km S of jetty, West Is., *D.G.Williams 105* (BRI, CBG, PERTH).

40. ROTTBOELLIA

Rottboellia L.f., *Nov. Gram. Gen.* 23 (1780); *Suppl. Pl.* 3, 114 (1781), *nom. cons.*; after Christen Friis Rottboell (1727–1797), a Danish botanist who studied under C.Linnaeus.

Type: *R. exaltata* L.f.

Erect grasses with stilt roots. Leaf lamina flat; ligule short, membranous. Inflorescence a raceme with a swollen, segmented rachis, each segment with a pedicellate, male spikelet; pedicel adnate to rachis and forming a cavity in which the sessile, bisexual spikelet is immersed; rachis segment and spikelets falling together at maturity. Sessile spikelets containing 2 florets; lower usually male; upper bisexual. Glumes as long as spikelet, coriaceous; lower glume external, enclosing spikelet in rachis cavity; upper glume concave, immersed in rachis cavity. Florets with hyaline to ±coriaceous lemma and palea.

A genus of c. 4 species in the Old World tropics; 1 species has recently developed into a serious weed naturalised elsewhere in the tropics, also on Christmas Is. The species occupy various habitats, including swamps, dry woodland, grassland and disturbed sites.

Rottboellia cochinchinensis (Lour.) Clayton, *Kew Bull.* 35: 817 (1981)

Stegosia cochinchinensis Lour., *Fl. Cochinch.* 1: 51 (1790). T: Vietnam (Cochinchina); not located. Epithet: the type specimen was collected in Cochinchina, now in the southern part of Vietnam.

Illustration: W.D.Clayton & S.A.Renvoize in R.M.Polhill (ed.), *Fl. Trop. E. Africa*, Gramineae 3: 852, fig. 202 (1982).

Coarse, erect, tufted grass, 40–90 cm tall, often with stilt roots. Leaves scattered; midvein pale; lamina 30–55 cm long, 10–18 mm wide; sheath rounded, with many sharp bristles. Racemes terminal and from upper sheaths, to c. 12 cm long; rachis inflated, coriaceous, fragmenting into segments, 5–6 mm long; spikelets paired, coriaceous, appressed to rachis. Sessile spikelet immersed in a deep cavity, c. 5 mm long, with 2 florets; lower floret male. Lower glume coriaceous, notched, enclosing florets in cavity; upper glume keeled, coriaceous, immersed in cavity. Lemma hyaline. Lower floret with a subcoriaceous palea. *Itch Grass*.

Christmas Is. Recorded from the north-eastern coastal terrace. A weedy species distributed from Africa, India and China, through Indo-China and Malesia to Australia (Qld) and the SW Pacific islands, and naturalised in some New World localities.

Ch.Is.: close to edge of sea cliff, N of Waterfall, *D.A.Powell 302* (K); NE coastal terrace, *D.A.Powell 539* (K).

The common name of *Itch Grass* is due to the sharp, irritant hairs on the leaf-sheaths of this species. The seed is dispersed with a segment of the rachis which includes an oil-producing elaiosome, attracting ants which transport the seed into their nests. The species is also widely known as *R. exaltata* L.f. (conserved against its earlier homonym of *R. exaltata* (L.) L.f.) which is now regarded as the basionym of *Ophiuros exaltatus* (L.) Kuntze (W.D.Clayton, *Kew Bull.* 35: 818, 1981).

92. CANNACEAE

D.J.Du Puy (Ch.Is.)

Perennial, rhizomatous, glabrous herbs. Leaves cauline, sheathing at base, broad, petiolate, pinnately veined. Inflorescence terminal, spicate, 1- or 2-flowered, bracteate. Flowers bisexual, showy, zygomorphic. Sepals 3, free, usually green. Petals 3, connate at base and adnate to androecium, sepaloid or ±petaloid. Staminodes 3–5, petaloid, connate at base. Stamen 1, petaloid, with 1 unilocular anther. Ovary inferior, 3-locular; ovules many, axile; style petaloid. Fruit a capsule. Endosperm present.

A family of 1 genus with c. 50 species, native in tropical and subtropical America, now widely cultivated and naturalised; 1 species naturalised on Christmas Is.

T.D.Stanley, Cannaceae, *Fl. Australia* 45: 38–39 (1987).

CANNA

Canna L., *Sp. Pl.* 1: 1 (1753); *Gen. Pl.* 5th edn, 1 (1754); from the Greek *kanna* (a reed).

Type: *C. indica* L.

***Canna indica** L., *Sp. Pl.* 1: 1 (1753)

T: not designated. Epithet given due to an early belief that it came from India.

Illustrations: G.Nicholson, *Ill. Dict. Gard.* 361, fig. 359 (1884); A.B.Graf, *Tropica* 288, 289 (1978); B.D.Morley & H.R.Toelken, *Fl. Pl. Australia* 554, fig. 212 (1983).

Erect herb to 1 m or more high. Leaves sheathing, ovate, 20–40 cm long, 8–18 cm wide,

long-pointed. Inflorescence lax, with c. 6–11 flowers to c. 6 cm long, often paired. Sepals ovate, 6–10 mm long, rounded. Petals 26–30 mm long, narrow, acute, red or yellow. Staminode erect, spathulate, 35–50 mm long, 5–10 mm wide. Capsule verrucose; seeds spherical, 4–5 mm diam., hard, black.

Christmas Is. Grown in gardens and found along the fringes of cultivation, several patches have become naturalised along the railway line near Drumsite. A native of tropical America, now naturalised throughout the tropics.

Ch.Is.: no precise locality, *D.A.Powell 483* (K).

93. LILIACEAE

D.J.Du Puy (Ch.Is.)
I.R.H.Telford (C.K.Is.)

Perennial herbs or rarely shrubs, with rhizomes, corms or bulbs, sometimes with tuberous roots; stems erect or climbing. Leaves simple, all basal or cauline, the base usually sheathing. Inflorescence racemose, paniculate, umbellate or solitary. Flowers bisexual, rarely unisexual, usually actinomorphic. Perianth usually petaloid, often showy, in 2 very similar whorls of 3, free or connate into a perianth tube. Stamens usually 3 or 6, usually adnate to perianth; anthers bilocular, often longitudinally dehiscent. Ovary superior to inferior, trilocular or rarely unilocular; ovules usually many, axile; style entire or 3-lobed. Fruit a capsule or rarely a berry. Endosperm produced.

A world-wide family of about 280 genera and perhaps 4000 species, most abundant in temperate to subtropical regions with seasonal climates; 1 genus (1 species) on Christmas Is.; 2 genera (2 species) on Cocos (Keeling) Is. On Christmas Is., *Gloriosa superba* L. (Flame Lily) is cultivated as an ornamental, and *Allium odorum* L. is cultivated by the Chinese community, occasionally persisting for a short while outside cultivation when its tubers are dispersed among discarded garden refuse. The family is treated here in a broad sense. For discussion of family classification see Liliaceae, *Fl. Australia* 45: 148–151 (1987). The 2 genera in our area are usually included in the Amaryllidaceae.

C.A.Backer & R.C.Bakhuizen van den Brink Jr, Liliaceae, *Fl. Java* 3: 82–95, 128–144 (1968), including Amaryllidaceae; A.C.Smith, Liliaceae, *Fl. Vit. Nova* 1: 141–148 (1979); Fifteen authors, Liliaceae, *Fl. Australia* 45: 148–452 (1987).

KEY TO GENERA

Leaves more than 8 cm wide; flowers in umbels (Ch.Is., C.K.Is.)	**1. CRINUM**
Leaves less than 1 cm wide; flowers solitary (C.K.Is.)	**2. ZEPHYRANTHES**

1. CRINUM

Crinum L., *Sp. Pl.* 1: 291 (1753); *Gen. Pl.* 5th edn, 141 (1754); from the Greek *krinon* (a lily).

Type: *C. americanum* L.

Large, bulbous herbs; bulb extended as a neck to ground level, or above as a pseudostem. Leaves basal, long, broadly linear. Inflorescence umbellate on a stout, leafless peduncle, with 2 broad, membranous apical bracts and smaller ones between the flowers. Flowers few to many, rarely solitary, showy, sessile or pedicellate. Perianth with a long, slender tube

and 6 lobes. Stamens 6, inserted in throat of perianth tube; filaments long, filiform. Stigma capitate. Fruit a capsule, dehiscing irregularly; seeds large.

A genus of 100 or more species, distributed especially on sea coasts in the tropics and subtropics; 1 species native on Christmas Is. and Cocos (Keeling) Is. The seeds of *Crinum* species are often corky and buoyant in water, allowing sea dispersal. Several species are widely cultivated for their showy flowers. *Crinum* × *powellii* Baker, with pink perianth lobes to 4 cm wide, is cultivated on Cocos (Keeling) Is. The genus requires monographic revision.

H.J.Hewson, *Crinum*, *Fl. Australia* 45: 369–375 (1987).

Crinum asiaticum L., *Sp. Pl.* 1: 292 (1753)

T: Sri Lanka. Illustration in Herb. P.Hermann n. 127, vol. 5, fol. 131; syn: BM. Epithet from the species being first described from Asia.

Illustration: A.B.Graf, *Tropica* 3rd edn, 63 (1986).

A robust herb 0.5–1 m tall; pseudostem of leaf bases 20–45 cm long. Leaves in a rosette, strap-shaped, 50–95 cm long, 10–14 cm wide, fleshy. Peduncle arising just below rosette of leaves, c. 40 cm long, hollow; umbel c. 25 cm diam., with 25–50 flowers; bracts 8–12 cm long, papery. Flowers large, white, scented; pedicel and ovary 3.5–5 cm long; perianth tube slender, 4–7 cm long; perianth lobes linear-ligulate, 7–8 cm long, widely spreading or reflexed, white. Stamens exserted; filaments 4–4.5 cm long, purple distally; anthers linear, 2–2.5 cm long, yellow. Style exserted, 4.5–5 cm long, filiform, purple. Capsule spherical, 4.5–6.5 cm diam., with 1–5 corky seeds. *Swamp Lily*.

Christmas Is., Cocos (Keeling) Is. H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 236 (1906), recorded it as common on Christmas Is. in Flying Fish Cove and on rocks and cliffs throughout. It has been removed from most readily accessible situations for cultivation in gardens but is still quite frequent on exposed cliffs, both at the coast and on the tiers of inland cliffs. It grows in partially shady to very exposed situations, on ledges and in crevices in the limestone. On Cocos (Keeling) Is. grows in coralline sand at the top of beaches, or in gullies or depressions. A widespread species, distributed from Sri Lanka and India to S China and Japan, through Indo-China, Malesia, the Philippines and northern and eastern Australia to the Pacific islands.

Ch.Is.: North East Point, *D.A.Powell 310* (K); cliff edge overlooking golf course, *D.J. & B.P.Du Puy CI86* (K); North East Point, Andrews Lookout, *B.A.Mitchell 182* (CBG, K). C.K.Is.: Direction Is., *I.R.Telford 10081 & C.Howard* (CBG, K); near lagoon, N end of airstrip, West Is., *A.S.George 16261* (CBG).

This species is perhaps conspecific with *C. pedunculatum* R.Br., from eastern Australia (N.T., Qld, N.S.W.). It is polymorphic and is a complex requiring further study.

The flowers open in the evening and are pollinated by a hawk moth, recorded by H.N.Ridley (*loc. cit.*), as *Sphinx convolvuli* (*Agrius convolvuli* (Linnaeus 1758)) on Christmas Is. The erect inflorescences often deposit their seed higher up the cliff than the parent plant, leading to a slow ascent up the cliffs. The inland cliffs on Christmas Is. must have been first colonised when they were at sea level, and have maintained their populations since.

This species is poisonous, containing an alkaloid, and will induce vomiting if eaten. It is sometimes used medicinally as an emetic. The sap is mucilaginous; the leaves are used for dressing wounds and sores, and to make poultices.

2. ZEPHYRANTHES

Zephyranthes Herb., *Appendix* 36 (1821), *nom. cons.*; from the Greek *zephyros* (the West wind) and *anthos* (flower).

Type: *Z. atamasco* (L.) Herb., *typ. cons.*

Bulbous perennial herbs; bulb tunicated. Leaves radical, terete to linear. Flower solitary,

scapose; involucral bract solitary, tubular, notched at apex. Perianth fused into tube or (not in our area) free; lobes 6, equal or not. Stamens 6; filaments inserted on perianth; anthers versatile, dehiscing by slits, introrse. Ovary inferior, 3-locular; placentation axile; ovules few to many per locule; style filiform; stigma 3-lobed or 3-branched. Fruit a ±globose, 3-valved, loculicidal capsule. Seeds few to many, D-shaped.

A genus of c. 40 species of the warmer regions of the Americas; 2 species naturalised in mainland Australia, 1 other on Cocos (Keeling) Is. Several species widely cultivated for their flowers.

***Zephyranthes rosea** (Spreng.) Lindl., *Bot. Reg.* 10: t. 821 (1824)

Amaryllis rosea Spreng., *Syst. Veg.* 4: 133 (1827). T: from Cuba; *n.v.*

Leaves linear, flattened, to 40 cm long, 3–9 mm wide. Flower on scape 10–30 cm long; bract 15–25 mm long, pink; pedicel 25–40 mm long. Perianth pink, green at base, fused at base into tube 5–7 mm long; lobes spreading, ovate, 25–35 mm long, the inner narrower. Stamens inserted at mouth of perianth tube; filaments 5–8 mm long; anthers 8–10 mm long. Stigma 3-branched. Capsule deeply 3-lobed.

Cocos (Keeling) Is. Naturalised around the kampong and previously settled sites on the main atoll; grows in calcareous sand. Native to Cuba; widely naturalised from garden escapes.

C.K.Is.: Direction Is., *D.G.Williams 265* (CBG); Home Is., *I.R.Telford 10068* & *C.Howard* (CBG, K).

94. DIOSCOREACEAE

D.J.Du Puy (Ch.Is.)

Mostly scandent, often dioecious herbs or shrubs; shoots usually twining; often with rhizomes or tubers. Leaves usually alternate, petiolate, usually cordate to sagittate, entire, with several veins from base, occasionally palmatifid to palmate. Inflorescence racemose or spicate, sometimes multiple along leafless shoots from leaf axils. Flowers commonly unisexual, minute, inconspicuous and greenish. Tepals in 2 whorls of 3. Stamens in 2 whorls of 3, the inner sometimes sterile; anthers bilocular. Style solitary, with 3 short, bifid stigmas. Ovary inferior, 3-locular; ovules usually 2 per locule. Fruit often a 3-lobed capsule, sometimes a berry; seeds usually winged.

A family of c. 7–9 genera with c. 600–700 species; 1 genus on Christmas Is. Most species are in the large genus *Dioscorea* L. They are mostly distributed in the tropics and subtropics, although there are some notable extensions into temperate regions.

I.H.Burkill, Dioscoreaceae, *Fl. Males.* ser. I, 4: 293–335 (1951); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Dioscoreaceae, *Fl. Java* 3: 154–155 (1968); A.C.Smith, Dioscoreaceae, *Fl. Vit. Nova* 1: 166–171 (1979); I.R.H.Telford, Dioscoreaceae, *Fl. Australia* 46: 196–202 (1986).

DIOSCOREA

Dioscorea L., *Sp. Pl.* 1: 1032 (1753); *Gen. Pl.* 5th edn, 456 (1754); named after Pedanios Dioscorides, a 1st century Greek physician and herbalist.

Type: *D. sativa* L.

Dioecious climbing herbs or shrubs; stems twining to the right or to the left, sometimes winged, sometimes prickly, often with basal tubers and axillary tubers. Leaves alternate or

sometimes opposite; lamina usually simple, occasionally palmate, cordate to sagittate basally; venation palmate from base. Inflorescence a spike or spike-like raceme, axillary or on short, leafless shoots. Flowers small, greenish, subtended by a short bract. Male flowers: stamens 6, sometimes the inner whorl of 3 sterile. Female flowers: style columnar; stigmas 3, bifid, deflexed; ovary inferior. Capsule oblong to obovoid, deeply 3-lobed; seeds flattened, with marginal, membranous wings.

A pantropical and warm temperate family of 6 genera and c. 750 species; 2 species on Christmas Is.

Leaves alternate; petiole base auriculate; lamina broadly ovate to ±circular, cordate at base, glossy, appearing slightly blistered; stems neither 4-angled nor winged, twining to the left **1. D. bulbifera**

Leaves opposite; petiole base not auriculate; lamina ±narrowly ovate, sagittate at base, not glossy or blistered; stems 4-angled and narrowly winged, twining to the right **2. D. alata**

1. Dioscorea bulbifera L., *Sp. Pl.* 1: 1033 (1753)

var. **bulbifera**

T: Ceylon [Sri Lanka]. Illustration of '*Rhizophora zeylanica*, scammonii folii ...' in P.Hermann, *Paradisus Batarus* t. 217 (1698); *fide* C.Jarvis, BM, pers comm. Epithet from the Latin *bulbus* (a bulb) and *ferre* (to carry, to bear), indicating the sometimes large bulbils often produced in the leaf axils.

Illustrations: I.H.Burkill, *Fl. Males.* ser. I, 4: 300, 301, figs 4A & B, 5F (1951); I.R.H.Telford, *Fl. Australia* 46: 201, fig. 51A–C (1986).

A scandent, dioecious vine to c. 8 m tall with a tuber; stems twining to the left, ±terete, not winged, often with bulbils in leaf axils. Leaves alternate, ±circular to broadly ovate, broadly cordate at base, rounded and abruptly acuminate, dark green, glossy, appearing slightly blistered; lamina 5–20 cm long; petiole base auriculate. Racemes unisexual, c. 6–13 cm long, pendulous, 1–several from leaf axils, or combined along a leafless axis into a panicle-like inflorescence; bracts triangular, 2–4 mm long, acuminate. Flowers facing downwards, minute; pedicels 1–2 mm long; tepals oblong, 1.5–2 mm long, obtuse, cream or greenish. Capsules 3-winged, oblong, 18–25 mm long, obtuse, chestnut brown.

Christmas Is. Uncommon, growing by track in the National Park, in rather open forest. A widespread species, occurring in Africa, SE Asia, the Phillipines, Malesia to northern Australia (W.A., N.T., Qld) and the Pacific islands.

Ch.Is.: N of Camp Hill, track into National Park, *D.J. & B.P.Du Puy CI57* (CBG, K).

This species bears many bulbils in the leaf axils. They are able to float, leading to dispersal in water. Some variants have been selected for cultivation, in which the plants produce either large tubers or large bulbils (the Air Yam). All but the best cultivars contain acrid, bitter alkaloids and must be specially prepared for eating, either by prolonged washing or cooking with lime and wood ashes.

2. Dioscorea alata L., *Sp. Pl.* 1: 1033 (1753)

T: Herb. P.Hermann n. 360, vol. 2, fol. 23; syn: BM; Herb. C.Linnaeus 1184.2; syn: LINN. Epithet from the Latin *alatus* (winged), in reference to the conspicuously winged stems.

A scandent vine to c. 10 m tall with a large tuber; stems twining to the right, 4-angled and narrowly winged, often with bulbils in leaf axils. Leaves opposite, ±narrowly ovate, sagittate, tapering and acuminate, bright green, not glossy or blistered; lamina 9–25 cm long; petiole not auriculate. Male spikes many, 1–2 cm long, in clusters along branched or unbranched leafless shoots from leaf axils. Female spikes unbranched, solitary, axillary, to 30 cm long. Flowers sessile; tepals c. 2 mm long, yellow to greenish white. Capsules 3-winged, broadly obovate, 17–20 mm long, retuse, chestnut brown. *Greater Yam*, *White Yam*.

Christmas Is. Common in disturbed or secondary forest, especially along roads or tracks in areas close to habitation. A pantropical species not known in its truly wild state, although it

often appears to be fully naturalised. Probably first cultivated in SE Asia.

Ch.Is.: no precise locality, Apr. 1980, *D.A.Powell* (K).

The large tubers (yams), which can reach 2 m long and weigh 45 kilograms, may be eaten after boiling.

95. ORCHIDACEAE

D.J.Du Puy (Ch.Is.)
D.L.Jones & E.Edgar (M.Is.)

Perennial, epiphytic or terrestrial sometimes saprophytic herbs. Roots often thick, velamen-covered, sometimes tuberous. Stems sometimes pseudobulbous. Leaves usually alternate, entire. Flowers solitary or in a raceme, panicle or spike, zygomorphic, usually resupinate, epigynous, usually bisexual. Perianth 6 in 2 whorls of 3, petaloid, free or variously connate; sepals similar, or dorsal sepal dissimilar in shape or colour, or lateral sepals sometimes adnate to a column foot, forming a mentum or spur; lower petal often highly modified into a variously lobed, ridged, occasionally saccate, lip (labellum). Androecium and gynoecium fused into a column with a ventral stigmatic cavity and an apical anther which contains 2–8 granulose or waxy pollinia, with or without stipes and a viscidium, enclosed in an anther cap. Ovary inferior, 3-carpellate, unilocular with parietal placentation, or trilocular with axile placentation. Fruit a dry capsule, usually dehiscing along 6 longitudinal sutures. Seeds many, dust-like, without endosperm.

A very large family, probably with more than 25,000 species in c. 800 genera, distributed worldwide except the polar regions, but with most diversity in the tropics; 11 genera each represented by 1 species on Christmas Is., and 1 genus with 1 species on Macquarie Is. Many species produce flowers of horticultural value and several genera have produced hybrids of commercial importance. Vanilla is obtained from the fermented pods of *Vanilla*.

The Orchidaceae can be divided into 6 subfamilies (R.L.Dressler, *The Orchids, Natural History and Classification*, 1981), 3 of which are represented on Christmas Is. The most primitive of these is the Spiranthoideae Dressler, represented by *Corymborkis* and *Zeuxine*. The Vandoideae Endl. are generally considered to be the most advanced, and are represented by *Thrixspermum* and *Brachypeza*. The remaining 6 genera are included in the Epidendroideae Lindl. *Corybas* from Macquarie Is. is in the subfamily Orchidoideae.

The family description does not include some of the unusual characters found in the primitive subfamilies Apostasioideae Rchb.f. and Cypripedioideae Lindl.

R.E.Holttum, *Fl. Malaya* 1, *Orchids Malaya* (1953); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Orchidaceae, *Fl. Java* 3: 215–450 (1968); A.W.Dockrill, *Austral. Indig. Orchids 1* (1969); R.L.Dressler, *The Orchids, Natural History and Classification* (1981).

KEY TO GENERA

1 Plants terrestrial; saprophytic or autophytic (Ch.Is., M.Is.)

2 Plants saprophytic, leafless; flowers campanulate, the petals and dorsal sepal fused into a single cup-shaped segment (Ch.Is.) **3. DIDYMOPLEXIS**

2: Plants autophytic, leafy; flowers with sepals and petals free

3 Flower solitary, almost sessile on cordate leaf (M.Is.) **12. CORYBAS**

3: Flowers in a panicle or raceme; leaves ovate or elliptic (Ch.Is.)

4 Plants small, 25–35 cm high, with long, white hairs; leaves not plicate, tender, 3–7 cm long **2. ZEUXINE**

4: Plants large, 40–100 cm high, glabrous; leaves plicate, tough, 20–35 cm long **1. CORYMBORKIS**

1: Plants epiphytic; autophytic (Ch.Is.)

5 Plants apparently lacking leaves (the leaves reduced to bracts); flowers 4-5 mm diam.; lip with a saccate spur and a navicular mid-lobe with an incurved, apical tooth **11. TAENIOPHYLLUM**

5: Plants with conspicuous leaves; flowers not as above

6 Plants without pseudobulbs

7 Plants small; leaves 0.2–0.5 cm wide; flowers c. 1 mm across **5. PHREATIA**

7: Plants large; leaves 1.5–2 cm wide; flowers c. 10–20 mm across

8 Stems very short; leaves 10–22 cm long, forming a fan; side-lobes of lip large, with rounded apices **10. BRACHYPEZA**

8: Stems elongated with the leaves well-spaced, c. 1 cm apart; leaves 5–7 cm long; side-lobes of lip narrow, acuminate **9. THRIXSPERMUM**

6: Plants with pseudobulbous stems, usually swollen at or near base

9 Pseudobulbs with a single, apical leaf

10 Pseudobulbs fusiform, produced in succession on aerial stems; inflorescence without a stem; flowers opening singly, 1–1.5 cm across **8. FLICKINGERIA**

10: Pseudobulbs obliquely compressed, decumbent against host branch; inflorescence with a long, slender stem; flowers 6 mm long, numerous, crowded **6. THELASIS**

9: Pseudobulbs with 2–several leaves

11 Plants large; stems 40–70 cm long, swollen into a pseudo-bulb near base, with several leaves and a long, slender apex where several inflorescences are borne; flowers c. 4 cm across, white, glabrous **7. DENDROBIUM**

11: Plants small; less than 15 cm tall; stems pseudobulbous, 1.5–2 cm long with 2 apical leaves and short, lateral inflorescences; flowers c. 2 mm across, light green, hairy **4. ERIA**

A further genus, probably *Robiquetia* Gaudich., has been collected on Christmas Is. (plateau SW of Hanitch Hill, vicinity of drill line 374, *B.A.Mitchell 49*, CBG), but cannot be identified specifically due to the absence of flowers. Vegetatively it is intermediate between *Brachypeza* and *Thrixspermum*, with an elongated stem bearing well-spaced, strap-shaped leaves c. 11–16 cm long, 1.5–2.5 cm wide, and strongly unequal at the apex. The racemes are slender, erect, and the capsules 1.7 cm long, ellipsoidal.

1. CORYMBORKIS

Corymborkis Thouars, *Nouv. Bull. Sci. Soc. Philom. Paris* 1: 318 (1809); from the Greek *korymbos* (a cluster) and *orchis* (an orchid), in reference to the corymb-like inflorescence of some species.

Type: *C. corymbis* Thouars

Medium to tall terrestrial herbs, with several usually unbranched stems. Leaves large, sessile, plicate, thin but tough. Inflorescences 1–5, axillary, paniculate. Sepals and petals slender, almost equal; lip long and slender, parallel to column except the recurved, apical lamina. Column long, straight, slender, clavate. Pollinia 2, grooved, slender, granulose on a stipe and viscidium.

A pantropical genus of 5 species, with 1 widespread SE Asian species present in Australia;

1 species on Christmas Is.

F.N.Rasmussen, The genus *Corymborkis* Thou. (Orchidaceae) a taxonomic revision, *Bot. Tidsskr*. 71: 161–192 (1977).

Corymborkis veratrifolia (Reinw.) Blume, *Fl. Java, Coll. Orch*. 125, t. 42 E, 43 I (1859)

var. **veratrifolia**

Hysteria veratrifolia Reinw., *Syll. Pl. Nov.* 2: 5 (1826); *Corymbis veratrifolia* (Reinw.) Rchb.f., *Flora* 48: 184 (1865). T: Java, *T.Lobb 162*; neo: K ; isoneo: BM, *fide* F.N.Rasmussen, *Bot. Tidsskr*. 71: 170 (1977). Epithet from the genus *Veratrum* (Liliaceae) and the Latin *folium* (a leaf), in reference to the resemblance between the species and that genus.

Corymbis angusta Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 234 (1906). T: Christmas Is., 1904, *H.N.Ridley 102*; isolecto: BM, *fide* F.N.Rasmussen, *loc. cit*.

Illustration: A.W.Dockrill, *Austral. Indig. Orchids* 1: 131 (1969).

Stems slender, to 1 m tall, closely spaced on a thin rhizome, with 6–13 leaves. Leaves large, elliptic, 20–35 cm long, 5–8 cm wide, tapering to acuminate apex. Inflorescence corymbose-paniculate, many-flowered. Flowers greenish white, fragrant. Sepals and petals 25–30 mm long; petals linear-spathulate, recurved, curled, undulate. Lip with a narrow basal region as long as and clasping column, expanded into a decurved, cordate lamina with a crenulate, undulate margin; callus of 2 weakly raised lines which diverge on the lamina. Column 18–20 mm long, 1 mm broad, with 2 short apical horns.

Christmas Is. Fairly common on the central plateau and higher terraces, usually above 150 m alt., in shaded forest undergrowth, often in association with the fern *Bolbitis heteroclita*. Widespread in SE Asia, from Japan and India through Indo-China and Malesia to Polynesia and Australia (Qld).

Ch.Is.: higher parts of island, 1897, *C.W.Andrews* (K); Aldrich Hill, *A.Pearson 41* (K); Taits Vale, *A.Pearson 48* (K); northern plateau, *D.A.Powell 35* (K); W of field S17D, South Point eastern perimeter, *B.A.Michell 8* (CBG, K).

Sterile plant resembles a palm seedling. F.N.Rasmussen (*loc. cit.*) placed the Christmas Is. specimens in the widespread var. *veratrifolia* with elliptic rather than linear leaves.

2. ZEUXINE

Zeuxine Lindl., *Coll. Bot. Append.* no. 18 (1826) (as *Zeuxina*), *nom. cons.*; from the Greek *zeuxis* (a yoke), in reference to the adnation of the column and the base of the lip.

Type: *Z. sulcata* (Roxb.) Lindl. = *Z. strateumatica* (L.) Schltr.

Terrestrial herbs, short, creeping. Rhizome slender, rooting at internodes, with succulent, ascending leafy shoots. Leaves ovate or (not on Christmas Is.) linear, often reddish or bicoloured. Inflorescence erect, terminal, racemose; peduncle long, slender; rachis loosely or densely several- to many-flowered. Flowers very small. Sepals spreading. Petals converging with dorsal sepal, forming a hood over column. Lip saccate, with two divergent lobes, adnate to column at base with several processes inside the sac. Column with 2 lateral stigmas and 1 dorsal anther. Pollinia 2, elongate-pyriform, granulose, on a sticky viscidium.

This genus has 40–50 species in Africa and SE Asia from India and Japan through Indo-China and Malesia to Polynesia and Micronesia; 1 species in Australia (Qld) and 1 on Christmas Is., both endemic.

J.J.Smith, *Die Orchideen von Java* 107–112 (1905); J.J.Smith, *Die Orchideen von Java, Figuren-Atlas* figs 76–79 (1908); G.Seidenfaden, Orchid genera in Thailand 6, Neottioideae Lindl., *Dansk Bot. Ark.* 32: 78–93 (1978).

Figure 94. **A–J**, ORCHIDACEAE. **A–C**, *Brachypeza archytas*. **A**, flowering plant X0.5 (C.Andrews 144, K); **B**, flower X2 (D.Powell 142, K); **C**, capsule X0.5 (H.Ridley, 1890, K, iso). **D–E**, *Zeuxine exilis*. **D**, fruiting plant X0.5; **E**, flower X4 (H.Ridley, 1904, K, lecto). **F–H**, *Thrixspermum carinatifolium*. **F**, flowering plant X0.5 (C.Andrews 143, K); **G**, flower X2; **H**, capsule X0.5 (**G–H**, D.Powell 141, K). **I–J**, *Phreatia listeri*. **I**, flowering and fruiting plants X0.5 (J.Lister, 1887, K, holo); **J**, flowers X5 (D.Powell 140, K). Drawn by E.Catherine.

Zeuxine exilis Ridl., *J. Straits Branch Roy. Asiat. Soc*. 45: 236 (1906)

T: Murray Hill track, Christmas Is., Oct. 1904, *H.N.Ridley*; lecto: K; isolecto: BM, *fide* G.Seidenfaden, *loc. cit*. Epithet is the Latin for weak or slender, in reference to the growth habit.

Shoots 25–35 cm tall, including inflorescence, with c. 4 basal leaves, white hairy. Leaves 3–7 cm long, including ovate lamina, short petiole and sheathing base, glabrous, light green. Inflorescence 17–24 cm long; rachis 4–8 cm long with c. 10–30 flowers. Sepals c. 3 mm long, reddish hairy. Petals white. Lip white with a yellow central bar; apical portion bilobed; lobes broad, oblong, diverging; margins crenulate; basal sac with 2 slender, subulate, curled processes. Capsule pubescent, ellipsoidal, 8 mm long. Fig. 94D–E.

Christmas Is. Endemic. Known only from the type collection. H.N.Ridley, *loc. cit.*, stated that this species was not rare, but it has not been collected in recent years. It may be seasonal, or restricted in its habitats. Grows in rainforest, in decaying leaves, often among ferns. Possibly endangered.

The area in which it was collected by H.N.Ridley is not at present threatened by mining.

3. DIDYMOPLEXIS

Didymoplexis Griff., *Calcutta J. Nat. Hist.* 4: 383, t. 17 (1843); from the Greek *didymos* (twin) and *plexis* (plaiting), in reference to the adnation of the two petals with the dorsal sepal.

Type: *D. pallens* Griff.

Leafless, terrestrial saprophyte. Rhizome fleshy, tuberous. Inflorescence racemose, terminal, reddish. Flowers with dorsal sepal and petals fused into a single, trifid segment forming a shallow cup or tube with the partially connate lateral sepals. Lip entire or (not on Christmas Is.) 3-lobed, adnate to the short column foot. Pollinia 2, granulose.

About 10 species from tropical Africa, Madagascar and SE Asia from India and China to Malesia, Polynesia and Micronesia, with 1 species reaching Australia; 1 species on Christmas Is.

R.E.Holttum, *Orchids Malaya* 107–108 (1953); C.A.Backer & R.C.Bakhuizen van den Brink Jr, *Fl. Java* 3: 262–263 (1968).

Didymoplexis pallens Griff., *Calcutta J. Nat. Hist.* 4: 383, t. 17 (1844)

T: Serampor, Calcutta, India, *W.Griffith*; *n.v.* Epithet is the Latin for pale, probably in reference to the flower colour.

Illustrations: G.King & R.Pantling, *Ann. Roy. Bot. Gard. Calcutta* 8: t. 346 (1898); A.W.Dockrill, *Austral. Indig. Orchids* 1: 219 (1969).

Inflorescence usually c. 10 cm long, with few flowers on short pedicels, extending to c. 20 cm in fruit; pedicels often elongating considerably, at times surpassing the total inflorescence length. Flowers campanulate, c. 1–1.5 cm across, whitish; lateral sepals with free portions reflexed, giving a bilabiate appearance. Lip entire, triangular when flattened, with an emarginate, crenate apex, and a central band of papillae crowded most closely towards the apex.

Christmas Is. In woods in the centre of the island, among a carpet of *Acrostichum* (H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 235, 1906); from N India and W China through Indo-China and Malesia to Polynesia and N Australia (N.T.).

Ch.Is.: towards Murray Hill, 1904, *H.N.Ridley*; *n.v.*

4. ERIA

Eria Lindl., *Bot. Reg.* t. 904 (1825) *nom. cons.*; from the Greek *erion* (wool), in reference to the woolly indumentum which sometimes covers the inflorescence.

Type: *E. stellata* Lindl. = *E. javanica* (Sw.) Blume

Herbs, usually epiphytic, of diverse habit. Stems tufted or separated on a rhizome, pseudobulbous with 1–3 leaves, or long and slender with many leaves. Inflorescence axillary or apparently terminal, racemose, usually few-flowered, glabrous to hairy, often inserted in cavities in stem. Flowers often small, often hairy; lateral sepals adnate at base to column foot, forming a short to long, saccate or spur-like mentum. Lip entire to 3-lobed, with longitudinal callus ridges, attached to a short to long column foot. Pollinia 8, in 2 groups of 4, each joined by a separate caudicle to a single viscidium.

A genus of over 500 species; widespread in tropical Asia, from India to Polynesia and Micronesia, with great diversity of species in Malesia, and 6 species in Australia; 1 species on Christmas Is.

F.Kraenzlin in A.Engler, Orchidaceae-Monandrae-Dendrobiinae, *Eria*, *Pflanzenr.* Heft 50: 15–176 (1911); R.Schlechter, *Die Orchideen von Deutsch-Neu-Guinea* 647–680 (1914).

Eria retusa (Blume) Rchb.f., *Bonplandia* 5: 54 (1857)

Dendrolirium retusum Blume, *Bijdr.* 351 (1825). T: Salak, Java, in high mountains, *C.L.Blume s.n.*; *n.v.* Epithet from the Latin *retusus* (with a rounded, notched tip), in reference to the leaves.

Phreatia congesta Rolfe, *J. Linn. Soc., Bot.* 25: 358 (1890). T: Christmas Is., Sept.–Oct. 1887, *J.J.Lister*; holo: K.

Illustrations: J.J.Smith, *Die Orchideen von Java, Figuren-Atlas* fig. 308 (1911); J.J.Wood, The Orchids of Christmas Is., *Orchadian* 7: 145, fig. 2 (1982).

Epiphytic herb, small, somewhat creeping. Pseudobulbs conical, 1.5–2 cm long, 0.7–1 cm diam., curved, closely spaced, with 2 apical leaves. Leaves narrowly ligulate, 6–13 cm long, 0.6–0.8 cm wide, tapering towards base, obtuse and unequally bilobed at apex, fleshy, rigid. Inflorescence erect, 1–2.5 cm long, hairy, with many closely spaced flowers, inserted in small cavity in pseudobulb. Flowers minute, triangular, c. 2 mm across, light green; sepals hairy, much broader than petals. Lip ovate, obtuse, entire, without callus ridges. Column very short, c. 0.5 mm. Capsule oblong-fusiform, 4–5 mm long. Fig. 95H–J.

Christmas Is. In primary rainforest, above 200 m alt., often high on tree trunks. It often grows with *Phreatia listeri*, which it somewhat resembles vegetatively. Also in Java and Lombok.

Ch.Is.: central plateau, on *Eugenia gigantea* in primary rainforest, *D.A.Powell 298* (K); Limestone Hill, *D.A.Powell 495* (K); track to Grants Well, SW of Hanitch Hill, *D.J. & B.P.Du Puy CI11* (CBG, K).

5. PHREATIA

Phreatia Lindl., *Gen. Sp. Orchid. Pl.* 63 (1830); from the Greek *phreatia* (a well), probably referring to the well-like mentum formed by the lateral sepals and the lip.

Type: *P. elegans* Lindl.

Epiphytic herbs of diverse form. Stems sometimes almost vestigial, thin or (not on Christmas Is.) pseudobulbous. Leaves few to many, thin or thick and fleshy, ±distichous, or in pseudobulbous species 1 or 2, slender and thin-textured. Inflorescence racemose, erect, few- to many-flowered, from leaf axils or sheaths at base of pseudobulb. Flowers small to minute, usually white, not opening widely. Lateral sepals forming a mentum with column foot; lip usually narrow and concave or sometimes saccate at base, upcurved near base then forwards to a usually entire lamina. Column very short, with a short column foot. Pollinia 8, in 2 groups, on a slender stipe and viscidium.

There are about 150 species distributed from northern India through SE Asia, including Malesia, to Polynesia and Micronesia, with 3 species in Australia, and 1 endemic on Christmas Is. There are many species concentrated in New Guinea.

F.Kraenzlin in A.Engler, *Pflanzenr.* Heft 50: 5–37 (1911); R.Schlechter, *Die Orchideen von Deutsch-Neu-Guinea* 908–930 (1914).

Phreatia listeri Rolfe, *J. Linn. Soc., Bot.* 25: 358 (1890)

T: Christmas Is., Sept.–Oct. 1887, *J.J.Lister*; holo: K. Named in honour of J.J.Lister who collected the type.

Small, clump-forming epiphyte with short stems covered by the persistent, sheathing leaf bases. Leaves c. 6 per shoot, distichous, linear, 4–11 cm long, 0.2–0.5 cm wide, obtuse. Inflorescence from lower leaf axil, c. 4–8 cm long, with many flowers. Flowers minute, c. 1 mm across, greenish white, the segments not opening widely. Lip elliptic, concave, contracted at base, entire. Capsule ellipsoidal, 2.5 mm long. Fig. 94I–J.

Christmas Is. Common on trees growing on the upper terraces and on the plateau. Endemic, but not at risk by mining operations.

Ch.Is.: no precise locality 1897, *C.W.Andrews* (BM, K); southern slopes of central limestone ridge, *D.A.Powell 5* (K); central limestone ridge, northerly aspect, *D.A.Powell 140* (K); plateau SW of Hanitch Hill, vicinity of drill line 374, *B.A.Mitchell 22* (CBG)

This species resembles *P. limenophylax* Benth. from Norfolk Is., and *P. minutiflora* Lindl. from Borneo, but differs from both in the larger size and in the suddenly contracted lip.

6. THELASIS

Thelasis Blume, *Bijdr.* 385 (1825); from the Greek *thele* (a nipple), perhaps alluding to the shape of the flowers which do not open widely, or to the vertically compressed pseudobulb shape in some species.

Type: not designated.

Herbs, usually epiphytic. Pseudobulbs vertically to laterally compressed, often covered with basal sheaths which may be leaf-like (not on Christmas Is.). Leaves usually 1 per shoot, linear or lorate, coriaceous or fleshy. Inflorescence racemose, lateral; peduncle long; rachis with many closely spaced, small flowers which do not open widely. Lip entire, widest and concave at base, narrowing to apex, attached to base of column. Pollinia 8, in 2 groups of 4, on long, slender stipes and an elongated viscidium.

A genus of c. 15 species distributed from northern India through Malesia including New Guinea, with 1 species in Australia and 1 species in Christmas Is. Closely related to *Phreatia* which differs in the presence of an elongated column foot, giving the flowers a distinct mentum.

F.Kraenzlin in A.Engler, *Pflanzenr.* Heft 50: 37–44 (1911).

Thelasis capitata Blume, *Bijdr.* 386 (1825)

T: Pantjar, Mt. Salak, Java, *C.L.Blume*; *n.v.* Epithet from the Latin *capitatus* (head- or knob-like), in reference to the inflorescence.

Illustration: J.J.Smith, *Die Orchideen von Java, Figuren-Atlas* fig. 372 (1911).

Epiphytic herb. Pseudobulbs obliquely compressed, decumbent, overlapping at base, with 1 leaf. Leaf lorate, 5–15 cm long, 1–1.8 cm wide, obtuse, often weakly bidentate, fleshy. Inflorescence 7–18 cm long, lateral from below pseudobulb; peduncle long, slender; rachis short with many crowded flowers, the whole appearing capitate. Bracts subtending flowers adpressed after flower falls, imbricating, giving the rachis a scaly appearance. Flowers small, pitcher-shaped, 4 mm long, not resupinate, yellowish green; sepals and petals not spreading except slightly at tips. Lip triangular-ovate, obtuse. Fig. 95F–G.

Christmas Is. Only seen on the plateau and on Murray Hill, and favouring trees with a dense, high canopy. It also occurs in Java, Sumatra and Sabah.

Ch.Is.: 1.6 km S of Drumsite, *D.A.Powell 297* (K).

H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 234 (1906), recorded this taxon as '*T. elongata* Bl.?'

7. DENDROBIUM

Dendrobium Sw., *Nova Acta Regiae Soc. Sci. Upsal.* ser. 2, 6: 82 (1799), *nom cons.*; from the Greek *dendron* (a tree) and *-bius* (living), in reference to the epiphytic habit of many species.

Type: *D. crumenatum* Sw.

Epiphytic, clump-forming herbs, usually with stems swollen into cane-like pseudobulbs, produced annually. Leaves alternate, distichous; lamina articulated to a closely sheathing base. Inflorescence racemose, borne laterally or apparently terminally. Flowers often showy; lateral sepals adnate at base to a column foot forming an often spur-like mentum. Lip 3-lobed with erect side-lobes separated by 1–7 raised ridges. Pollinia 4, in 2 appressed pairs, without caudicles or stipes.

The second largest orchid genus with about 900 species, from SE Asia to Australia which has 48 species; 1 species occurs on Christmas Is.

Dendrobium crumenatum Sw., *J. Bot.* (*Schrad.*) 2: 237 (1799)

T: 'Habitat in India oriental; Java', *O.P.Swartz s.n.*; *n.v.* Epithet from the Latin *crumena* (a purse), probably in reference to the spur at the base of the flower.

Illustration: R.E.Holttum, *Orchids Malaya* 2nd edn, 8, 15, figs 3, 6 (1957).

Stems c. 40–70 cm long, swollen, ridged, yellow near base, tapering to a long, slender apex. Leaves narrowly oblong-elliptic, c. 5–8 cm long, 1–2 cm wide, thick, leathery, obtuse, slightly bilobed, confined to central region of stem. Inflorescences borne laterally in upper, leafless part of stem; axis short, to 1 cm, enclosed in several bracts. Flowers c. 4 cm across, produced singly from each inflorescence, white, strongly scented, ephemeral, open in the morning only. Lip with 5 parallel, yellow keels. Fig. 95A–B.

Christmas Is. Common on trees throughout the island, often in exposed positions; wide-spread in SE Asia from India and southern China to western and central Malesia.

Ch.Is.: no precise locality, *C.W.Andrews 110* (K); first terrace, *D.A.Powell 77* (K); Murray Hill road, *B.A.Mitchell 72* (CBG).

The flowers open synchronously, 9 days after a sudden drop in temperature.

8. FLICKINGERIA

Flickingeria A.D.Hawkes, *Orchid Weekly* 2(46): 451 (1961); after E.A.Flickinger, editor of several American orchid and horticultural journals.

Type: *F. angulata* (Blume) A.D.Hawkes

Desmotrichum Blume, *Bijdr.* 329, pl. 35 (1825), *nom rej.*, *non* Kütz. (1845); *Dendrobium* sect. *Desmotrichum* (Blume) Rchb.f. in W.G.Walpers, *Ann. Bot. Syst.* 1: 778 (1849). T: *D. angulatum* Blume

Epiphytic herbs with a creeping rhizome from which arise erect, branching aerial stems of several nodes, the uppermost swollen into a pseudobulb with a single leaf and inflorescence at apex. Branching occurs below pseudobulb and aerial stems and may extend to several pseudobulbs, forming a tangled clump. Inflorescence a short tuft of bracts, with 1 flower, but several may develop from the same point on the pseudobulb. Flowers ephemeral; lateral

Figure 95. **A–J**, ORCHIDACEAE. **A–B**, *Dendrobium crumenatum*. **A**, flowering plant X0.5 (C.Andrews 110, K, & B.Mitchell 72, CBG); **B**, flower X1 (D.Powell 543, K). **C–E**, *Flickingeria nativitatis*. **C**, flowering shoot X0.5; **D**, flower X1 (C.Andrews, 1897, K); **E**, capsule X1 (D.Powell 296, K). **F–G**, *Thelasis capitata*. **F**, flowering plant X0.5; **G**, inflorescence tip X2.5 (D.Powell 297, K). **H–J**, *Eria retusa*. **H**, flowering plant X0.5; **I**, inflorescence X4; **J**, capsule X4 (D.Powell 298, K). Drawn by E.Catherine.

sepals adnate at base to a column foot, forming a mentum. Lip 3-lobed, with erect side-lobes and a usually fimbriate or bilobed mid-lobe, often with a strongly undulating margin. Pollinia 4, in 2 pairs, without caudicles.

There are 65–70 species in this genus, but the Malesian species are in need of revision. It extends from northern India and Taiwan through Indo-China, Malesia to Australia and Polynesia; 2 species in Australia and 1 on Christmas Is.

G.Seidenfaden, Orchid genera in Thailand 9, *Flickingeria* Hawkes and *Epigenium* Gagnep., *Dansk Bot. Ark.* 34: 9–67 (1980).

Flickingeria nativitatis (Ridl.) J.J.Wood, *Orchadian* 7: 145, fig. 1 (1982)

'*Dendrobium* sect. *Cadetia* sp' Ridl., *J. Straits Branch Roy. Asiat. Soc.* 23: 126, 134 (1891); *D. pectinatum* Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 232 (1906), *non* Finet (1903); *D. nativitatis* Ridl., *op. cit.* 48: 107 (1907); *Ephemerantha pectinata* (Ridl.) P.F.Hunt & Summerh., *Taxon* 10: 105 (1961). T: on trees on Phosphate Hill and the Plateau, Christmas Is., Oct. 1904, *H.N.Ridley*; lecto: K; isolecto: BM, *fide* J.J.Wood, *loc. cit.* Epithet from the Latin *nativitas* (nativity, birth), implying the nativity of Christ, or Christmas, after Christmas Is. where the type was collected.

[*Dendrobium macraei auct. non* Lindl. (1830): C.W.Andrews, *Monogr. Christmas Is.* 190 (1900)]

Illustration: J.J.Wood, *Orchadian* 7: 144, fig. 1 (1982).

Aerial stems c. 15–40 cm long, sometimes branching, with c. 5–15 fusiform, bilaterally compressed, yellow-green pseudobulbs c. 2.5–4 cm long. Leaf narrowly elliptic, 5–12 cm long, 1–2 cm wide, obtuse, coriaceous. Inflorescence in front at leaf base. Flowers opening singly, 1–1.5 cm across, pale yellow; sepals and petals lanceolate, acute; lateral sepals recurved, forming a 3–4 mm, subacute mentum at base. Lip with side-lobes clasping column; mid-lobe dilated; margin strongly undulating, ±fimbriate towards apex; callus ridges 2, sinuate, reaching middle of mid-lobe. Capsule ellipsoidal, 1.5 cm long. Fig. 95C–E.

Christmas Is. Common on the plateau and the high terraces, favouring *Planchonella* (Sapotaceae) and *Eugenia* (Myrtaceae) as the host. Thought to be endemic, but has been identified from eastern Java, see J.B.Comber, *Orchids of Java* 252–253 (1990).

Ch.Is.: no precise locality, 1897, *C.W.Andrews* (BM, K); no precise locality, on *Planchonella nitida*, *D.A.Powell 296* (K); south-western slopes of Aldrich Hill, on fallen *Planchonella nitida*, *D.A.Powell 460* (K); central plateau, on *Ficus microcarpa*, *D.A.Powell 544* (K).

This species is closely related to *F. aureiloba* (J.J.Sm.) J.J.Wood from Java and Sumatra, but has 2, not 3, keels on the lip, and lacks the golden yellow mid-lobe of the lip. Both species are included in sect. *Plicales* Seidenf. (C.Seidenfaden, *Dansk Bot. Ark.* 34(1): 16, 1980)

9. THRIXSPERMUM

Thrixspermum Lour., *Fl. Cochinch.* 2: 519 (1790); from the Greek *thrix* (hair) and *sperma* (seed), descriptive of the slender, hair-like seeds.

Type: *T. centipeda* Lour.

Epiphytic herbs with leafy, monopodial stems. Leaves ±distichous, coriaceous. Inflorescence axillary, racemose; rachis either flattened, with flowers in two ranks (not on Christmas Is.) or terete with congested, unranked flowers. Flowers produced in succession, ephemeral. Lip firmly united with the column foot, fleshy, saccate, entire or 3-lobed; callus often in front of sac. Pollinia 4, unequal, in 2 pairs, on stipes and a viscidium.

A genus of c. 60 species from tropical SE Asia, Malesia and Polynesia, with 2 species in Australia (Qld) and 1 species on Christmas Is. It is difficult to assess the number of species, as many have been incorrectly included in this genus.

R.Schlechter, Die Gattung *Thrixspermum* Lour., *Orchis* 5: 54–58 (1911).

Thrixspermum carinatifolium (Ridl.) Schltr., *Orchis* 5: 56 (1911)

Sarcochilus carinatifolius Ridl., *J. Straits Branch Roy. Asiat. Soc.* 23: 136 (1891); *Dendrocolla carinatifolia* (Ridl.) Ridl., *J. Linn. Soc., Bot.* 32: 382 (1896). T: Christmas Is., 1904, *H.N.Ridley s.n.*; *n.v.* Epithet from the Latin *carinatus* (keeled) and *folium* (a leaf).

Illustration: J.J.Smith, *Bull. Jard. Bot. Buitenzorg* ser. 3, 4: t. 13, fig. 1 (1924), as *T. batuense* var. *javanicum* J.J.Smith.

Stems straggling, c. 30 cm long, flattened, with many branching aerial roots. Leaves c. 1 cm apart, distichous, fleshy, elliptic, 5–7 cm long, 1.5–2 cm wide, broadly rounded and unequally bilobed, flattened and sheathing at base. Scape 12–24 cm long, wiry; rachis to 3 cm long; bracts 5 mm long, acute, somewhat congested. Flowers c. 2 cm across, white, becoming yellowish with age; sepals 8–9 mm long, acuminate; lateral sepals ±triangular, unequal-sided. Lip with side-lobes 7 mm long, narrow, curved, acuminate; mid-lobe thick, ovate; sac curved, conical; callus rounded. Capsule linear, 10 cm long, 0.3 cm diam. Figs 62, 94F–H.

Christmas Is. Usually on the plateau, high in the canopy among the branches of *Eugenia* or *Planchonella*. Also found in Malaya, Sumatra, Java and Pulau Pulau Batu Islands.

Ch.Is.: no precise locality, *C.W.Andrews 143* (BM, K); central area on *Eugenia* in primary forest, *D.A.Powell 141* (K); plateau SW of Hanitch Hill, vicinity of drill line 374, *B.A.Mitchell 50* (CBG).

This species is in sect. *Dendrocolla* Blume (R.Schlechter, *Repert. Spec. Nov. Beih.* 1: 958, 1913), characterised by the flowers placed all round the rachis, not in 2 ranks.

10. BRACHYPEZA

Brachypeza Garay, *Bot. Mus. Leafl.* 23(4): 163 (1972); from the Greek *brachy* (short) and *peza* (a foot), in reference to the characteristically short column foot.

Type: *B. archytas* (Ridl.) Garay

Epiphytic herb, short-stemmed, monopodial. Leaves fleshy, few, distichous. Inflorescence racemose, slender, arching to pendulous from below leaves, with a long peduncle. Flowers short-lived; sepals and petals free. Lip hanging from a short column foot, strongly saccate, 3-lobed; side-lobes large, erect; mid-lobe minute, recurved. Column elongated, arching, inflated at apex. Pollinia 2, cleft in basal half to point of attachment to stipe.

A genus of 6 species from India to Malesia; 1 species on Christmas Is. Originally included in *Saccolabium* Blume, a genus greatly subdivided by L.A.Garay (*loc. cit.*).

Brachypeza archytas (Ridl.) Garay, *Bot. Mus. Leafl.* 23(4): 164 (1972)

Saccolabium archytas Ridl., *J. Straits Branch Roy. Asiat. Soc.* 23: 137 (1891). T: Christmas Is., 1890, *H.N.Ridley s.n.*; iso: K. Epithet after the Greek philosopher Archytas, c. 400 BC, who saved Plato's life.

[*Doritis*, sp. n.?', see R.A.Rolfe in W.B.Hemsley, *J. Linn. Soc., Bot.* 25: 359 (1890)]

Illustration: J.J.Wood, *Orchadian* 7: 146, fig. 3 (1982).

Stems obscured by many aerial roots. Leaves 4 or 5, lorate, 10–22 cm long, 1.6–2.6 cm wide, unequally bilobed, forming a fan. Inflorescence 15–35 cm long; peduncle long, angled; rachis with many densely spaced flowers. Flowers small, white; pedicel and ovary 7–11 mm long, white; dorsal sepal oblong, obtuse, concave, c. 8 mm long, 2.5 mm wide; lateral sepals triangular; petals shorter, spathulate. Lip c. 5 mm long with large, rounded side-lobes, with violet spots, and a large, straight, blunt spur; callus of 2 appendages at base of side-lobes. Capsule narrowly cylindical, c. 6 cm long, 0.4 cm diam. Fig. 94A–C.

Christmas Is. Endemic. A pretty species, relatively common especially in forest on the lower terraces where it often occurs low down on large tree trunks such as *Gyrocarpus* and *Tristiropsis*.

Ch.Is.: highest part of hill above Flying Fish Cove, 4 Oct. 1887, *J.J.Lister* (K); no precise locality,

C.W.Andrews 144 (BM, K); first terrace immediately below Drumsite, *D.A.Powell 531* (K); Flying Fish Cove, on terrace at c. 170 m, on *Terminalia catappa*, *D.A.Powell 545* (K); National Park, S side of Fergusson Hill, *B.A.Mitchell 102* (CBG, K).

11. TAENIOPHYLLUM

Taeniophyllum Blume, *Bijdr.* 355, table 3, fig. 70 (1825); from the Greek *tainia* (a ribbon, tape) and *phyllon* (a leaf), a misnomer for this orchid which is virtually leafless, the function of the leaves being taken over by ribbon-like roots containing chlorophyll.

Type: not designated.

Epiphytic herbs, very short-stemmed, monopodial. Leaves reduced to small, inconspicuous scales, functionally replaced by many green–grey, terete to flattened roots, usually appressed against supporting branch. Inflorescence racemose, small, erect, usually with a short peduncle, sometimes with distichous bracts. Flowers small, often short-lived, borne singly in succession along raceme. Sepals and petals free or connate at base. Lip attached to column base, with a saccate to conical basal spur, 1- or weakly 3-lobed; mid-lobe flat or concave, sometimes incurved at apex, sometimes with a slender, apical tooth or bristle. Column short, broad. Pollinia 4. Capsule linear-oblong.

A poorly known genus of inconspicuous, epiphytic orchids containing c. 170 species. It is distributed from Sri Lanka, India, S China and Japan through Indo-China and Malesia to northern Australia (Qld) and the Pacific islands, with a centre of diversity in New Guinea; 1 species has been recorded from Christmas Is. Most species grow among the leaves on small branches of forest canopy trees. In some species flowering may be triggered by a certain climatic stimulus, leading to gregarious flowering.

The genus can be divided into 2 groups: those with free petals and sepals, flowering during the day, and those with connate sepals and petals, flowering at night.

J.J.Smith, Die Orchideen von Java, *Fl. Buitenzorg* 6: 621–626 (1905); J.J.Smith, *Die Orchideen von Java, Figuren-Atlas* t. 466–469 (1914); C.E.Carr, The genus *Taeniophyllum* in the Malay Peninsula, *Gard. Bull. Straits Settlem.* 7: 61–86, t. 6–14 (1932).

Taeniophyllum hasseltii Rchb.f., *Xenia Orchid.* 2: 68, t. 116 (1862/63)

T: Java, herb. H.G.Reichenbach; holo: probably W *n.v.* Named after J.C. van Hasselt (1797–1823), a Dutch physician and biologist who explored widely in western Java.

Illustration: J.J.Smith, *Die Orchideen von Java, Figuren-Atlas* fig. 468 (1914).

Plant apparently lacking leaves; roots spreading along supporting branch up to 20 cm from centre of plant, c. 3 mm wide, flattened, silvery grey. Inflorescence to 2 cm long; rachis with few distichous scales, each enclosing a flower bud. Flowers 4–5 mm diam., pale yellow, opening sequentially; sepals and petals free; sepals elliptic, c. 2.5 mm long, obtuse, concave, spreading or lateral sepals somewhat porrect; petals slightly narrower, spreading. Lip navicular, c. 3.5 mm long including spur, obscurely 3-lobed; apex acute, incurved; spur saccate, c. 1.5 mm long, sparsely hairy within; callus of 2 thickened ridges.

Christmas Is. Not recorded from the island until 1987, when specimens were noted on small, fallen branches in the primary rainforest. Probably restricted to Malesia, but its total distribution is not known.

Ch.Is.: plateau forest, *J.Tranter s.n.* (K).

The lack of leaves makes this orchid resemble other fallen epiphytic orchids from which the leaves have been eaten by red land crabs. It is difficult to give its correct identification as the genus is badly in need of taxonomic revision. It is related to the more common and widespread *T. obtusum* Blume, but this has an entire, very obtuse lip, lacking the incurved tooth of the specimens on Christmas Is. C.E.Carr (*Gard. Bull. Straits Settlem.* 7: 61–86, 1932) and R.E.Holttum (*Fl. Malaya* 1: 583–589, 1953) did not include *T. hasseltii* in their reviews of this genus in Malaysia. They did, however, include *T. calceolus* Carr, a species

recorded by J.J.Smith (*Fl. Buitenzorg* 6: 621–626, 1905), from Java which appears identical with *T. hasseltii*.

12. CORYBAS

Corybas Salisb., *Parad. Lond.* t. 83 (1807); after Corybas, of Greek mythology, one of the priests of the goddess Cybele.

Type: *C. aconitiflorus* Salisb.

Terrestrial plants, glabrous, with orbicular tuberoids; above-ground parts annual. Leaf solitary, green or variegated, with broad usually horizontal lamina. Flowers usually solitary; pedicel short, usually elongating in fruit. Perianth small to relatively large dominated by dorsal sepal and labellum; dorsal sepal uppermost, hood-like, curved forwards; lateral sepals and petals linear to filiform. Labellum relatively large, the basal edges overlapping or connate behind the short column to form a tube; lateral margins incurved or widely flared. *Helmet Orchids*.

A genus of c. 100 species of India, the Philippines, Indonesia, New Guinea and Australasia; 20 native species in Australia; 1 species on Macquarie Is.

M.J.Brown, J.F.Jenkin, N.P.Brothers & G.R.Copson, *Corybas macranthus* (Hook. f.) Reichb. f. (Orchidaceae) a new record for Macquarie Island, *New Zealand J. Bot.* 16: 405–407 (1978).

Corybas dienemus D.L.Jones, *Fl. Australia* 50: 572 (1993)

T: N of Bauer Bay, Macquarie Is., 27 Nov. 1989, *J.R.Croft 10445*; holo: CBG; iso: CBG, HO, MEL, NSW, WELT. Epithet from the Greek *dienemos* (windswept), in reference to the habitat.

[*C. macranthus auct. non* (Hook.f.) Rchb.f.: M.J.Brown *et al.*, *New Zealand J. Bot.* 16: 405–407 (1978)]

Illustration: M.J.Brown *et al.*, *op. cit.* fig. 3 as *C. macranthus*; T.Flannery & T.Rodd, *Australia's Wilderness Heritage* 2: 358 (1988), as *C. macranthus*.

Plant 3–5 cm tall at flowering. Leaf orbicular, 1.5–2.5 cm diam., dark green above, pellucid beneath, cupular and semi-erect at flowering, apiculate, thick-textured. Flowers pale green and reddish purple, semi-erect in cordate base of leaf. Dorsal sepal linear-oblanceolate, acuminate, cucullate over labellum tube; lateral sepals and petals filiform, long-acuminate, subequal, stiffly erect. Labellum tubular at base; lateral margins flared to incurved, irregularly crenate. Fig. 90F–G.

Macquarie Is. First recorded in 1978. An endemic occurring as colonies in very wet bog communities dominated by the moss *Breutelia pendula*, mainly on upper raised beach terraces. Flowers Nov.–Jan.

M.Is.: Green Gorge, 24 Feb. 1980, *G.Leaman & G.Copson* (HO); Half Moon Bay, 12 Nov. 1980, *G.Copson* (HO); Green Gorge Basin, 5 Nov. 1981, *R.D.Seppelt 12098* (HO); Sawyer Ck valley, 5 Nov. 1981, *R.D.Seppelt 12099* (HO); between Douglas Point and Boiler Rocks, 11 Dec. 1981, *R.D.Seppelt 12161* (HO).

This species can be immediately distinguished by the pale green and red, semi-erect flowers which sit in the cordate base of the leaf.

PINOPHYTA

96. CYCADACEAE

D.J.Du Puy (Ch.Is.)

Palm-like trees, unbranched, dioecious; trunk thick, woody, covered in old leaf bases; sap mucilaginous. Leaves pinnate, spirally arranged in a crown at trunk apex, produced in flushes; pinnae numerous, narrow, with a prominent, central, longitudinal vein but lacking secondary venation, circinnate in bud. Male strobilus large, cone-like, the spirally arranged scales (microsporophylls) with an upturned apex. Female strobilus a terminal, spirally arranged crown of modified and reduced scale-like leaves (megasporophylls), replacing sterile leaves and often persisting below whorls of new leaves; megasporophylls ±spathulate, densely hairy, fleshy; ovules large, conspicuous, 2–8 in subopposite teeth on margin of megasporophyll. Seed sessile on megasporophyll, large, thinly fleshy.

Monogeneric family. *Cycas* contains 15–20 species, mostly in SE Asia, distributed from India, China and Japan through Indo-China, Malesia to Australia and the south-western Pacific islands. There is also one species in eastern Africa, Madagascar and islands of the western Indian Ocean. Probably c. 7 species occur in Australia; 1 species is native on Christmas Is. Several species, including *C. revoluta* Thunb., *C. circinalis* L. and *C. rumphii* Miq., are cultivated as garden ornamentals. Several imported specimens are cultivated on Christmas Is. The genus is poorly understood, and is in need of a full taxonomic revision, see L.A.S.Johnson, *Proc. Linn. Soc. New South Wales* 84: 67–68 (1959).

The order Cycadales was split by L.A.S.Johnson, *op. cit.* 64–117 into three families. The Cycadaceae itself contains only the genus *Cycas*. It is distinguished from the Stangeriaceae (1 genus, 1 species) and Zamiaceae (8 genera, c. 80 species) by its lack of any secondary venation in the pinnae, its circinnate pinnae in bud, and the form of the female strobilus, which in the other two families is cone-like, resembling the male strobilus, and has inward-facing ovules.

Cycads are wind-pollinated, the male strobili producing vast numbers of pollen grains. The life-cycle of these plants is more advanced than in ferns, but mobile male spermatozoids are still involved in the fertilisation process. This primitive life-cycle gives an insight into the evolution of some flowering plants. Cycads were abundant c. 80–200 million years ago, and comparatively few taxa still survive. This ancient origin and their primitive life-cycle have led to the term 'living fossil' being applied.

Cycads have a thick tap root, with the surface roots thick and branched, forming a growth resembling stag coral. The tissue within these roots is host to a symbiotic blue-green alga, which probably fixes atmospheric nitrogen into a form that can be utilised by the plant.

L.A.S.Johnson, The families of Cycads and the Zamiaceae of Australia, *Proc. Linn. Soc. New South Wales* 84: 64–117 (1959); C.A.Backer & R.C.Bakhuizen van den Brink Jr, Cycadaceae, *Fl. Java* 1: 87 (1963); T.Smitinand, The genus *Cycas* L. (Cycadaceae) in Thailand, *Nat. Hist. Bull. Siam Soc.* 24: 163–175 (1971); P.Vorster, The African *Cycas*, *Excelsa* 3: 14–22 (1973); A.C.Smith, Cycadaceae, *Fl. Vit. Nova* 1: 89–91 (1979).

CYCAS

Cycas L., *Sp. Pl.* 2: 1188 (1753); *Mant. Pl. Alt.* 2: 166 (1771); from the Greek name *kykas*, for a type of palm, due to the superficial resemblance of *Cycas* species to palms.

Type: *C. circinalis* L.

Cycas rumphii Miq., *Bull. Sci. Phys. Nat. Neerl.* 45 (1839)

T: illustrations of *Olus calappoides*/*Sajor calappa* in G.E.Rumphius, *Herb. Amboin.* 1: t. 22 & t. 23 (1741). Named after G.E.Rumphius (1627–1702), a Dutch naturalist who worked mainly in Java and the Moluccas (Ambon).

Tree to 10 m tall; trunk to 40 cm diam., light grey, deeply fissured into ±rectangular pieces. Leaves 1.5–2 m long. Pinnae numerous, closely spaced, subopposite, narrow, linear, decurrent at base as a narrow wing on the rachis, finely acuminate, glabrous, coriaceous, dark green, glossy, to 25 cm long; midvein prominent; petiole 30–50 cm long, with scattered recurved spines. Male strobilus oblong-ellipsoidal, 30–60 cm long, orange, foetid. Megasporophylls c. 30 cm long, fleshy, densely brown hairy; fertile area c. 3.5 cm wide, somewhat flattened, with c. 6 marginal ovules; tip obovate, flattened, acuminate; margins weakly toothed. Seed subspherical, c. 5 cm long, glabrous, green becoming wrinkled and red-brown. *Cycad*.

Christmas Is. Uncommon, occurring as isolated, mature trees along the cliff tops and areas of limestone scree and pinnacles in the higher altitudes of the islands, although specimens do also occur on the shore terrace. Distributed throughout Malesia, the Philippines and the Pacific islands as far as Fiji.

Ch.Is.: Steep Point, *H.N.Ridley 165* (K); high north-western terrace, *D.A.Powell 412* (K); high north-western terrace, *D.A.Powell 561* (K); south-eastern terrace, *D.A.Powell 638* (K).

The species complex also includes *C. thoursii* Gaudich., from eastern Africa, Madagascar and the Seychelles, and *C. circinalis* L., from India, Sri Lanka, southern China and Indo-China. Differences between these species are apparent especially in the shape and indentation of the lamina of the megasporophylls, see T.Smitinand, *Nat. Hist. Bull. Siam Soc.* 24: 168, fig. 4 (1971); P. & E.Vorster, *Excelsa* 3: 17–18 (1973); A.C.Smith, *Fl. Vit. Nova* 1: 91 (1979). However, they are often considered to be conspecific with *C. rumphii*.

Most specimens reproduce only vegetatively, by the production of bulbils and plantlets which drop off the tree trunk and become rooted. The trunk contains a starchy pith which helps the plant to resist dessication. Sago can be prepared from the pith by drying, grinding and washing. The seeds are poisonous, containing the toxic glucoside pakoein, but have a high starch content. They become edible after pounding and repeated washing followed by boiling or roasting to produce a starchy meal. The seeds, bark and mucilaginous sap are widely used for poultices on sores.

PTERIDOPHYTA AND ALLIES

D.J.DuPuy (Ch.Is.)
A.E.Orchard (M.Is.)

Vascular herbs, rarely arborescent, often rhizomatous, often with scales. Leaves either bract-like, or with a broad, simple lamina or variously pinnate, usually circinnate in bud, bearing sporangia. Sporangia usually grouped in sori or synangia, or in the axils or sporophylls grouped into strobili; sori often protected by an indusium. Spores germinate to form a prothallus (gametophyte), which bears the male and female organs, reproducing, after fertilisation, the new plant (sporophyte).

Ferns and fern allies; a large, worldwide division of land plants. Represented on two offshore island Territories, Christmas Is. and Macquarie Is.

The Classification proposed by Mary D.Tindale and S.K.Roy in A Cytotaxonomic Survey of the Pteridophyta of Australia, *Austral. Syst. Bot.*, in press, is adopted here.

R.E.Holttum, *Revised Fl. Malaya* II, *Ferns Malaya* (1954); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn (1981); R.M. & A.F.Tryon, *Ferns & Allied Pl.* (1982); D.L.Jones, *Encycl. Ferns* (1987); S.B.Andrews, *Ferns Queensland* (1990).

97. LYCOPODIACEAE

D.J.Du Puy (Ch.Is.)
A.E.Orchard (M.Is.)

Herbs, epiphytic, lithophytic or terrestrial, sometimes with a creeping rhizome, rarely tuberous; roots wiry; aerial stems erect to pendulous, procumbent or climbing, often branched, sometimes dichotomously. Leaves (microphylls) scale-like, with one central vein, spirally arranged or in whorls, spreading or appressed, rarely ±reduced to a rosette. Fertile leaves (sporophylls) sometimes scattered among sterile leaves, but often modified and combined into specialised terminal or lateral cone-like structures (strobili); strobili simple or dichotomously branched. Sporangia solitary, in axils of sporophylls or epiphyllous, reniform, containing many spores, dehiscing through a marginal slit. *Clubmosses*, *Tassel Ferns*.

A family containing c. 280 species in 4 genera; 18 species in Australia; 1 genus with 1 species on Christmas Is. and 1 species on Macquarie Is. These are the relatively few, modern representatives of a primitive plant group which was abundant during the Carboniferous period, c. 290–365 million years ago.

Huperzia can be distinguished from *Lycopodium* L. in having a tuft of roots at the base only, and dichotomously branched shoots.

D.L.Jones & S.C.Clemesha, Lycopodiaceae, *Austral. Ferns & Fern Allies* 2nd edn, 20–27 (1981); F.M.Tryon & A.F.Tryon, Lycopodiaceae, *Ferns & Allied Plants* 796–812 (1982); D.L.Jones, Lycopodiaceae, *Encycl. Ferns* 364–368 (1987); B.Ollgaard, A revised classification of the Lycopodiaceae *s. lat.*, *Opera Botanica* 92: 153–178 (1987); P.J.Brownsey & J.C.Smith-Dodsworth, Lycopodiaceae, *New Zealand Ferns and Allied Pl.* 19–24 (1989).

HUPERZIA

Huperzia Bernh., *J. Bot.* (*Schrader*) 1800(2): 126 (1801); after Huperz (fl. 1800), the German grower of the specimen which led to the description of this genus (c. 1800).

Type: *H. selago* (L.) Schrank & Mart.

Epiphytic or terrestrial herbs; stems pendulous, prostrate, ascending or erect, dichotomously branched; roots appearing as a basal tuft. Sporophylls similar to the leaves, or gradually to abruptly reduced, persistent after sporangium dehiscence. Sporangia axillary, reniform, splitting into 2 equal valves.

This cosmopolitan genus includes c. 200 species distributed in tropical, temperate, arctic and montane regions, but with greatest diversity in the tropical, evergreen, montane forests. There are two main groups of species: the tropical, epiphytic 'tassel ferns', often found at high altitudes, and the cosmopolitan, terrestrial 'clubmosses', typically occuring in damp, acidic soils.

Spore germination leads to the growth of various types of prothallus. The epiphytic 'tassel ferns' produce a slender, creeping and branching, colourless prothallus which derives nourishment through a mycorrhizal fungal association, and is attached to the substrate by many minute root hairs. The branches develop independently, and may form several mature

plants, or vegetative reproduction by gemmae may also occur at this stage. Eventually archegonia (female) and antheridia (male) form, and motile spermatozoids effect fertilisation to form the mature plant.

T.F.Cheeseman, *Vasc. Fl. Macquarie Is.* 40–41 (1919), as *Lycopodium*; B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* 156 (1955), as *Lycopodium*; H.H.Allan, Lycopodiaceae, *Fl. New Zealand* 1: 2–7 (1961), as *Lycopodium*; G.R.Copson, An Annotated Atlas of the Vascular Fora of Macquarie Island, *ANARE Res. Notes* 18: 52 (1984), as *Lycopodium*.

Leaves ovate; sporophylls much smaller than leaves; stems 20–90 cm long (Ch.Is.) **1. H. phlegmaria**

Leaves linear; sporophylls similar to leaves; stems to 6 cm long (M.Is.) **2. H. australiana**

1. Huperzia phlegmaria (L.) Rothm., *Fedde Repert. Spec. Nov. Regni. Veg.* 54: 62 (1944)

Lycopodium phlegmaria L., *Sp. Pl.* 2: 1101 (1753). T: Ceylon [Sri Lanka], herb. P.Hermann vol. 4, fol. 5, n. 386; syn: BM. Epithet from the Greek *phlegma* (mucilage, slime), indicating that the species has mucilaginous sap.

Illustrations: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 24, fig. 8B, t. 3 (1981), as *Lycopodium*; D.L.Jones, *Encycl. Ferns* 50, 367 (1987), as *Lycopodium*.

Epiphytic herb; stems 20–90 cm long, arching to pendulous, sparsely dichotomously branched; roots at base of aerial stems. Leaves sessile, spreading, ovate, 6–15 mm long, acute, rounded at base, coriaceous. Strobili terminal, slender, dichotomously branched, ±quadrangular, c. 2–10 cm long, 1–1.5 mm diam., sharply differentiated from leafy stems. Sporophylls decussate, broadly ovate, c. 1 mm long, obtuse, green. Sporangia overlapping, axillary, reniform, c. 1.2 mm diam., rounded at apex, splitting around margin into 2 flattened valves, becoming dry and cream-coloured. Spores minute, dark brown. *Common Tassel Fern*.

Christmas Is. Uncommon, confined to the western and central plateau areas (including Aldrich Hill and Jacks Hill), in tall humid rainforest. Usually occurs on the canopy and emergent tree species *Planchonella nitida* (Sapotaceae) and *Syzygium nervosum* (Myrtaceae), and situated on large branches, high up in the centre of the crown. Widely distributed from SE Asia through Malesia to Australia (Qld) and Polynesia.

Ch.Is.: middle of the island, 1897, *C.W.Andrews* (BM); no precise locality, *D.A.Powell 221* (K); Jacks Hill, *D.A.Powell 301* (K); central area, *D.A.Powell 320* (K); Aldrich Hill area, *D.J. & B.P.Du Puy CI108* (K).

This attractive species is more tolerant of dry habitats than many of the other epiphytic species, although large specimens occur mainly in rainforest. It is easy to cultivate if shade and moisture are maintained. A few specimens collected from fallen branches are cultivated on Christmas Is. The clumps can attain a large size, the stems arching outwards in fans, sometimes in several tiers, the strobili formed at the same level in each fan of stems.

2. Huperzia australiana (Herter) Holub, *Folia Geobot. Phytotax.* 20: 70 (1985)

Lycopodium australianum Herter, *Bot. Jahrb. Syst.* 43 Beibl. 98: 42 (1909); *Urostachys australianus* (Herter) Herter ex Nessel, *Die Barlappgewachse* 49 (1939); *Lycopodium australianum* (Herter) Allan, *Fl. New Zealand* 1: 3 (1961). T: a large number of collections from Indonesia, Australia and New Zealand; syn: K, P all *n.v.*, *fide* W.Herter, *loc. cit.* (1909). Epithet from the Latin *australianus* (southern), in reference to the geographical occurrence.

[*Lycopodium varium auct. non* R.Br.: T.F.Cheeseman, *Vasc. Fl. Macquarie Is.* 40 (1919)]

[*Lycopodium saururus auct. non* Lam.: B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* 156 (1955)]

Illustrations: B.D.Duncan & G.Isaac, *Ferns & Allied Pl. Victoria, Tasmania & South Australia* 40, fig. 4.4. (1986), as *Lycopodium*; P.J.Brownsey & J.C.Smith-Dodsworth, *New Zealand Ferns & Allied Pl.* pl. 2A, fig. 19 (1989), as *Lycopodium*.

Terrestrial. Stems decumbent to erect, freely branched, to 6 cm tall, clothed with microphylls throughout length, rooting at base. Leaves spirally arranged, crowded, linear, blunt to acute, entire or with a few minute teeth near the tip, 5.5–6 mm long, 1.5 mm wide,

thick, subfleshy, decurrent at base. Sporangia yellow, c. 1 mm diam., in axil of undifferentiated microphylls in upper part of stem. Lateral buds (bulbils) borne in axils of some upper microphylls. Fig. 69.

Macquarie Is. Very rare in the central and southern parts of the island. Extending from Indonesia to Australia (N.S.W., Vic., Tas.), New Zealand (North, South, Stewart and Campbell Islands) and Macquarie Is.

M.Is.: Pyramid Lake, *R.D.Seppelt 12038* (HO).

This taxon was formerly included in the cosmopolitan *L. selago* L., but is now considered distinct.

98. SELAGINELLACEAE

D.J.Du Puy (Ch.Is.)

Mostly terrestrial or lithophytic herbs; stems prostrate, suberect or scrambling, branched, sometimes combined into frond-like structures; rhizophores slender, often produced from the nodes. Leaves (microphylls) small, scale-like, entire, toothed or ciliate, 1-veined, minutely ligulate, spirally arranged or in 4 rows with the two lower rows larger and spreading (lateral leaves) and the two upper rows reduced (median leaves), producing a flattened shoot. Fertile leaves (sporophylls) combined into compact, terminal, cone-like structures (strobili); strobili either 4-angled, with all sporophylls similar, or bilaterally compressed, with 2 rows of reduced sporophylls. Sporangia solitary, axillary, either producing 1–4 megaspores or many microspores, often present in the same strobilus.

A predominantly tropical and subtropical family, with a few species extending into arctic regions, probably containing c. 600–700 species, all in the genus *Selaginella*; 1 prostrate species has been recorded from Christmas Is.

The genus can be divided into two subgenera on the basis of the leaf arrangement, either spirally arranged as in most temperate species, or in 4 rows with the leaves of 2 distinct sizes, as in most of the tropical species. Most species occur in damp, shaded habitats such as beside streams or waterfalls in forest, the prostrate species often creeping along moist earth banks or rocks, or in rock crevices. The more erect, frondose species also often cover earth banks or roadsides in damp forest localities, while the scrambling species occur at forest margins as well as in the forest. *Selaginella* species also occasionally occur in seasonally dry habitats, some species becoming very dessicated and shrivelled but able to resume growth when humidity is restored.

A.H.G.Alston, The genus *Selaginella* in the Malay Peninsula, *Gard. Bull. Straits Settlem.* 8: 41–62 (1934); A.H.G.Alston, The *Selaginellae* of the Malay Islands, 1, Java and the Lesser Sunda Islands, *Bull. Jard. Bot. Buitenzorg* 13: 432–442 (1935); A.G.H.Alston, The *Selaginellae* of the Malay Islands, 2, *Summatra* 14: 175–186 (1937); K.M.Wong, Critical Observations on Peninsular Malaysian *Selaginella*, *Gard. Bull. Singapore* 35: 107–135 (1982).

SELAGINELLA

Selaginella P.Beauv., *Mag. Encycl. Paris* 5: 478 (1804); *Prodr.* 101 (1805), *nom. cons.*; a diminutive of the Latin *selago*, originally a Celtic name probably applied to *Lycopodium selago* (a clubmoss), indicating the similarity in habit, leaves and strobili of those species and the smaller *Selaginella selaginoides*.

Type: *S. spinosa* P.Beauv., *nom. illeg.* = *S. selaginoides* (L.) Link

Selaginella alutacia Spring, *Bull. Acad. Roy. Sci. Bruxelles* 10: 33 (1843)

T: Penang, W Malaysia, *C.Gaudichaud*; holo: probably LG *n.v.* Epithet from the Latin *aluta* (a kind of soft, pale-coloured leather, tanned with alum), probably in reference to the colour of the dried plant, a pale yellow.

S. rupicola Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 248 (1906). T: holes in the rock at South Point, Christmas Is., Oct. 1904, *H.N.Ridley*; holo: SING *n.v.*; iso: BM.

A prostrate, lithophytic herb; stems creeping, to c. 20 cm long, 2.5–4 mm wide (including leaves), flattened, branched; rhizophores slender, wiry at branching points. Leaves dimorphic, ciliolate towards base; lateral leaves spreading, alternate, distichous, broadly ovate, unequal-sided, 1–2 mm long, obtuse; median leaves forward-pointing, on upper side of stem, ovate, 1–1.5 mm long, aristate. Sporophylls overlapping, those in upper 2 rows larger than those beneath, ovate, c. 1 mm long, acute, keeled, ciliolate; strobili c. 3–6 mm long, compressed.

Christmas Is., collected only once, on limestone rocks near the shore. Occurs in W Malaysia, Sumatra and Java.

Ch.Is.: rare on rocks on Smith Point, Oct. 1904, *H.N.Ridley* (BM).

H.N.Ridley, *loc. cit.*, described his collection as a new species, *S. rupicola*. He described it as endemic on Christmas Is., but it was subsequently reduced to synonymy within *S. alutacia* by A.H.G.Alston, *Bull. Jard. Bot. Buitenzorg* 13: 432–442 (1935) & A.H.G.Alston, *Summatra* 14: 175–186 (1937).

99. PSILOTACEAE

D.J.Du Puy (Ch.Is.)

Erect to pendulous, terrestrial, lithophytic or epiphytic herbs; shoots flattened or 3-ridged; rhizome much-branched, creeping, with many minute hairs; roots absent. Aerial shoots dichotomously branched, with occasional, distant, spirally arranged scales; scales minute, lacking venation. Terminal branchlets fertile, with many clusters of 3, fused sporangia (synangia). Synangium 3-lobed, sessile, subtended by a pair of scales, dehiscing through 3 radiating, apical slits. Spores numerous, minute, lacking pigments.

A monogeneric family containing 2 species, *P. nudum* (L.) P.Beauv. and *P. complanatum* Sw., both of which occur in Australia, the former also found on Christmas Is. The genus *Tmesipteris* Bernh. (Tmesipteridaceae) is sometimes included in this family.

Psilotum resembles the most primitive land plants, *Rhynia* Kidst. & W.H.Lang and *Psilophyton* Dawson, which are only known from fossils. However, it is probably more closely related to true ferns.

The rhizome is host to a mycorrhizal fungus which contributes to the nutrition of the plant in the absence of true roots.

R.E.G.Pichi Sermolli, Tentatem Pteridophytorum genera in taxonomicum ordinem redigendi, *Webbia* 31: 313–512 (1977); R.A. White, D.W.Bierhorst, P.G.Gensel, D.R.Kaplan, & W.H.Wagner, Jr., Taxonomic and morphological relationships of the Psilotaceae, *Brittonia* 29: 1–68 (1977); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 27–28 (1981); R.M.Tryon & A.F.Tryon, *Ferns & Allied Plants* 782–787 (1982); D.L.Jones, *Encycl. Ferns* 44–47 (1987).

PSILOTUM

Psilotum Sw., *J. Bot.* (*Schrader*) 1800 (2): 109 (1801); from the Greek *psilotes* (nakedness), after the scattered, naked fruit and apparently leafless stems.

Type: *P. triquetrum* Sw., *nom. illeg.* = *P. nudum* (L.) P.Beauv.

Psilotum nudum (L.) P.Beauv., *Prodr. Aetheogam.* 112 (1805)

Lycopodium nudum L., *Sp. Pl.* 2: 1100 (1753). T: without locality, herb. C.Linnaeus 1257.1; syn: LINN. Epithet is the Latin word for naked, descriptive of the apparently leafless stems and unprotected fruits.

Illustrations: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 28, fig. 12 (1981); D.L.Jones, *Encycl. Ferns* 45, 49 (1987).

Herb, c. 20–40 cm tall, clump-forming, usually terrestrial; rhizome subterranean, creeping, attached by many fine, rhizoidal hairs. Aerial shoots wiry, usually erect, unbranched in the basal half, repeatedly dichotomously branched immediately below the apical fertile branchlets, strongly 3-ridged, green becoming yellow and eventually brown; scales spirally arranged, distant, to 3 mm long, acute. Synangium subtended by a pairs of scales, sessile, strongly 3-lobed, c. 2–3 mm diam., yellow, dehiscing through 3 radiating slits. Spores numerous, hyaline. *Skeleton Fork-Fern*.

Christmas Is. Common in quarries on Christmas Is., especially in the South Point and Phosphate Hill areas. It grows in full sun on limestone or limestone gravel mixed with poor phosphatic soil, protected only by the limestone pinnacles and the other low ferns which colonise this inhospitable type of habitat. Found rarely as a forest epiphyte in association with large ferns. A widely distributed species in the tropics and subtropics, occurring as far north as Florida, Spain, Hawaii and Japan, and south to New Zealand and Australia (W.A., N.T., Qld, N.S.W., Vic.).

Ch.Is.: no precise locality, *D.A.Powell 286* (BO, K, L); SE of Stewart Hill, Field 22 south, *D.J. & B.P.Du Puy CI69* (CBG, K).

The shoots are reputed to have laxative properties.

100. OPHIOGLOSSACEAE

D.J.Du Puy (Ch.Is.)

Erect or rarely pendulous, terrestrial or epiphytic herbs; rhizome tuberous or creeping. Sterile fronds simple to bipinnate, rarely palmate or dichotomously branched. Fertile fronds in 2 distinct parts, the fertile portion simple and spike-like, or compound, stalked, arising from stipe or from sterile lamina at or near to point of insertion of stipe. Sporangia in marginal rows along axis or branches of fertile portion of frond, sometimes fused into a synangium through transverse or rarely longitudinal slits.

A cosmopolitan family of 3 genera with c. 80 species; 1 genus on Christmas Is. *Ophioglossum* and *Botrychium* Sw. are the largest genera, with 1 species in the Old World genus *Helminthostachys* Kaulf. This family of ferns is considered primitive, originating before the Jurassic period (c. 210 million years ago), although there is little fossil evidence.

The roots are thick and lack root hairs, relying on a symbiotic mycorrhizal association for nutrient absorption.

R.T.Clausen, A Monograph of the Ophioglossaceae, *Mem. Torrey Bot. Club* 19: 1–77 (1938); J.H.Wieffering, A preliminary revision of the Indo-Pacific species of *Ophioglossum* (Ophioglossaceae), *Blumea* 12: 321–337 (1964); R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn,

2: 38–42 (1968); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern* Allies 2nd edn, 57, 62–63 (1981); R.M.Tryon & F.M.Tryon, *Ferns & Allied Pl.* 25–39 (1982).

OPHIOGLOSSUM

Ophioglossum L., *Sp. Pl.* 2: 1062 (1753); *Gen. Pl.* 5th edn, 486 (1754); from the Greek *ophis* (a snake) and *glossa* (a tongue), the fertile spike bearing a fancied resemblance to a snake's tongue.

Type: *O. vulgatum* L.

Terrestrial herbs with short, erect fronds and bulbous rhizomes, or epiphytes with long, pendulous fronds arising from a creeping, fleshy rhizome; roots thickened, sometimes with vegetative buds. Fronds solitary to several; sterile lamina simple or rarely dichotomously or palmately divided, with reticulate venation. Fertile spike simple or rarely forked, subcylindrical, stalked, arising at or near base of lamina. Sporangia in 2 rows along apical portion of spike, fused into a thick-walled synangium, dehiscing through transverse slits. Spores numerous. *Adder's Tongue Ferns*.

A genus of c. 30 species, with probably 4 species in Australia, 2 of these also on Christmas Is. The variation in this genus is poorly understood, particularly with regard to the terrestrial species, and the genus is in need of a complete taxonomic revision. The epiphytic species are confined to the humid tropics, but the terrestrials are distributed from tropical to polar regions. The latter group are generally found in open situations, in grassland or open woodland, and can be pioneer species on roadsides, quarries and other disturbed land with poor quality soil.

Large, evergreen, epiphytic herb, eventually forming a larger clump; lamina of frond pendulous, ribbon-shaped, to 200 cm long; fertile portion of frond pendulous, much shorter than sterile lamina **1. O. pendulum**

Small, deciduous, terrestrial herb, occurring as scattered individuals with 1–3 fronds; lamina of frond erect, rhombic to ovate, to 3 cm long; fertile portion of frond erect, greatly exceeding sterile lamina **2. O. reticulatum**

1. Ophioglossum pendulum L., *Herb. Amboin.* 27 (1754)

T: illustration of *Scolopendra major*, in G.E.Rumphius, *Herb. Amboin.* 6: t. 37, fig. 3 (1750); *fide* C.Jarvis, BM, pers. comm. Epithet from the Latin *pendere* (to hang), descriptive of the pendulous growth habit of this species.

Illustration: D.L.Jones, *Encyl. Ferns* 346 (1987).

Large, clump-forming, epiphytic herb; rhizome creeping, with 1–several fronds. Fronds pendulous, glabrous, persistent; sterile lamina strap-shaped, to 200 cm long, c. 2–4 cm wide, strap-shaped, sparingly dichotomously branched, undulating, leathery, grey-green, glossy, narrowing basally into a fleshy stipe; fertile spike inserted towards base of lamina, 10–35 cm long, entire or forked, the 2 rows of fused sporangia each c. 2.5 cm diam. Spores pale yellow. *Ribbon Fern*.

Christmas Is. Uncommon in tall primary rainforest on the plateau, and in more open forest on the upper terraces around Aldrich Hill; also reported from the lower terraces near Sydneys Dale, where surface water maintains a high humidity. It is a handsome species, forming large clumps of undulating, ribbon-like fronds, usually hanging from beneath large specimens of *Asplenium* (on Christmas Is.) and *Platycerium* ferns. Widespread in the Old World humid tropics, occurring from Madagascar, India and Sri Lanka through Indo-China, and Malesia to Australia (Qld, N.S.W.) and the Pacific islands.

Ch.Is.: southern terraces, *D.A.Powell 427* (K); on *Planchonella nitida*, *D.A.Powell 556* (K); 1.5 km SW of Aldrich Hill, on *Pongamia*, *D.J. & B.P.Du Puy CI83* (K).

Figure 96. **A**, POLYPODIACEAE: *Leptochilus decurrens*, a fertile and two sterile fronds X0.3 (D. & B.Du Puy CI87, K). **B**, LOMARIOPSIDACEAE: *Bolbitis heteroclita*, fertile frond and sterile frond with an elongated terminal pinna and a subapical plantlet X0.3 (B.Molesworth Allen P4, K). **C**, OPHIOGLOSSACEAE: *Ophioglossum reticulatum* f. *complicatum*, sterile frond and fertile frond with spike X0.5 (D. & B.Du Puy CI81, K). Drawn by E.Catherine.

The specimens from Christmas Is. occasionally have forked fronds, which R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 41 (1968), noted is usually found in specimens from more exposed situations.

2. Ophioglossum reticulatum L., *Sp. Pl.* 2: 1063 (1753)

T: illustration by C.Plumier, *Filic. Amer.* t. 164 (1705); lecto: P, *fide* G.R.Proctor in R.A.Howard, *Fl. Less. Antilles* 43 (1977). Epithet from the Latin *reticulum* (a net), descriptive of the net-like venation in the sterile lamina of the frond.

f. **complicatum** (Miq.) Wieff., *Blumea* 12: 330, fig. 1A (1964)

O. moluccanum f. *complicatum* Miq., *Ann. Mus. Bot. Lugduno-Batavum* 4: 290 (1868). T: from Megamendong, Java, *Zippelius*; *n.v.* Epithet from the Latin *complicatus* (folded on itself), in reference to the fronds.

Illustrations: J.H.Wieffering, *Blumea* 12: 325, fig. 1a (1964); D.L.Jones, *Encycl. Ferns* 58 (1987), as *O. petiolatum.*

Small, terrestrial herb 4–15 cm tall; rhizome tuberous, subterranean, with 1–3 fronds. Fronds erect, glabrous, deciduous; sterile lamina, rhombic to ovate, 1–3 cm long, 0.5–1.2 cm wide, cuneate at base, obtuse or apiculate, entire, somewhat fleshy, mid-green, narrowing to a slender stipe; fertile spike arising from the lamina base, 2–13 cm long, entire, slender, the 2 rows of fused sporangia each 0.5–1 mm diam. Spores pale yellow. *Adders Tongue Fern*. Fig. 96C.

Christmas Is. Occurs in a single locality in an old mine field to the south of Wharton Hill. The plants usually grow in bare soil between other ferns (*Psilotum nudum*, *Davallia denticulata* and *Nephrolepis hirsutula*), in poor soil mainly of limestone and phosphate gravel. This species is probably pantropical, but because of its close resemblance to several other species, the exact distribution is not known.

Ch.Is.: old quarry at South Point, *D.A.Powell 285* (K); Field 17, S of Wharton Hill, *D.J. & B.P.Du Puy CI81* (CBG, K).

The nomenclature followed here is that of J.H.Wieffering (*Blumea* 12: 321–337 (1964)), who did not compare her taxa to those occurring in Australia, but gave the distribution of f. *complicatum* as from India and Japan through Indo-China, the Philippines and Malesia through New Guinea to New Caledonia. This group of small, terrestrial species is inadequately known, and its taxonomy should be completely revised.

The whole plant is edible either raw as a salad, or cooked as a vegetable, although it is not abundant enough on Christmas Is. to consider harvesting.

101. HYMENOPHYLLACEAE

D.J.Du Puy (Ch.Is.)
A.E.Orchard (M.Is.)

Epiphytic or terrestrial ferns of humid places; rhizome slender, wide-creeping or short and suberect. Fronds diverse; lamina membranous, 1 cell thick, without stomata. Sori marginal at vein endings; sporangia on short or elongated receptacles enclosed in tubular or 2-lobed indusia, developing basipetally, sessile, with oblique or horizontal annulus. *Filmy Ferns*.

A family with a variable number (2–34) of genera according to the authority followed, but containing about 600 species, most abundant in the wet tropics; 1 species of *Gonocormus* on Christmas Is. and 1 species of *Hymenophyllum* on Macquarie Is.

KEY TO GENERA

Indusium 2-lipped; fronds 10–20 mm long; epiphytic (M.Is.)	**1. HYMENOPHYLLUM**
Indusium tubular, entire; fronds 2.5–7 mm long; terrestrial (Ch.Is.)	**2. GONOCORMUS**

1. HYMENOPHYLLUM

Hymenophyllum Sm., *Mem. Acad. Roy. Soc.* (*Turin*) 5: 418, t. 9(8) (1793); from the greek *hymen* (membranous) and *phyllon* (a leaf), in reference to the semitransparent fronds.

Type: *H. tunbrigense* (L.) Sm.

Small epiphytes, rarely terrestrial or on rocks; rhizomes elongate, thin, wiry, usually freely branching, scabrous. Fronds entire or variously dissected, to multipinnate; stipe and rachis wiry, naked or winged; lamina or pinnae thin, semitransparent with free venation. Sori terminating segments of pinnae; indusium two-lipped, cup-shaped, enclosing the sporangia which are borne on a short stalk-like receptacle. *Filmy Ferns*.

An almost cosmopolitan genus of about 300 species, with a major centre of diversity in the northern Andes of S America; c. 30 species in Australia; 1 species on Macquarie Is.

While species of this group are relatively easily recognised, their generic delimitations are less settled. Some authors prefer to recognise the many segregate genera erected by E.B.Copeland, *Philipp. J. Sci.* 67: 1–110 (1938), while others treat these as subgenera of *Hymenophyllum sens. lat.*

R.J.Hnatiuk, *Hymenophyllum peltatum* (Poiret) Desvaux, A new Macquarie Island record. *New Zealand J. Bot.* 10: 701 (1972); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 24 (1984); B.D.Duncan & G.Isaac, Hymenophyllaceae, *Ferns & Allied Pl. Victoria, Tasmania & South Australia* 81–89 (1986); P.J.Brownsey & J.C.Smith-Dodsworth, Hymenophyllaceae, *New Zealand Ferns & Allied Pl.* 67–78 (1989).

Hymenophyllum falklandicum Baker in W.J.Hooker & J.G.Baker, *Syn. Fil.* 2nd edn, 68 (1874)

T: Falkland Islands, Apr.–Sept. 1842, *J.D.Hooker & C.Abbott*; *n.v.* Named for the locality of the type collection.

[*H. peltatum auct. non* (Poir.) Desv.: R.J.Hnatiuk, *New Zealand. J. Bot.* 10: 701 (1972)]

Illustration: D.M.Moore, *Fl. Tierra del Fuego* fig. 13 (1983).

Terrestrial; rhizome, slender, creeping, freely branched, naked, deep brown; fronds widely spaced, 2–4 cm long. Stipe almost half length of frond, slender, unwinged, dark brown; rachis similar, very narrowly winged in upper part only. Fronds with lamina bipinnate, broadly oblong, 10–20 mm long, 5–7 mm wide, membranous; pinnae about 10–15, asymetrically divided with secondary pinnae on apical side only; secondary pinnae oblong, truncate, sharply serrate. Sori near frond tip, solitary, inserted on a short segment near base of pinna, brown when mature, 0.8 mm long, 0.65–0.7 mm wide; indusium deeply 2-lipped, slightly wider than segment, elliptic, ovate.

Macquarie Is. Restricted to small populations on the feldmark in the north and central parts of the island. Found from southern S America (western Argentina and Chile) to Falkland, South Georgia, Juan Fernandez and Macquarie Islands.

M.Is.: 2 km SW of Green Gorge Hut, *R.D.Seppelt 12312* (AD, HO, MEL); 700 m E of Mt Gwynn, *R.D.Seppelt 12467* (HO); Boot Hill, *R.D.Seppelt 12760* (HO).

The plant on Macquarie Is. has been treated in the past as *H. peltatum*. However, it differs from typical *H. peltatum* in the small frond size, sori solitary on the pinnae, secondary pinnae only 1 or 2 (commonly 3–5 in *H. peltatum*) and in the restriction of the wing on the

rachis to the section between the ultimate 2 or 3 pinnae (in *H. peltatum* the narrow wing usually extends the full length of the rachis but not onto the stipe). D.M.Moore (1983) recognised plants identical to the Macquarie Is. ones in Fuegia and distinguished them from *H. peltatum* by the characters above. B.S.Parris & J.P.Croxall, *New Zealand J. Bot.* 10: 259–266 (1972), discussed dwarfed forms of *H. peltatum* in N.Z. pointing out that the number of sori per pinna could be reduced to 1, as could the secondary pinnae, but that the wing on the rachis was maintained. The same situation appears to apply in dwarfed *H. peltatum* from high exposed localities in Tas. Clearly, the *H. peltatum* complex needs re-examination throughout its wide range (Europe, S America, Australia, New Zealand and the subantarctic), but in the meantime, the Macquarie Is. plants seem best segregated as *H. falklandicum*.

2. GONOCORMUS

Gonocormus Bosch, *Hymen. Javan.* 7–12 (1861); *Verslagen Meded. Afd. Kon. Natuurk. Akad. Wetensch.* 11: 321 (1861); from the Greek *gonos* (progeny) and *kormos* (Latin *cormus* - a tree trunk, stalk) in reference to the proliferation in this genus by the development of secondary fronds and new plantlets on the stipes.

Type: *G. prolifer* (Blume) Prantl

Minute, epiphytic or lithophytic, filmy ferns; rhizome filiform, creeping, much-branched; scales absent; fronds scattered along rhizome. Stipe filiform, wiry, sometimes with buds which develop into secondary fronds or plantlets. Fronds ±erect, fan-shaped and deeply palmately lobed, to pinnately lobed, glabrous, very thin, dark green; lobes narrow, 1-veined, without false or anastomosing veins. Sori situated at lobe apices; indusium tubular, flared, the frond lamina longitudinally winged, with a minute, mucronate receptacle which is eventually exserted from the apical aperture; paraphyses absent.

A genus of up to 5 species, at least 2 of which are generally recognised as distinct. Even these two, *G. prolifer* (Blume) Prantl and *G. saxifragoides* (C.Presl) Bosch, are not easily separable, although most specimens can be referred to one or the other. They are widespread throughout the range of the genus from Africa, Madagascar, Sri Lanka, India, S China and Japan through Indo-China and Malesia to Australia and the Pacific islands, where they occur in damp, shaded situations on rocks or trees. *G. saxifragoides* had been recorded from Christmas Is.

The genus is sometimes treated as a section of *Trichomanes* L. but the nomenclature followed here is that of J.P.Croxall, *Austral. J. Bot.* 23: 509–547 (1975), which is based on the series of genera originally proposed by E.B.Copeland, *Philippine J. Sci.* 67: 1–110 (1938).

E.B.Copeland, Genera Hymenophyllacearum, *Philippine J. Sci.* 67: 1–110, t. 1–11 (1938); W.A.Sledge, The Hymenophyllaceae of Ceylon, *J. Linn. Soc., Bot.* 60: 289–109 (1968), as *Trichomanes*; J.P.Croxall, The Hymenophyllaceae of Queensland, *Austral. J. Bot.* 23: 509–547 (1975).

Gonocormus saxifragoides (C.Presl) Bosch, *Hymen. Javan.* 9 (1861)

Trichomanes saxifragoides C.Presl, *Hymen.* 16, 39 (1843). T: Ilocos, Luzon, the Philippines, *H.Cuming 256*; holo: K. Named after the genus *Saxifraga* L., some species of which have leaves lobed in similar manner to the fronds of this species.

[*Trichomanes parvulum auct. non* Poir. (1808): C.W.Andrews, *Monogr. Christmas Is.* 194 (1900)]

Illustration: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 44, fig. 20J (1981).

A minute, epiphytic fern; rhizome thread-like, creeping, much-branched; fronds c. 3–10 mm apart. Stipe c. 2–7 mm long, very slender. Fronds fan-shaped, c. 2.5–7 mm long, c. 4–11 mm wide, deeply palmately lobed, the lobes dichotomously branched or lobed, membranous, dark green, occasionally with a secondary lamina arising from a bud at the frond base. Sori c. 1 mm long, at lobe apices; indusium tubular with a dilated apex, the laminae of the frond

lobes forming narrow, longitudinal wings; receptacle eventually protruding from the apical pore as a minute mucro.

Christmas Is. Recorded on trees on the plateau by both C.W.Andrews, *Monogr. Christmas Is.* 194 (1900), and H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 245 (1906), but it has not been collected since then. Possibly overlooked due to its small size. A widely distributed, Old World species, occurring from eastern Africa, Madagascar, Sri Lanka, India, southern China and Japan, S through Indo-China, the Philippines, and Malesia to northern Australia (Qld, N.S.W.), the SW Pacific islands (Micronesia and Polynesia) and Hawaii.

Ch.Is.: trees on plateau, Feb. 1898, *C.W.Andrews* (BM); Flying Fish Cove, 4 May 1898, *C.W.Andrews* (BM).

This species is also widely, but incorrectly known as *Gonocormus minutus* (Blume) Bosch (*Trichomanes minutus* Blume).

102. ADIANTACEAE

D.J.Du Puy (Ch.Is.)

Terrestrial ferns; rhizome erect or creeping, with scales and/or hairs. Stipe dark-coloured, often shining. Fronds simple or 1- to 5-pinnate or -pedate; veins free or anastomosing, without free veinlets. Sori marginal, without indusia, often protected by a reflexed flap of the laminal margin, terminal on veins or spreading along them; paraphyses present.

A cosmopolitan family containing a variable number of genera according to the classification followed. Sometimes treated as monogeneric, but here including *Pityrogramma*, which occurs on Christmas Is.

PITYROGRAMMA

Pityrogramma Link, *Handbuch* 3: 19 (1833); from the Greek *pityron* (bran, chaff) and *gramma* (an inscription), probably referring to the powdery indumentum and naked sporangia on the undersurface of the frond, which leaves an outline of the frond when pressed on to a surface.

Type: *P. chrysophylla* (Sw.) Link

Terrestrial ferns; rhizome erect, usually with a crown of fronds; scales narrow, entire, present on rhizome and stipe bases. Stipe usually grooved above, dark-coloured; vascular strands usually 2. Fronds 1–3-pinnatisect, the pinnae becoming gradually smaller towards the apex and finally reduced to lobes, usually floury beneath, rarely pubescent or glabrous; rachis grooved; lobes narrowly decurrent; veins all free. Sporangia on veins beneath, sometimes ±covering undersurface of frond; indusia absent; paraphyses absent.

A genus of c. 16 species, from tropical America, Africa and Madagascar. A few species are widely naturalised throughout the tropics, including 1 species on Christmas Is. They occur on disturbed ground such as landslides, gravel bars in streams, rocks and cliffs and in open woodland and grassland. They prefer open, damp situations, but some species will tolerate short, dry periods.

R.Tryon, Taxonomic Fern Notes, 2. *Pityrogramma* (including *Trismeria*) and *Anogramma*, *Contr. Gray Herb.* 189: 52–76 (1962); G.Panigrahi, The genus *Pityrogramma* (Hemionitidaceae) in Asia, *Kew Bull.* 30: 657–667 (1975); R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 592–594 (1968); D.L.Jones & S.C. Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 213 (1981); R.M.Tryon & A.F.Tryon, *Ferns & Allied Pl.* 216–223 (1982).

***Pityrogramma calomelanos** (L.) Link, *Handbuch* 3: 20 (1833)

var. **calomelanos**

Acrostichum calomelanos L., *Sp. Pl.* 2: 1072 (1753). T: America, Herb. C.Linnaeus 1245.19; syn: LINN. Epithet from the Greek *kalos* (beautiful) and *melanos* (black, dark), descriptive of the black stipe and rachis which contrast with the white undersurface of the frond.

Illustration: D.L.Jones, *Encycl. Ferns* 383 (1987).

Terrestrial fern; rhizome short, erect; scales 3–4 mm long, narrow, brown; fronds in a crown. Stipe usually 3–20 cm long, slender, wiry, grooved, dark purple-brown, glossy. Fronds erect, usually bipinnatisect, c. 6–30 cm long, densely white-floury beneath; pinnae longest in basal half of frond, to 10 cm long, deeply pinnatisect, sometimes with a few shortly stalked pinnules at base, somewhat coriaceous, shortly stalked; lobes incised almost to rachis, with veins free and much-branched, ovate to oblong, acute, serrulate, decurrent on rachis forming a narrow wing. Sporangia covering undersurface of pinnae; indusium absent. *Silver Fern*.

Christmas Is. Introduced, now fairly common, mainly on the plateau, in clearings and along roadsides in the primary forest, and in mixed areas where it has some shade provided by rock pinnacles and other plants. Originally from tropical America, this species has become commonly naturalised throughout the tropics, including Christmas Is. and Australia (Qld).

Ch.Is.: Phosphate Hill quarries, *C.W.Andrews 205* (BM); Rocky Point, *D.A.Powell 111* (K); quarry, *D.A.Powell 510* (K); roadside clearing, E of Stewart Hill, *D.J. & B.P.Du Puy C1 32* (CBG, K).

This species was already present on Christmas Is. at the end of the 19th century, when it was collected by C.W.Andrews, although it was subsequently omitted from his account of the vegetation.

The finely divided, lacy fronds, white-floury beneath, and the dark, glossy stipes make this an attractive species. It is readily cultivated if given sufficient light, and is not overwatered.

Var. *calomelanos* is distinguished by its silvery white to pale yellow, resinous indumentum. In specimens larger than those observed on Christmas Is., the fronds can reach up to 60 cm long and are more divided, becoming bipinnate, with lobed pinnules.

103. VITTARIACEAE

D.J.Du Puy (Ch.Is.)

Plants epiphytic. Rhizome usually short, creeping, with narrow, latticed scales. Fronds simple, entire, linear-ovate to obovate; veins reticulate, forming elongate areolae, without free veinlets. Sori elongate, along veins, usually submarginal or marginal; exindusiate, but often in a groove, when young protected by paraphyses.

A tropical family of 7–9 genera; 1 genus on Christmas Is.

VITTARIA

Vittaria Sm., *Mem. Acad. Sci. Turin* 5: 413, t. 9 (1753); from the Latin *vitta* (a ribbon, ceremonial headband), referring to the narrow, ribbon-like leaves.

Type: *V. lineata* (L.) Sm.

Epiphytic, lithophytic or rarely terrestrial ferns; rhizome creeping, densely scaly; roots densely hairy; scales latticed, with a hair-like apex. Stipe usually narrowly winged, with 2 vascular strands. Fronds usually pendulous, ribbon-like, linear to narrowly elliptic, entire,

±coriaceous; venation indistinct, consisting of a midvein with oblique lateral veins which unite into 2 marginal veins. Sori linear, in 2 longitudinal, marginal or submarginal grooves; paraphyses abundant, usually club-shaped.

A genus of c. 50–70 species, mainly tropical but extending into warm-temperate regions; 1 species on Christmas Is. They mainly occur in damp, shaded habitats. The similarity in frond shape, sori and habit make the species difficult to distinguish, and a full taxonomic revision is necessary.

R.C.Ching, The studies of Chinese ferns, 6. Genus *Vittaria* of China and Sikkim-Himalaya, *Sinensia* 1: 175–192 (1931); R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 607–614 (1968); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 211–212 (1981); R.M.Tryon & A.F.Tryon, *Ferns & Allied Pl.* 362–368 (1982).

Vittaria elongata Sw., *Syn. Fil.* 109, 302 (1806)

T: India, *J.P.Rottler*; *n.v.* Epithet is the Latin for long or extended, descriptive of the long, narrow fronds.

Illustrations: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, t. 33 (1981); D.L.Jones, *Encycl. Ferns* 384 (1987).

Epiphytic, clump-forming fern; rhizome with several scattered fronds, and ginger-felty roots; scales dense, c. 5–7 mm long, very slender, latticed, the apex hair-like, very dark brown. Stipe wings gradually broadening into the narrow frond. Fronds pendulous, linear, 25–90 cm long, 0.5–1 cm wide, usually dry and lacerated at apex, glabrous, thinly coriaceous, dark geen, glossy; midvein only apparent. Sori linear, enclosed in narrow grooves extending along margins of frond; paraphyses club-shaped. *Tape Fern.*

Christmas Is. Common in the rainforest, mainly on the plateau and upper terraces, usually growing from the root mass of other epiphytic ferns such as *Asplenium nidus*, and may form large, attractive clumps of narrow, pendulous fronds. A widely distributed species in the Old World tropics and subtropics, from Africa, India and S China, through Indo-China, the Philippines, and Malesia to Australia (Qld, N.S.W.) and the Pacific islands (Polynesia).

Ch.Is.: no precise locality, *C.W.Andrews 163* (K); plateau, *H.N.Ridley 160* (K); Headridge Hill, *B.Molesworth Allen P9* (K); in forest at edge of National Park, central plateau, *R.Shivas 958* (PERTH); S of Field 22 South, on fallen branch in tall rainforest, *D.J. & B.P.Du Puy CI6* (CBG, K).

H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 247 (1906), noted that the variant on Christmas Is. is particularly large. Its fronds are very long and narrow, resembling those of *C. zosterifolium* Bory, see R.C.Ching, *op. cit.* 176, 179. However, R.E.Holttum, *op. cit.* 614, indicated that the variation present in Malaya, which includes variants similar to those on Christmas Is., does not allow the separation of distinct species.

104. PTERIDACEAE

D.J.Du Puy (Ch.Is.)

Terrestrial ferns. Rhizome erect or creeping, scaly. Fronds usually uniform, 1- to 4-pinnate; veins free or less frequently anastomosing. Sori often marginal, without indusia or with a false indusium forming a scarious leaf margin; paraphyses often present.

A worldwide family variously interpreted as containing from 3 to 7 genera; 1 genus on Christmas Is. The family is closely related to the Adiantaceae.

PTERIS

Pteris L., *Sp. Pl.* 2: 1073 (1753); *Gen. Pl.* 5th edn, 484 (1754); from the Greek *pteron* (a wing, feather) which may have been used descriptively, but which was also the Greek name for certain types of fern.

Type: *P. longifolia* L.

Terrestrial ferns; rhizome erect or creeping, often with an apical tuft of fronds; scales various, always present on rhizome and stipe base. Stipe grooved above; vascular strand U-shaped in section. Fronds pinnate to tripinnate, occasionally tripartite; basal pair of pinnae tending to be branched, or with more complex division than the others; apical pinna subequal to the lateral ones; rachis and costae grooved; veins all free, or some anastomosing and forming areolae, connected by marginal veins above the sori in fertile frond. Sori linear, submarginal; indusium formed from the thin, reflexed margin of the lamina; paraphyses often numerous. *Brakes*.

A large genus containing c. 250 species. They are mainly tropical and subtropical, with a few species occurring in temperate regions; 2 species of *Pteris* on Christmas Is. They bear little resemblance to each other, but can be recognised as members of this genus by their linear sori on the margins of the fronds, covered by an indusium which is a flap attached at the margin of the fronds and opening inwards. This is an important genus in commercial fern cultivation.

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 393–409 (1968); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 192–197 (1981); R.M.Tryon & A.F.Tryon, *Ferns & Allied Pl.* 332–341 (1982).

Fronds pinnate; pinnae simple; stipe usually 2–15 cm long **1. P. vittata**

Fronds divided into 5–9 subsimilar laminae, each lamina bipinnatisect; pinnae pinnatisect; stipe usually 50–150 cm long **2. P. tripartita**

1. Pteris vittata L., *Sp. Pl.* 2: 1074 (1753)

T: China, *P.Osbeck*, herb. C.Linnaeus 1246.3; lecto: LINN, *fide* R.Tryon, *Contr. Gray Herb.* 194: 191 (1964). Epithet from the Latin *vitta* (a ribbon, ceremonial headband), alluding to the narrow, linear pinnae.

Illustrations: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 196, fig. 269 (1981); D.L.Jones, *Encycl. Ferns* 273 (1987).

Terrestrial or lithophytic fern; rhizome shortly creeping; scales numerous, conspicuous, c. 5 mm long, narrow, ginger-brown; fronds appearing to radiate from a crown. Stipe usually c. 2–15 cm long, grooved, scaly towards base. Fronds arching, very variable in size, c. 20–80 cm long, pinnate; terminal pinna resembling the others or sometimes rather longer, glabrous; pinnae numerous, closely spaced, longest towards frond apex, becoming much reduced at base, narrow, linear, 1–25 cm long, gradually tapering, finely serrate in sterile zones, cordate and sometimes oblique at base, coriaceous, dark green, sessile. Sori linear, marginal; indusial flap recurved from margin. *Ladder Brake*, *Chinese Brake*.

Christmas Is. Common in exposed situations in disturbed sites such as old quarries where the soil is poor or replaced by limestone rubble or bare rock, and on road cuttings. A common, tropical to warm-temperate, Old World species, distributed through Malesia to Australia, and sometimes naturalised in the New World.

Ch.Is.: no precise locality, *D.A.Powell 293* (K); roadside cutting on Irvine Hill Road, *D.J. & B.P.Du Puy CI5* (CBG, K); old mine site, 0.5 km N of airport, *R.Shivas 938* (PERTH).

Very variable in size, with specimens producing fertile fronds in particularly harsh situations. It is cultivated as an ornamental garden or pot-plant, requiring some limestone in the compost, but is otherwise easily grown.

2. Pteris tripartita Sw., *J. Bot.* (*Schrader*) 1800 (2): 67 (1801)

T: Java, *C.P.Thunberg*, herb. Thunberg 24968, 24969; *n.v.* Epithet from the Latin *tri-* (three-) and *partire* (to divide), in reference to the frond which has 2 basal branches, each of those side-branches dividing again, giving a 5-branched frond (in large fronds often further divided).

[*P. quadriaurita auct. non* Retz. (1791): H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 245 (1906)]

Illustrations: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Ferns Allies* 2nd edn, 195, fig. 267 (1981); D.L.Jones, *Encycl. Ferns* 273 (1987).

Large, terrestrial fern; rhizome short, erect, stout; scales small, pale brown; fronds; 1–few. Stipe erect, very long, often 50–150 cm, robust, grooved, with scattered basal scales. Fronds very large, ±circular in outline, saucer-shaped, c. 1 m diam., glabrous, divided into 5–9 subsimilar, radiating laminas, each lamina bipinnatisect, the central lamina largest; pinnae to 15 cm long, pinnatisect, herbaceous, shortly stalked, the veinlets forming elongated areolae along the midvein; lobes slightly falcate, rounded, serrulate, separated by rounded sinuses. Sori linear, marginal, broken both at lobe apices and sinuses; indusial flap recurved from margin. *Giant Brake.*

Christmas Is. H.N.Ridley (*loc. cit.*) recorded that this species had recently appeared around Settlement and the Waterfall Road. It is now quite frequent over much of the plateau and upper terraces, where it occurs in damp, semi-shaded positions, most frequently along tracks and drill-lines through the primary rainforest. A variable, Old World species, distributed from tropical Africa, Madagascar and SE Asia through Indo-China and Malesia to Australia (Qld) and the Pacific islands, and occasionally naturalised in the New World.

Ch.Is.: no precise locality, *H.N.Ridley 178* (K); Harrison Springs, Ross Hill terrace, *D.A.Powell 125* (K).

The tendency for the fronds in this genus to have a branched lower pinna is taken to an extreme in this species. The side portions of the frond are often only slightly smaller than the central portion. These subequal frond portions radiate from near the centre of the frond, giving a large, dish-shaped structure.

This handsome species is a frequent coloniser of disturbed sites in the tropics. In poor, dry conditions, smaller specimens than those described above can be fertile.

105. POLYPODIACEAE

D.J.Du Puy (Ch.Is.)

Epiphytic or sometimes terrestrial ferns; rhizome creeping, rarely erect, with peltate, latticed or non-latticed scales; stipes usually articulate on rhizome. Fronds simple, lobed, dichotomously branched or pinnate, uniform or dimorphic, often clothed with peltate or stellate hairs; veins usually reticulate with free, included veinlets. Sori superficial or somewhat immersed, spread over lamina surface or sometimes confluent; paraphyses often present; without indusia.

A family of about 1000 species, found throughout the world, but mostly tropical and subtropical; 3 genera on Christmas Is.

KEY TO GENERA

1 Fronds mostly pinnately lobed; sori large, c. 2.5–4 mm diam., mostly in single rows on either side of midveins of lobes **2. MICROSORUM**

1: Fronds simple; sori smaller, not arranged as above

2 Fronds thick, leathery, c. 5–20 cm long, covered beneath by minute, stellate hairs; fertile fronds covered beneath by confluent sori in apical portion **3. PYRROSIA**

2: Fronds not thick and leathery, more than 20 cm long, glabrous; sori not as above

3 Stipe 10–50 cm long; fronds dimorphic, the fertile fronds linear, acrostichoid, with sporangia densely covering undersurface **1. LEPTOCHILUS**

3: Stipe very short, often ±absent; fronds not dimorphic, the sori scattered in apical half **2. MICROSORUM**

1. LEPTOCHILUS

Leptochilus Kaulf., *Enum. Filic.* 147 (1824); from the Greek *leptus* (narrow, slender) and *chilus* (a lip), perhaps after the shape of the fertile frond which resembles a pair of narrow lips.

Type: *L. axillaris* (Cav.) Kaulf.

Terrestrial or lithophytic ferns, sometimes climbing; rhizome short- to long-creeping; scales on rhizome and stipe base, small, minutely latticed, peltate; fronds closely to distantly spaced along rhizome. Stipe slightly grooved above; vascular strand broadly U-shaped in section. Fronds simple, entire, articulate on rhizome, dimorphic. Sterile frond oblong to elliptic, the base narrowly decurrent on stipe; midvein and lateral veins pinnate, with anastomosing veinlets between, forming areolae. Fertile frond reduced, very narrow; sporangia acrostichoid, densely covering lamina beneath; indusium and paraphyses absent.

A genus of c. 12 species distributed from SE Asia, through Malesia, to the western Pacific islands; 1 species on Christmas Is. They are usually forest-dwelling species, favouring damp, shaded habitats, sometimes climbing on tree trunks.

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 163–166 (1968).

Leptochilus decurrens Blume, *Enum. Pl. Javae* 206 (1828)

T: Java, *C.L.Blume*; *n.v.* Epithet from the Latin *decurrere* (to run down), in reference to the frond base which is decurrent on the stipe.

Acrostichum listeri Baker, *J. Linn. Soc., Bot.* 25: 361 (1890); *Gymnopteris listeri* (Baker) Ridl., *J. Straits Branch Roy. Asiat. Soc.* 45: 248 (1906); *Leptochilus listeri* (Baker) C.Chr., *Ind. Fil.* 386 (1906). T: Christmas Is., Sept.–Oct. 1887, *J.J.Lister*; holo: K.

Illustrations: R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 165, fig, 74 (1968); D.L.Jones, *Encycl. of Ferns* 241 (1987).

A terrestrial fern, sometimes forming small clumps; rhizome creeping; scales ovate, c. 3 mm long, minutely latticed, dark brown; fronds closely spaced near apex. Fronds dimorphic, the fertile fronds much narrower and held above the sterile ones. Sterile frond: stipe c. 10–25 cm long; lamina suberect, narrowly ovate to narrowly elliptic, c. 20–40 cm long, rarely forked, acute, undulating, gradually tapering into a narrow wing on stipe, glabrous, glossy; veins pinnate, distinct, with anastomosing veinlets between. Fertile frond: stipe erect, c. 20–50 cm long; lamina erect, very narrow, c. 10–20 cm long, 6–9 mm wide, narrowly decurrent, covered by sporangia beneath, except midvein and narrow margins. Fig. 96A.

Christmas Is. A terrestrial species sometimes growing on basaltic rock, but usually in deep, phosphate-rich soil. It is mostly confined to shaded positions in tall rainforest on the plateau, often growing with *Bolbitis heteroclita* and *Corymborkis veratrifolia*. A tropical and subtropical SE Asian species, distributed from India and SW China through Indo-China to Malesia as far as Sulawesi, preferring regions with some climatic seasonality.

Ch.Is.: no precise locality, *C.W.Andrews 89* (K); Phosphate Hill, *H.N.Ridley 176* (K); sheltered valley close to Aldrich Hill, *D.A.Powell 457* (K); plateau, gully floor, line 256, *D.J. & B.P.Du Puy CI18* (CBG, K); plateau, NE slope of Murray Hill, *D.J.& B.P.Du Puy CI87* (CBG, K).

Leptochilus decurrens is often found with *Bolbitis heteroclita*, which it closely resembles in habit, both having narrow, fertile fronds with acrostichoid sporangia. It can be distinguished by its entire fronds. Despite this close resemblance, the 2 genera are currently classified in separate families due to differences in the rhizome anatomy, venation pattern, and the presence of articulated stipes.

Leptochilus listeri, described as a species of *Acrostichum*, was considered endemic on Christmas Is. (Baker, *loc. cit.*). It was compared to *A. variabile* Hook., now considered a synonym of *L. decurrens*, in the type description. There appears to be no character to justify the separation of the two taxa. *A. variabile* Hook. was described from Ceylon and the name has not been applied to Christmas Is. material.

2. MICROSORUM

Microsorum Link, *Hort. Berol.* 2: 110 (1833); from the Greek *mikros* (small), indicating the small sori of some species.

Type: *M. irregulare* Link

Epiphytic, lithophytic or terrestrial ferns; rhizome short- to long-creeping; scales latticed, peltate, scattered mainly on rhizome; fronds scattered along rhizome. Stipe grooved above, sometimes ±absent; vascular strands various. Fronds erect to pendulous, simple to deeply pinnatisect, ±glabrous, sometimes coriaceous, articulate on rhizome; veinlets anastomosing, forming many areolae, with included, free veinlets. Sori small to large, circular, irregularly distributed or in rows on either side of midvein of lamina lobes; indusium absent; paraphyses sometimes present.

An Old World genus of c. 45–60 species, distributed from Africa and the Indian Oceanic islands through SE Asia and Malesia to Australia and the Pacific islands; 2 species on Christmas Is. They occur in various habitats, from damp, shaded rocks near streams to open sites exposed to full sun.

The genus is sometimes split into 2 genera, those with large sori and pinnatifid fronds being removed to the genus *Phymatodes* C.Presl. Most species can be easily placed in 1 of these 2 groups, but there is also an almost complete range of intermediate species. Many species are very variable and a full taxonomic revision of the genus is required.

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 170–180, 188–193 (1968) *p.p.* as *Phymatodes*; D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 169–172 (1981).

Fronds entire; sori small, c. 1 mm diam., irregularly scattered in upper half of frond **1. M. punctatum**

Fronds mostly deeply pinnatisect; sori large, c. 2.5–4 mm diam., mostly in rows on either side of midveins of lobes **2. M. scolopendria**

1. Microsorum punctatum (L.) Copel., *Univ. Calif. Publ. Bot.* 16: 111 (1929)

Acrostichum punctatum L., *Sp. Pl.* 2nd edn, 2: 1524 (1763). T: China, *J.Fothergill*; *n.v.*, apparently lost. Epithet from the Latin *punctatus* (spotted), in reference to the small, dot-like sori scattered over the apical half of the frond.

Polypodium irioides Poir. in, J.B.A.P.Lamarck, *Encycl.* 5: 513 (1804); *Pleopeltis irioides* (Poir.) T.Moore, *Ind. Fil.* 1: 78 (1857). T: Mauritius, Herb. J.B.A.P.Lamarck; holo: P, microfiche seen.

Illustrations: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 170, fig. 227 (1981); D.L.Jones, *Encycl. Ferns* 243 (1987).

A robust, epiphytic or occasionally lithophytic fern, forming large clumps; rhizome creeping, glaucous; scales ovate, c. 2 mm long, peltate, acute, latticed, dark brown; fronds closely spaced. Fronds subsessile, articulate on short spurs from rhizome, erect to arching, linear-elliptic, entire, abruptly acute, c. 60–120 cm long, c. 6–11 cm wide, tapering to a broad or narrow wing at frond base, glabrous, somewhat coriaceous, pale green; venation pinnate, with many anastomosing veinlets, the veins not easily observed in living

specimens. Sori small, to 1.5 mm diam., irregularly and often densely scattered in apical half of frond.

Christmas Is. Abundant as an epiphyte in the rainforest on the plateau and upper terraces, and on limestone pinnacles and rocks in open but humid sites. Occasionally in open situations among other ferns in old quarries. A common and widely distributed species in the lowland tropics and subtropics, from Africa, the Indian Oceanic islands, India and southern China, through Indo-China, the Philippines and Malesia to Australia (Qld) and the Pacific islands.

Ch.Is.: common everywhere, *C.W.Andrews 108* (K); plateau, *H.N.Ridley 194* (K); on *Planchonella nitida*, *D.A.Powell 290* (K); Headridge Hill, below the wireless station, *B.Molesworth Allen P7* (K); track to Grants Well, SW of Hanitch Hill, *D.J. & B.P.Du Puy CI7* (CBG, K).

This species resembles *Asplenium nidus* L., but it forms untidy clumps rather than the characteristic rosettes of the Bird's Nest Fern. The root ball of *A. nidus* sometimes forms a suitably moisture-retentive substrate on which this species can flourish.

2. Microsorum scolopendria (Burm.f.) Copel., *Univ. Calif. Publ. Bot.* 16: 112 (1929)

Polypodium scolopendria Burm.f., *Fl. Ind.* 232 (1768). T: India; *n.v.* Epithet from the Greek *skolopendria* (millipede), a name inspired by the appearance of the creeping rhizome.

Polypodium phymatodes L., *Mant. Pl.* 306 (1771); *Pleopeltis phymatodes* (L.) T.Moore, *Ind. Fil.* 1: 78 (1857). T: Herb. C.Linnaeus 1251.6; syn: LINN.

Illustrations: R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 192, fig. 94 (1968), as *Phymatodes scolopendria* (Burm.f.) Ching; D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 171, fig. 229 (1981).

A terrestrial or lithophytic fern, forming spreading patches; rhizome creeping, glaucous; scales ovate, c. 4 mm long, peltate, acuminate, latticed, dark brown; fronds scattered, c. 2–5 cm apart. Stipe usually 15–45 cm long, articulate on a short spur from rhizome. Fronds stiffly erect, usually 25–50 cm long, pinnatisect, with 1–9 pairs of lobes, occasionally entire, glabrous, coriaceous, often yellowish; lobes narrowly oblong, acuminate, to 19 cm long, separated by broad sinuses; veinlets anastomosing. Sori large, circular, c. 2.5–4 mm diam., slightly sunken, usually in single rows on either side of midveins of lobes, sometimes in double rows in reduced fronds or very large fronds.

Christmas Is. Terrestrial or lithophytic, growing on limestone rock and poor soil in road cuttings, old quarries and other disturbed sites, often in full sun. Has become much more common following clearance of forest for phosphate mining. Distributed from Africa to SE Asia, including India, southern China and Indo-China, the Philippines and through Malesia to Australia (Qld, ?N.T., W.A.) and the Pacific islands (Polynesia).

Ch.Is.: rocks above Flying Fish Cove, *H.N.Ridley 162* (K); Phosphate Hill, old quarry, *D.A.Powell 126* (K); no precise locality, *D.A.Powell 292* (K); old mine site, 0.5 km N of airport, *R.Shivas 932* (PERTH); cutting on Irvine Hill Rd., *D.J. & B.P.Du Puy CI4* (CBG, K).

This species is very variable in its frond morphology, and even very small fronds which are few-lobed or entire can be fertile. Specimens with 2 rows of sori on either side of midveins of the lobes are often placed in *M. nigrescens* (Blume) J.Sm.. Most specimens on Christmas Is. have single rows of sori, but occasionally the larger specimens, or specimens with reduced fronds, may bear double rows of sori. The specimens are otherwise identical, and it is not possible to recognise 2 distinct taxa on the basis of this character.

3. PYRROSIA

Pyrrosia Mirb., *Hist. Nat. Veg.* 3: 471, 5: 91 (1802); from the Greek *pyros* (fire), perhaps from the burnt appearance of the fertile portions of the fronds.

Type: *P. chinensis* Mirb.

Epiphytic, lithophytic or terrestrial ferns; rhizome usually long-creeping, densely scaly; scales peltate or basally attached, sometimes ciliate, ±confined to the rhizome; fronds

scattered. Stipe not deeply grooved, sometimes very short; vascular strands several. Fronds erect to pendulous, usually simple and entire, minutely stellate-hairy beneath, coriaceous, articulate on short spurs from rhizome, sometimes dimorphic, the fertile fronds or portions of fronds narrow and elongated; venation obscure, anastomosing. Sori circular, in 1–several rows on either side of midvein, usually confined to apical half of frond, sometimes confluent; indusium absent; paraphyses present.

The 51 species in this Old World genus are distributed from Africa and Madagascar throughout SE Asia including India, China, Japan and Indo-China, the Philippines and Malesia to Australia, the SW Pacific islands and New Zealand; 1 variable species on Christmas Is. The greatest diversity is in SE Asia. They mainly occur in regions with high rainfall and humidity but also tolerate seasonally dry climates.

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 141–149 (1968); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 197–199 (1981); P.Hovenkamp, *A monograph of the genus Pyrrosia* (1986).

Pyrrosia lanceolata (L.) Farw., *Amer. Midl. Nat.* 12: 245 (1930)

Acrostichum lanceolatum L., *Sp. Pl.* 2: 1067 (1753). T: Sri Lanka, Herb. P.Hermann vol. 1, fol. 3, no. 380; syn: BM. Epithet from the Latin *lanceolatus* (lanceolate, but which in the sense of C.Linnaeus meant narrowly elliptic), in reference to the shape of the fronds.

Polypodium adnascens Sw., *Syn. Fil.* 25, 222, t. 2, fig. 2 (1806); *Niphobolus adnascens* (Sw.) Kaulf., *Enum. Filic.* 124 (1824). T: India, *J.P.Rottler s.n.*; *n.v.*

Illustrations: R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 145, fig. 60 (1968), as *Pyrrosia adnascens* (Sw.) Ching; D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 198, fig. 272, t. 30 (1981).

Epiphytic fern, often forming extensive colonies; rhizome slender, wiry, creeping, scaly; scales appressed, narrowly ovate, c. 3 mm long, peltate, acuminate, ciliate, becoming chocolate-brown; fronds scattered, c. 1.5–3.5 cm apart. Stipe c. 2–4 cm long, stellate-hairy. Fronds suberect to pendulous, linear to elliptic, c. 5–20 cm long, obtuse, acute or acuminate, entire, decurrent, the margins often incurved, minutely stellate-hairy beneath, coriaceous, dimorphic, the fertile fronds longer and narrower than the sterile fronds, usually fertile only in apical half. Sori circular, densely covering fertile portion of frond, the outer sporangia maturing first, with a central cluster of paraphyses. Fig. 68.

Christmas Is. Abundant high in the canopy of trees in the plateau rainforest, on small trees in scrubby forest, even in exposed situations such as the edge of the inland cliffs. The creeping and much-branched rhizome forms a tangle of intercrossing shoots, allowing the fern to cover entire branches. Common throughout Malesia and widely distributed in Africa, Madagascar and the Mascarenes, and from India and southern China through Indo-China, the Philippines and Malesia to Australia (Qld) and the SW Pacific islands.

Ch.Is.: no precise locality, *D.A.Powell 226* (K); Phosphate Hill, *B.Molesworth Allen P2* (K); Grants Well, *R.Shivas 809* (PERTH); walk to West White Beach, *R.Shivas 923 & 924* (PERTH); fallen branch on drill line near track to Grants Well, *D.J. & B.P.Du Puy CI12* (K).

The fronds are used for dressing cuts in some of the Pacific islands.

106. GRAMMITIDACEAE

A.E.Orchard (M.Is.)

Relatively small epiphytic or rock-dwelling ferns; rhizomes erect or tufted or creeping, scaly. Fronds entire or pinnate; petiole continuous (not articulate); lamina with long stiff hairs, or glabrous. Sori round or oval, unprotected; sporangium with a 1-rowed stalk; spores tetrahedral–globose and green (containing chlorophyll). Gametophyte at first filamentous,

later elongate or cordate.

A family of about 6–10 genera and 200–400 species, the majority of which belong to *Grammitis*. The family is distributed from S America to New Zealand, Australia and Malaysia, with a few species extending to subantarctic regions.; 1 genus on Macquarie Is.

Some authors treat this group as a tribe of the cosmopolitan family Polypodiaceae.

GRAMMITIS

Grammitis Sw., *J. Bot.* (*Schrader*) 1800 (2): 3, 17 (1801); from the Greek *gramme* (a line), in reference to the sori which are often elongate or coalescing.

Type: *G. marginella* (Sw.) Sw.

Fronds entire, linear to spathulate, glabrous or hairy. Sori naked, round, oval or elongate, often oblique, in a single row on either side of midrib, remote from margins. *Finger Ferns*.

A genus of 150–400 species, distributed as for the family, in humid forests, shrubland and herbfields; about 10 species in Australia, 1 of which extends to Macquarie Is.

T.F.Cheeseman, *Vasc. Fl. Macquarie Is.* 40 (1919), as *Polypodium*; B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* 155–156 (1955), as *Polypodium*; B.S.Parris, A revision of the genus *Grammitis* Sw. (Filicales: Grammitidaceae) in Australia, *Bot. J. Linn. Soc.* 70: 21–43 (1975); B.S.Parris, An analysis of the *Grammitis poeppigiana – G. magellanica* complex in the South Atlantic and south Indian Oceans, *Fern Gaz.* 12: 165–168 (1981); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 26 (1984).

Grammitis poeppigiana (Mett.) Pic.-Serm., *Webbia* 32: 461 (1978)

Polypodium poeppigiana Mett., *Polyp.* 37 (1857). T: Cape of Good Hope, *E.F.Poeppig*; B *n.v.*, *fide* B.S.Parris & D.R.Given, *New Zealand J. Bot.* 14: 90 (1976).

G. nana Brack., *U.S. Expl. Exped., Filic.* 16: 1 (1854), *non* Fée (1853). T: Orange Harbour, Tierra del Fuego, *C.Wilkes*; holo: US *n.v.*; iso: K *n.v.*, *fide* B.S.Parris & D.R.Given, *loc. cit.*

G. australis var. *nana* Franch., *Mission Sci. Cap. Horn* 5 Bot.: 397 (1889); *Polypodium billardierei* f. *nana* (Franch.) Skottsb., *Kongl. Svenska. Vetenskapsakad. Handl.* 56: 167 (1916); *Grammitis billardierei* f. *nana* (Franch.) de la Sota, *Opera Lilloana* 5: 208 (1960). T: Packsaddle Anchorage, Tierra del Fuego, *Hahn*; holo: P *n.v.*, *fide* B.S.Parris & D.R.Given, *op. cit.* 91.

G. armstrongii Tindale, *Contr. New South Wales Natl. Herb.* 3(2): 88 (1961). T: Thredbo River Gorge, Kosciusko, N.S.W., Jan. 1951, *L.A.S.Johnson & E.F.Constable NSW P3086*; holo: NSW *n.v*; iso: US *n.v.*

G. kerguelensis Tardieu, *Adansonia* 2: 114 (1962) T: Kerguelen Is., Butte aux Fougères Molloy, *Cours*; holo: P *n.v.*, *fide* B.S.Parris & D.R.Given, *op. cit.* 91.

Illustrations: B.S.Parris, *Bot. J. Linn. Soc.* 70: 27 fig. 1A, B (1975), as *G. armstrongii*; B.S.Parris & D.R.Given, *New Zealand J. Bot.* 14: 90, figs 1. 2a & b. (1976), as *G. armstrongii*; B.D.Duncan & G.Isaac, *Ferns & Allied Pl. Victoria, Tasmania & S. Australia* 148, fig. 14.1 (1986).

Terrestrial, mat-forming; rhizome prostrate, slender, creeping, freely branched, densely scaly; scales papery, brown, ovate, 2.5–4 mm long, 1–1.5 mm wide; fronds crowded. Lamina entire, spathulate to narrowly oblanceolate, 7–28 mm long, 1.5–4 mm wide, but usually 10–16 mm long and 2–4 mm wide, tapering to base, rounded at tip, coriaceous, glabrous or young fronds with sparse, red-brown, septate hairs on margins and midrib; veins indistinct. Sori 1 or 2 towards tip of frond, tending to coalesce into 1 more or less circular mass. Spores c. 0.05 mm diam., greenish.

Macquarie Is. Widespread but rare in rock crevices and in cushions of *Azorella* and bryophytes. Extends from southern S America (Chile and Argentina) to Falkland, South Georgia, Tristan da Cunha, Gough, Kerguelen, Marion, Crozet and Macquarie Islands, South Africa, south-eastern Australia (including Tas.) and New Zealand (North, South, Stewart, Campbell and Auckland Islands).

M.Is.: E side of plateau towards Nuggets, 23 Jan. 1949, *N.R.Laird* (HO); 500 m NW of Island Lake, *R.D.Seppelt 11903* (HO); western slopes of Mt Ifould, *R.D.Seppelt 12577* (HO); 500 m E of Mt Gwynn, *R.D.Seppelt 12600* (HO, MEL); Boot Hill, NE side of summit, *R.D.Seppelt 12725* (HO).

Although most specimens from the island are very uniform morphologically, one aberrant record is known (Bauer Bay, *R.D.Seppelt 11701* (HO)). This consists of soft thin sterile fronds, most of which are longer than normal, more or less linear, some acute, and many with sparse red-brown multi-cellular hairs on the margins and faces of the lamina. These are believed to be young shade forms, probably from deep bryophyte cushions, which have retained a juvenile form and indumentum.

107. THELYPTERIDACEAE

D.J.Du Puy (Ch.Is.)

Terrestrial, rarely epiphytic ferns; rhizome erect (sometimes forming a trunk), creeping or scandent, scaly towards apex. Fronds usually in a crown, sometimes scattered along rhizome, often coarsely textured, simple to bipinnate but usually pinnate with lobed pinnae; lateral pinnae usually subequal; basal lateral pinnae sometimes greatly reduced; apical pinna triangular and deeply lobed near base. Fertile frond usually similar to sterile ones. Sori on the veins, usually ±circular, indusiate or not; indusium reniform when present, attached at one side.

A large family of almost 1000 species in c. 30 genera; 2 genera on Christmas Is. Distributed throughout the tropics, especially in wetter forest ares, with a few species in temperate regions.

KEY TO GENERA

Fronds with c. 6–10 pairs of greatly reduced basal pinnae; pinnae lobed 1/3–1/2 way to midvein, with several pairs of veinlets anastomosing below pinna lobe sinuses; sori on undersurface of lamina of pinna lobes, not submarginal **1. PNEUMATOPTERIS**

Fronds lacking a series of greatly reduced basal pinnae; pinnae lobed 2/3–3/4 towards midvein, with a single pair of veinlets anastomosing below pinna lobe sinuses; sori submarginal **2. AMPHINEURON**

1. PNEUMATOPTERIS

Pneumatopteris Nakai, *Bot. Mag. Tokyo* 47: 179 (1933); from the Greek *pneuma* (air, breath) and *pteris* (a fern), in reference to the breathing pores (aerophores) at the base of the pinnae.

Type: *P. callosa* (Blume) Nakai

Terrestrial ferns; rhizome short, erect or decumbent, rarely creeping; scales on stipe base and rhizome broad, thin, with a few marginal hairs; fronds in a crown. Stipe usually grooved; vascular strands 2 at base, linear in T.S. Fronds usually large, arching, not articulate, pinnate, the pinnae becoming gradually reduced towards the apex, and usually abruptly so towards base, often with swollen aerophores on rachis at base of pinna; pinnae lobed; veins occasionally all free, usually the basal veins of the pinna lobes anastomosing. Sori small, circular, in paired rows in the pinna lobes; indusium reniform, thin; paraphyses absent.

A genus of c. 80 species, distributed throughout the Old World tropics, from Africa to the Pacific islands, Australia and New Zealand, with greatest diversity in Malesia; 1 species on Christmas Is. They mainly occur near streams in tropical forest, and a few species are confined to limestone.

This genus has previously been included in *Cyclosorus* Link.

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 255–285 (1968), as *Cyclosorus*; D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 185–186 (1981); R.E.Holttum, *Fl. Males.* ser. II, 1: 414–436 (1982).

Pneumatopteris truncata (Poir.) Holttum, *Blumea* 21: 314 (1973)

Polypodium truncatum Poir. in J.B.A.P. de Lamarck, *Encycl.* 5: 534 (1804). T: Brazil, *coll. unknown*; *n.v.* Epithet from the Latin *truncatus* (cut short, lopped), in reference to the pinna lobe apex.

[*Nephrodium truncatum auct. non.* (Gaudich.) C.Presl: C.W.Andrews, *Monogr. Christmas Is.* 195 (1900)]

Illustration: R.E.Holttum, *Fl. Males.* ser. II, 1: 416, fig. 11 D–F (1982).

A large, terrestrial fern; rhizome erect; scales broad, c. 5 mm long, thin; fronds in a crown. Stipe 10–30 mm long, grooved above. Fronds c. 80–120 cm long, bipinnatifid, with aerophores at base of pinnae, the terminal pinna similar to lower pinnae, the frond base with c. 6–10 pairs of greatly reduced pinnae; pinnae numerous, sessile, to c. 15–25 cm long, acuminate, shallowly lobed 1/3–1/2 way to midvein, obtuse at base, ±glabrous; lobes truncate, slightly toothed; several pairs of veinlets anastomosing below pinna lobe sinuses. Sori circular, in rows either side of midvein of pinna lobes; indusium small, reniform.

Christmas Is., collected by C.W.Andrews and H.N.Ridley in the region of Waterfall, and may occur elsewhere on the island where there is water near the surface. Occurs from India and southern China, through Indo-China and western Malesia, to the Philippines, the Lesser Sunda Islands and the Mariana Islands.

Ch.Is.: no precise locality, *C.W.Andrews s.n.* (K); freshwater stream, Waterfall, *H.N.Ridley 179* (K).

The young fronds are covered in mucilage, probably giving protection from dessication. The aerophores protrude through this, allowing the developing frond to respire.

2. AMPHINEURON

Amphineuron Holttum, *Blumea* 19: 45 (1971); from the Greek *amphi* (of two kinds or places) and *neuron* (a nerve, vein), in reference to the varied venation of the fronds.

Type: *A. opulentum* (Kaulf.) Holttum

Terrestrial ferns; rhizome erect to creeping; scales narrow, setiferous, on the young fronds and stipe base; fronds in a crown or scattered along rhizome. Stipe grooved; vascular strands 2 at base. Fronds often large, arching, not articulate, pinnate, the pinnae becoming gradually reduced towards apex, the basal pinnae only slighty reduced, with elliptic aerophores on rachis at base of pinna; pinnae lobed, usually glandular-hairy. Veins all free, or the basal veins of the pinna lobes anastomosing or connivent at sinuses. Sori small, circular, in paired rows in pinna lobes; indusium reniform, glandular or hairy.

The c. 12 species in this genus are native to the Old World tropics, from eastern Africa and SE Asia, through Malesia to Australia (Qld) and the Pacific islands; 1 species on Christmas Is. They occur in rather open sites, particularly near streams and often in areas with seasonal climate, sometimes preferring limestone.

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 255–285 (1968), as *Cyclosorus*; D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 74–76 (1981); R.E.Holttum, *Fl. Males.* ser. II, 1: 544–550 (1982).

***Amphineuron opulentum** (Kaulf.) Holttum, *Blumea* 19: 45 (1971)

Aspidium opulentum Kaulf., *Enum. Filic.* 238 (1824). T: Guam, *A. von Chamisso*; *n.v.* Epithet from the Latin *opulentus* (sumptuous, wealthy), perhaps in reference to the lush growth habit of this fern.

Illustrations: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 75, fig. 54 (1981); R.E.Holttum, *Fl. Males.* ser. II, 1: 546, fig. 19 B & C (1982).

A large, terrestrial fern; rhizome creeping; scales c. 10 mm long, narrow; fronds closely spaced. Stipe c. 35–60 cm long, grooved above. Fronds c. 50–80 cm long, bipinnatisect, with aerophores at base of pinna, the terminal pinna subsimilar to the lower pinnae, the lowest pinnae sometimes reduced; pinnae numerous, sessile or short-stalked (to c. 1 mm), to c. 25–30 cm long, acuminate, deeply lobed 2/3–3/4 towards midvein, obtuse at base, shortly hairy especially on veins, with minute glands on the veins beneath; lobes acute, curved, ±entire, with tiny yellow particles on undersurface; 1 pair of veinlets anastomosing below pinna lobe sinuses. Sori circular, submarginal, mostly confined to pinna lobes; indusium small, reniform.

Christmas Is. It appears to be a recent introduction, occurring along tracks and in the more open areas of rainforest on the plateau. A widely distributed species in the Old World, occurring from eastern Africa, the Seychelles and southern India, through Indo-China, Malesia to Australia (Qld) and the Pacific islands (to Tahiti and Marquesas). It has become naturalised in a few New World localities.

Ch.Is.: track side, N of Aldrich Hill, *D.J. & B.P.Du Puy CI21* (CBG, K).

This species closely resembles *Pneumatopteris truncata* (Poir.) Holttum, but can be distinguished by its creeping rhizome, lack of a series of highly reduced pinnae at the frond base, more deeply lobed pinnae, acute pinna lobes, hairy veins, fewer anastomosing veinlets, and its submarginal sori which are mostly confined to the pinna lobes. On Christmas Is. occurs mainly alongside *Nephrolepis biserrata* which it resembles in habit, but has deeply lobed rather than entire pinnae.

108. DENNSTAEDTIACEAE

D.J.Du Puy (Ch.Is.)

Rhizomes long-creeping, underground, bearing hairs; stipes often distant. Fronds large, much-divided, usually with multicellular hairs on the rachis and usually the lamina; veins free or anastomosing. Sori marginal or submarginal, terminal on veins, indusiate; indusium continuous from margin of lamina or pouch shaped, or sorus protected by a 'cup' formed from the fusion of the indusium with a lobe of the leaf margin.

A mainly tropical family, variously considered to contain between 7 and 17 genera; 1 genus on Christmas Is.

MICROLEPIA

Microlepia C.Presl, *Tent. Pterid.* 124, t. 4 (1836), *nom. cons.*; from the Greek *mikros* (small) and *lepis* (a scale), in reference to the small, scale-like indusia.

Type: *M. polypodioides* (Sw.) C.Presl

Terrestrial ferns; rhizome creeping, shortly hairy; fronds scattered along rhizome, in 2 rows. Stipe grooved; vascular stand U-shaped in section. Fronds suberect to arching, usually 2–4-pinnate, rarely simply pinnate, with an occasionally sparse indumentum of short hairs; pinnae becoming gradually reduced towards apex; lobes usually toothed to pinnatifid, the basal lobe enlarged; rachis and costae shallowly grooved; veins all free. Sori subcircular,

submarginal, often near base of sinuses, terminal on veins; indusia attached at base and sides, cup-shaped, opening towards margin, the surface hairy.

The c. 45–50 species in this genus are mainly native to SE Asia; 1 species, *M. speluncae*, has a pantropical distribution including Africa, Australia and the New World. This is the only species present on Christmas Is. and is probably native there. The species mainly occur in moist to wet forests.

W.A.Sledge, *Microlepia speluncae* (L.) Moore, *M. trapeziformis* (Roxb.) Kuhn and *M. firma* Mett. in Kuhn, *Kew Bull.* 11: 523–531 (1956); R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 306–316 (1968); M.Tagawa & K.Iwatsuki, *Fl. Thailand* 3: 112–124 (1979); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 168–169 (1981); R.M.Tryon & A.F.Tryon, *Ferns & Allied Pl.* 373–377 (1982).

Microlepia speluncae (L.) T.Moore, *Ind. Fil.* 93 (1857)

Polypodium speluncae L., *Sp. Pl.* 2: 1093 (1753); *Davallia speluncae* (L.) Baker in W.J.Hooker & J.G.Baker, *Syn. Fil.* 100 (1868). T: Ceylon [Sri Lanka], Herb. P.Hermann vol. 3, fol. 41, no. 384; lecto: BM, *fide* W.A.Sledge, *Bot. J. Linn. Soc.* 84: 25 (1982). Epithet from the Latin *spelunca* (a cave), in reference either to the indusium shape or to the habitat.

Illustrations: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 168, fig. 224 (1981); D.L.Jones, *Encycl. Ferns* 333 (1987).

Large, terrestrial fern; rhizome creeping, dark brown, the young parts shortly hairy, with few, closely spaced fronds. Stipe c. 30–75 cm long, grooved, sparsely shortly hairy, purple-brown. Fronds arching, c. 60–90 cm long, deeply tripinnatisect to tripinnate, finely hairy, thinly and softly herbaceous; pinnae largest towards base, to 20–35 cm long; pinnules shortly stalked, narrowly triangular, deeply lobed, the basal lobes distinctly enlarged and often ±stalked; lobes oblong, to 8–15 mm long, rounded, deeply incised to shallowly toothed, decurrent, sparsely hairy above and beneath; veins all free. Sori ±circular, submarginal near sinuses of lobe teeth; indusium cup-shaped, opening outwards.

Christmas Is. Confined to the upper terraces and plateau, among other ferns on the sides of tracks through the primary rainforest, and also in damp situations in marginal forest, especially in areas of basaltic rock. A pantropical species, perhaps introduced to the New World. It occurs in Australia (W.A., Qld).

Ch.Is.: Flying Fish Cove, *H.N.Ridley 187* (K); Sydneys Dale, *D.A.Powell 4461* (K); Headridge Hill, *B.Molesworth Allen P5* (K); Stewart Hill, *D.J. & B.P.Du Puy CI36* (CBG, K); SW of Hanitch Hill, *D.J. & B.P.Du Puy CI70* (CBG, K).

This is a very variable species, the degree of division increasing in older and larger specimens. It is also variable in the hairiness of the fronds, and several varieties and even separate species have been distinguished. The specimens from Christmas Is. have hairs on the lamina as well as on the veins, corresponding most closely to var. *pubescens* (Hook.) Sledge (*sensu* W.A.Sledge, *Kew Bull.* 11: 525, 1956) and var. *villosissima* C.Chr. (*sensu* R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 315, 1968).

109. ASPLENIACEAE

D.J.Du Puy (Ch.Is.)

Terrestrial or epiphytic ferns, with creeping or erect rhizomes covered with dark brown, latticed scales. Fronds simple or compound; veins usually free. Sori elongate, along one side of the veins with a narrow, linear indusium.

A cosmopolitan family of 1 large genus (*Asplenium*) and about 7 smaller ones; 1 genus on Christmas Is.

Figure 97. **A–B**, ASPLENIACEAE: *Asplenium listeri*. **A**, fertile plant X0.5; **B**, fertile pinna X2 (**A–B**, D. & B.Du Puy CI88A, K). **C–F**, DRYOPTERIDACEAE: **C–D**, *Pteridrys syrmatica*. **C**, habit with one frond X0.25; **D**, pinna lobe with sori and prominent tooth at the sinus base X2 (**C–D**, D. & B.Du Puy CI14, K). **E–F**, *Tectaria dissecta*. **E**, habit with one frond X0.25; **F**, pinna lobe with sori X2 (**E–F**, D.Powell 456, K). Drawn by E.Catherine.

ASPLENIUM

Asplenium L., *Sp. Pl.* 2: 1073 (1753); *Gen. Pl.* 5th edn, 485 (1754); from the Greek *a* (not) and *splen* (a spleen), in reference to the former use of some European species as a remedy for disorders of the spleen. Dioscorides used the name 'asplenon' for these ferns.

Type: *A. marinum* L.

Epiphytic, lithophytic or terrestrial ferns; rhizome erect or creeping; scales dense, small, minutely latticed, dark brown, on rhizome and stipe base; fronds scattered or in a crown. Stipe grooved, with 2 vascular strands. Fronds erect to pendulous, simple to 4-pinnatified, often with vegetative buds, not articulate; veins usually forked, free, rarely uniting upwards into a submarginal vein. Sori elongate to linear, along one side of vein; indusium narrow, attached along vein, usually opening towards midrib of frond segment. *Spleenworts*.

This is one of the largest fern genera, with c. 600–650 species distributed world-wide, from the arctic to the tropics; 3 species on Christmas Is. They most frequently occur in moist forest, as lithophytes or epiphytes. They include several attractive species which are popular in cultivation. Some species are exceptionally variable in habit, and many cultivars have been selected.

W.A.Sledge, The Ceylon species of *Asplenium*, *Bull. Brit. Mus.* (*Nat. Hist.*), *Bot.* 3: 235–277 (1965); R.E.Holttum, *Fl. Malaysia* (*Ferns*) 2nd edn, 2: 413–433 (1968); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 81–93 (1981); M.Tagawa & K.Iwatsuki, *Fl. Thailand* 3: 261–291 (1985).

1 Fronds in a large rosette, simple, with entire margins **1. A. nidus**

1: Fronds arching to pendulous, rarely erect, pinnate, the pinnae with serrate or incised margins, rarely lobed

2 Frond lamina c. 25–60 cm long, with c. 15–37 pinnae; pinnae c. 5–13 cm long, coarsely serrate, the serrations usually with secondary teeth; usually epiphytic **2. A. polyodon**

2: Frond lamina c. 3.5–9 cm long, with c. 8–18 pinnae; pinnae c. 0.8–1.8 cm long, with several lobes divided to near the midvein, the apex and margin incised and toothed; lithophytic **3. A. listeri**

1. Asplenium nidus L., *Sp. Pl.* 2: 1079 (1753)

T: Java, *P.Osbeck*, Herb. C.Linnaeus 1250.6; syn: LINN. Epithet is the Latin word for a nest, the radiating fronds and epiphytic habit of this fern giving the appearance of a bird's nest.

Illustrations: A.B.Graf, *Tropica* 443 (1978); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 87, fig. 74 (1981).

A large, epiphytic or occasionally lithophytic fern; rhizome erect, stout, scaly; scales narrow c. 1–2 cm long, hair-like towards apex, latticed, dark brown, glossy; fronds in a crown. Stipe 2–5 cm long, grooved above, black, scaly at base. Fronds erect to spreading, forming a rosette, simple, linear-elliptic, narrowed to base, entire, acute, to 100–150 cm long, c. 15–25 cm wide, ±glabrous, rather coriaceous; midvein raised above; lateral veins numerous, forked, joined towards apex by a submarginal vein. Sori narrow, linear, in apical half of frond, on lateral veins; indusium linear. *Bird's Nest Fern*.

Christmas Is. Abundant in the rainforest, especially on the plateau and upper terraces, where it can form very large specimens. It is most frequent in the canopy and on the emergent trees *Syzygium nervosum*, *Planchonella nitida* and *Hernandia ovigera*, and is occasionally found as a lithophyte on sheltered limestone rocks and pinnacles in the forest. A common species in the Old World Tropics, from India and southern China through Indo-China, Malesia (including the Malay islands) and Australia (Qld) to Hawaii.

Ch.Is.: northern plateau, *D.A.Powell 115* (K); walk to West White Beach, *R.Shivas 921* (PERTH).

This species traps leaf litter by producing erect fronds which later bend outwards, trapping any litter at their base. The root ball becomes large and is capable of holding large amounts

of water. This root ball is a habitat utilised by other epiphytic ferns including *Vittaria elongata*, *Asplenium polyodon* and *Ophioglossum pendulum*.

2. **Asplenium polyodon** G.Forst., *Prodr.* 80 (1786)

T: none cited; *n.v.* Epithet from the Greek *polus* (many) and *odons* (a tooth), in reference to the toothed pinnae.

A. falcatum Lam., *Encycl.* 2: 306 (1786). T: Mauritius (Isle de France), *P.Commerson*; *n.v.*

Illustrations: R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 433, fig. 250 (1968), as *A. adiantoides*; D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 90, fig. 79, 91, fig. 81 (1981).

An epiphytic or rarely lithophytic fern; rhizome shortly creeping, stout, scaly; scales narrow, c. 1–2 cm long, slender at apex, latticed, dark brown, glossy; fronds in a crown. Stipe usually 15–40 cm long, grooved above, black, with some scales at base. Fronds usually pendulous to arching, c. 25–60 cm long, pinnate, with c. 15–37 pinnae which are gradually reduced towards apex; pinnae narrowly ovate, c. 5–13 cm long, unequal-sided, acuminate, coarsely serrate or double-serrate, cuneate and strongly oblique at base, ±glabrous, shortly stalked; lateral veins numerous, forked, free. Sori narrow, linear, along lateral veins; indusium linear. *Sickle Spleenwort*, *Mare's Tail Fern*.

Christmas Is., a frequent and attractive epiphyte in the rainforest on the plateau and upper terrace. It usually forms the largest specimens when it grows on the water-retentive root ball of *Asplenium nidus*. It has once been collected from limestone rock crevices, growing with the endemic *A. listeri*. A widely distributed, Old World species, occurring from Madagascar and the Mascarenes through India, southern China, Indo-China, the Philippines and Malesia to Australia (W.A., S.A., Qld, N.S.W., Vic.), Polynesia and New Zealand.

Ch.Is.: plateau, *H.N.Ridley 172* (K); limestone ridge 0.8 km S of Camp 4, *D.A.Powell 110* (K); Headridge Hill, *B.Molesworth Allen P8* (K); track to Grants Well, SW of Hanitch Hill, *D.J. & B.P.Du Puy CI9* (CBG, K); Gannet Hill, on limestone rocks of lookout point over Margaret Knoll, *D.J. & B.P.Du Puy CI88B* (CBG, K).

This is an extremely variable speices or species complex, with regard to the size and division of the fronds. W.A.Sledge (*Bull. Brit. Mus.* (*Nat. Hist.*), *Bot.* 3: 235–277, 1965) gave a detailed account of a range of variants with entire, pinnatifid or pinnate pinnae found in Sri Lanka. Similarly D.L.Jones & S.C.Clemesha (*Austral. Ferns & Fern Allies* 2nd edn, 90, 1981) recorded this type of variation in Australia. Changes in frond shape may be linked with habitat and environmental factors, and may also involve alterations in ploidy levels. The specimen distinguished here as *A. listeri* is no doubt closely related to this complex, but it appears to be unique to Christmas Is., and differs so greatly from *A. polyodon* as represented on the island, that it has been maintained here as a distinct taxon.

3. **Asplenium listeri** C.Chr., *Ind. Fil.* 118 (1906)

A. centrifugale Baker, *J. Linn. Soc., Bot.* 25: 360 (1890), *non* Baker (1874), *nom. illeg.* T: [Christmas Is., Sept.–Oct. 1887, *J.J.Lister s.n.*; holo: missing from BM & K]. Gannet Hill, in exposed crevices on limestone rocks of lookout point over Margaret Knoll, Christmas Is., 29 Apr. 1987, *D.J. & B.P.Du Puy CI88A*; neo: K; isoneo: CBG, *fide* D.J.Du Puy, *Fl. Australia* 50: 573 (1993). Named after Joseph Jackson Lister, an Englishman educated at Cambridge, who embarked at Colombo [Sri Lanka] as volunteer naturalist on H.M. Survey Vessel *Egeria*, and landed on Christmas Is. on 30 September 1887, where he collected specimens for about a week in the vicinity of Flying Fish Cove.

A small, lithophytic fern; rhizome shortly creeping, scaly; scales narrowly ovate, c. 3–6 mm long, long-acuminate, latticed, dark brown, glossy; fronds in a crown. Stipe slender, c. 2.5–3.5 cm long, slender, black, with some scales at base. Fronds short, erect, c. 3.5–9 cm long, with c. 8–18 pinnae which are gradually reduced towards apex; pinnae ovate, c. 8–18 mm long, with several lobes divided to near midvein, unequal-sided, incised and toothed, cuneate at base, ±glabrous, coriaceous, with stalk 0.3 mm long; lateral veins forked, free. Sori linear along lateral veins; indusium linear. *Christmas Island Spleenwort*. Figs 67, 97A–B.

Christmas Is. Endemic. Occurs on exposed limestone rocks and cliffs at a single locality.

Originally collected by J.J.Lister in 1887, probably near Flying Fish Cove. It was not

collected by C.W.Andrews, but H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 246 (1906), reported having found a single small specimen at Toms Ladder, again in Flying Fish Cove. These historical collections have been lost, and there had been some mystery concerning the identity of this species. J.G.Baker, *J. Linn. Soc., Bot.* 25: 360 (1890), described the plant as having pinnate fronds c. 10–13 cm long, c. 2.5–4 cm wide, with stipes c. 5–7.5 cm long. He described the pinnae as being deeply lobed, with the sori confined to the lobes, leaving the central regions of the pinnae sterile and naked.

A specimen recently collected from crevices in exposed limestone rocks at the viewpoint in Gannet Hill (*D.J. & B.P.Du Puy CI88A*), closely resembles the above description of *A. listeri*, although with slightly smaller fronds. As this is the only specimen available of this species, it has been neotypified here, and the description has been drawn up from this single collection.

A larger specimen (*D.J & B.P.Du Puy CI88B*), was collected along with the above specimen of *A. listeri*, growing in the same rock crevice. It is much larger than *A. listeri* (frond laminas 16–27 cm long), and the pinnae are not lobed, but toothed as in *A. polyodon*, from which it differs only in its slightly smaller size, and somewhat more coriaceous and suberect fronds. This specimen has therefore been included in *A. polyodon*. The large variation in the morphology of *A. polyodon* has already been discussed, but does not appear to include the distinct variant distinguished here as *A. listeri*.

110. DRYOPTERIDACEAE

D.J.Du Puy (Ch.Is.)
A.E.Orchard (M.Is.)

Terrestrial ferns; rhizome erect or creeping, the apex covered in non-latticed scales; stipes not articulate on rhizome, with scales or multicellular hairs. Fronds usually 1- to 4-pinnate, rarely simple; rachis and costae scaly or with multicellular hairs; veins free or netted; pinnules asymmetrical. Sori round, on veins or ends of veins; indusia peltate or reniform, rarely absent.

A family containing many genera whose classification is still unsettled. It is distributed throughout the world; 2 genera on Christmas Is.; 1 genus on Macquarie Is.

KEY TO GENERA

1 Pinnae oblique at base (M.Is.) **1. POLYSTICHUM**

1: Pinnae equal-sided at base (Ch.Is.)

2 Pinnae mostly simple, entire, the basal pair of pinnae of basiscopically lobed **2. TECTARIA**

2: Pinnae mostly deeply lobed to pinnately divided, with toothed or lobulate lobes

3 Lowest pair of pinnae more finely divided than upper pinnae; sinus between pinna lobes without a tooth at base **2. TECTARIA**

3: Lowest pair of pinnae identical to upper pinnae; sinus between pinna lobes with a small, prominent tooth at base **3. PTERIDRYS**

1. POLYSTICHUM

Polystichum Roth, *Tent. Fl. German.* 3: 31, 69 (1799); from the Greek *poly-* (many) and *stichos* (a row), in reference to the arrangement of the sori.

Type: *P. longchitis* (L.) Roth

Terrestrial; rhizome erect, densely covered in scales. Fronds large, 2- or 3-pinnate; rachis usually densely scaly; pinnules asymmetric. Sori circular, in 1 row either side of midrib, remote from margins; indusion circular, peltate or absent. *Shield Ferns*.

A cosmopolitan genus of about 160–180 species; 4 species in south-eastern Australia; 1 species on Macquarie Is. Mainly found in temperate areas of both hemispheres and mountainous areas in the tropics.

T.F.Cheeseman, *Vasc. Fl. Macquarie Is.* 39 (1919), as *Aspidium*; B.W.Taylor, *Fl. Veg. Soils Macquarie Is*. 154–155 (1955); H.H.Allan, *Polystichum*, *Fl. New Zealand* 1: 87–89 (1961); G.R.Copson, Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 27 (1984).

Polystichum vestitum (G.Forst.) C.Presl, *Tent. Pterid.* 83 (1836)

Polypodium vestitum G.Forst., *Prodr.* 82 (1786); *Aspidium vestitum* (G.Forst.) Sw., *Syn. Fil.* 53 (1806). T: no locality cited, *G.Forster*; *n.v.*

Polystichum venustum Hombr., *Voy. Pôle Sud* t. 5m–n. (1843); *Aspidium venustum* (Hombr.) Hook.f., *Fl. Antarct.* 1: 106 (1844). T: no specimen cited; *n.v.*

Illustrations: B.W.Taylor, *Fl. Veg. Soils Macquarie Is*. pl. 24 (1955); P.J.Brownsey & J.C.Smith-Dodsworth, *New Zealand Ferns & Allied Pl.* pl. 30D, figs 165, 167 (1989).

Terrestrial; rhizome short, erect, scaly; frond 22–60 cm long. Stipe densely scaly; scales linear to triangular or ovate, 2–4 cm long, long-attenuate, brown, papery, those nearer base with dark brown centre, interspersed with long flattened bristles. Fronds with primary rachis similarly clothed but scales shorter; upper rachis scales dark brown with light margin; lower rachis scales often uniformly light; indumentum sometimes sparse; secondary rachis usually with bristles only or almost glabrous. Lamina bipinnate, oblong to narrowly lanceolate, tapering, truncate at base; primary pinnae usually 15–40 pairs; secondary pinnae mostly 9–13 pairs, ovate, oblique, deeply dentate, acute, to 10 mm long, 6 mm wide. Sori 3–7 per pinnule, usually 5, round, c. halfway between margin and midrib; indusium peltate, light brown.

Macquarie Is. Localised in valleys on the eastern side of the island, rare on the west. Extends from Tasmania and New Zealand (North, South, Stewart, Chatham, Auckland, Campbell, Antipodes and Snares Islands) to Macquarie Is.

M.Is.: on southern slopes of Nuggets Ck, *R.Filson 6374* (HO); Green Gorge, 18 Jan. 1949, *N.R.Laird* (HO); Nuggets Ck valley, 12 Feb. 1949, *N.R.Laird* (AD, AK, BISH, CANB, CBG, CHR, H, HO, MEL, NSW, WELT); Finch Ck, Sandy Bay, *R.D.Seppelt 12675* (AD, AK, HO, MEL).

2. TECTARIA

Tectaria Cav., *Anales Hist. Nat.* 1: 115 (1799); from the Latin *tectus* (covered, concealed), in reference to the indusia which cover the sori.

Type: *T. trifoliata* (L.) Cav.

Medium to large, terrestrial ferns; rhizome creeping to erect, sometimes thick, covered by the persistent stipe bases; roots numerous, wiry; fronds in a crown, or closely to widely spaced. Scales large, entire, conspicuous on rhizome apex and scattered on stipe base. Stipe not deeply grooved, often becoming brown; vascular strands several, small. Fronds pinnate to tripinnatisect, rarely simple, the basal pair of pinnae often basiscopically lobed or more finely divided than the others, sometimes dimorphic; veins usually anastomosing, forming

areolae (not in *T. dissecta*). Sori usually circular, terminal on free veinlets; indusium usually reniform or peltate; paraphyses absent.

A pantropical and subtropical genus of c. 150 species; 3 species on Christmas Is.

The species are very variable in frond shape, venation, soral position, indusial type and indumentum, and have previously been variously split into several taxa. There is an evolutionary trend in this genus towards a reduction in the degree of dissection of the fronds, perhaps as an adaptation to damp, windless environments. They usually occur in damp, shady forests, especially on streambanks, rocks or gullies. They show some preference for calcareous rocks and can occur on the mortar of old walls.

The Malesian species have been revised by R.E. Holttum, who kindly allowed the use of his unpublished manuscript (Pteridophyta, *Tectaria* Group, *Fl. Males.* ser. II, 2, 1: 1–132, 1991).

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd end, 2: 501–519 (1968); R.E.Holttum, The fern genus *Tectaria* in Malaya, *Gard. Bull. Singapore* 34: 132–147 (1981); R.E.Holttum, Studies in the fern genera allied to *Tectaria* Cav. VII. *Species of *Tectaria* sect. *Sagenia* (Presl) Holttum in Asia excluding Malesia, *Kew Bull.* 43: 475–489 (1988); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 206–208 (1981); R.M.Tryon & A.F.Tryon, *Ferns & Allied Pl.* 470–481 (1982).

1 Fronds pinnate, sometimes with a basiscopic lobe on the basal pinnae **3. T. siifolia**

1: Fronds much more finely divided, 2- or 3-pinnatisect

2 Veins anastomosing, forming areolae along midveins of pinnae, pinnules and lobes; fronds tripinnatisect, the pinnae mostly bipinnatisect; basal pair of pinnae with stalks c. 1.5–2.5 cm long; sori mainly in lobules of pinna lobes; indusia glabrous **1. T. devexa**

2: Veins all free; fronds bipinnatisect, the pinnae pinnatisect except for the basal pair which have 1–3 pairs of stalked pinnules; basal pair of pinnae with stalks up to 1.5 cm long; sori in single rows on either side of midvein of pinna lobes; indusia hairy **2. T. dissecta**

1. Tectaria devexa (Kunze ex Mett.) Copel., *Philipp. J. Sci.* (*Bot.*) 2: 415 (1907)

var. **minor** (Hook.) Holttum, *Kew Bull.* 43: 486 (1988)

Aspidium giganteum var. *minor* Hook., *Spec. Fil.* 4: 50 (1862). T: Ceylon, *G.Thwaites CP1358*; holo: K, *fide* R.E.Holttum, *loc. cit.* (1988). Epithets from the Latin *devexus* (descending, sloping), in reference to the frond shape; and from the Latin *minor* (lesser, smaller).

Illustration: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, fig. 288 (1981), as *T. devexa*.

Terrestrial fern; usually solitary; rhizome suberect to procumbent, thick; scales narrowly ovate to linear, c. 6–9 mm long, dark brown; fronds in a crown. Stipe C. 10–35 cm long, becoming brown. Fronds arching, c. 20–40 cm long, tripinnatisect, thinly herbaceous; pinnae bipinnatisect, the basal pinnae largest and most deeply divided, with stalks 1.5–2.5 cm long; lobes narrowly triangular, mostly lobulate, acute, to 4–7 cm long; veins densely hairy; lamina sparsely hairy above and in sinuses; veins anastomosing, forming elongated areolae along larger veins. Sori small, circular, mainly in lobules of pinna lobes; indusia reniform, glabrous.

Christmas Is. Grows in shaded positions in the primary rainforest on the plateau, usually in areas of deep soil. It may be the only forest floor species in this type of habitat. A tropical and subtropical species distributed from Taiwan, southern China and Sri Lanka through Indo-China, the Philippines and Malesia to the New Hebrides and Australia (Qld). Var. *minor* is known only from Sri Lanka and Christmas Is.

Ch.Is.: no precise locality, Sept.–Oct. 1988, *J.J.Lister* (K); no precise locality, *C.W.Andrews 12, 131* (K); Flying Fish Cove, *H.N.Ridley 186* (K); S side of island, Line 256, *D.J. & B.P.Du Puy CI17* (CBG, K).

Var. *minor* differs from the typical variant in having frond laminas which are almost glabrous beneath, although the veins are hairy. This species closely resembles *T. dissecta*,

with which it shares similar habitat preferences. *Tectaria dissecta* has less finely divided fronds with no anastomosing veins.

2. Tectaria dissecta (G.Forst.) Lellinger, *Amer. Fern J.* 58: 156 (1968)

Polypodium dissectum G.Forst., *Prodr.* 81 (1786); *Nephrodium dissectum* (G.Forst.) Desv., *Mém. Soc. Linn. Paris* 6(2): 259 (1827); *Lastrea dissecta* (G.Forst.) Carr, B.Seemann, *Fl. Vit.* 360 (1873). T: Pacific, *G.Forster*; iso: BM, K. Epithet from the Latin *dissectus* (cut into pieces), descriptive of the finely divided fronds.

[*Lastrea blumei auct. non* T.Moore (1858): H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 247 (1906)]

[*Nephrodium intermedium auct. non* (Blume) Hook. & Baker (1867): C.W.Andrews, *Monogr. Christmas Is.* 195 (1900)]

Terrestrial fern, usually solitary; rhizome suberect; scales narrowly ovate, c. 4–8 cm long, dark brown; fronds in a crown. Stipe c. 25–30 cm long, becoming brown. Fronds arching, 30–60 cm long, ±bipinnatisect excluding basal pair of pinnae, thinly herbaceous; pinnae mostly pinnatisect, the basal pair largest and most finely divided, ±bipinnatisect, with 1–3 pairs of pinnules, and stalks to 1.4 cm long; lobes narrowly oblong, mostly to 3 cm long, rounded, mostly shallowly toothed; lamina sparsely hairy above; veins all free, densely hairy. Sori small, circular, in single rows on either side of midvein of pinna lobes; indusia reniform, hairy. Fig. 97E–F.

Christmas Is. Not uncommon, in deep soil on the plateau and upper terraces, in deeply shaded positions under primary rainforest. Occurs from Taiwan, through the Philippines, Borneo and Sulawesi to Java, the lesser Sunda Islands, and Christmas Is., and east through New Guinea to the SW Pacific islands.

Ch.Is.: Phosphate Hill, *H.N.Ridley 182* (K); Murray Hill track, *H.N.Ridley 183* (K); sheltered valley close to Aldrich Hill, *D.A.Powell 456* (K); Headridge Hill, *B.Molesworth Allen P10* (K); S side of island, Line 256, *D.J. & B.P.Du Puy CI20* (CBG, K).

3. Tectaria siifolia (Willd.) Copel., *Philipp. J. Sci.* (*Bot.*) 2: 414 (1907)

Polypodium siifolium Willd., *Sp. Pl.* 5: 196 (1810). T: Java, *L.Ventenat s.n.*, Herb. C.L.Willdenow 19689; holo: probably B *n.v.*, *fide* R.E.Holttum, *Fl. Males.* ser. II, 2, 1: 84 (1991). Epithet from the Latin *folium* (a leaf) and the genus *Sium* (Apiaceae), because of the similar appearance of the foliage of these two taxa.

[*Nephrodium polymorphum auct. non* (Wall. ex Hook.) Hook. & Baker (1868): C.W.Andrews, *Monogr. Christmas Is.* 195 (1900)]

[*Aspidium polymorphum auct. non* Wall. ex Hook. (1862): H.N.Ridley, *J. Straits Branch Roy. Asiat. Soc.* 45: 247 (1906)]

Illustration: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 208, fig. 290 (1981).

Terrestrial fern; rhizome shortly creeping; scales to 10 mm long, dark brown; fronds clustered near apex. Fronds pinnate, with 1–4 pairs of pinnae, the lowest pair sometimes lobed to bifid, glabrous, dimorphic, the sterile frond with broader pinnae than the fertile ones, and with a shorter stipe; pinnae entire or with sinuous margins. Fertile frond: stipe to 50 cm long; pinnae narrowly oblong, 9–22 cm long, to 5 cm wide, acuminate, obtuse at base; lateral veins oblique, with a network of anastomosing veins between, forming many areoles. Sori circular, in paired rows between lateral veins of pinnae, sometimes coalescing into short, linear sori; indusia small, reniform, glabrous.

Christmas Is. Collected only once in an area recently extensively mined, but may still exist on the remaining rock outcrops or gullies. This species is of local occurrence throughout Malesia and in north-eastern Qld, Australia.

Ch.Is.: North West Point, *C.W.Andrews 94* (BM, K).

Vegetative propagation can occur naturally in this species, through the development of buds in the pinna axils of old, sterile fronds which have collapsed onto the soil.

3. PTERIDRYS

Pteridrys C.Chr. & Ching, *Bull. Fan Mem. Inst. Biol.* 5: 129–130 (1934); from the resemblance of the frond venation to certain species of the fern genus *Pteris*.

Type: *P. syrmatica* (Willd.) C.Chr. & Ching

Terrestrial or lithophytic ferns; rhizome erect, covered by persistent stipe bases. Stipe conspicuously grooved; vascular strands several, small. Fronds suberect, mostly bipinnatisect; pinnae and the apical pinna usually all similar, occasionally the basal pinnae with elongated pinnules (not on Christmas Is.); sinuses between pinna lobes with a small, prominent tooth at base; veins all free. Sori circular, small, on lamina beneath, usually at apex of veinlets in lobes; indusium reniform; paraphyses absent.

A small genus of c. 10 species, distributed from India and S China through Indo-China, the Philippines and Malesia including New Guinea; 1 species is native to Christmas Is. The species usually occur in shaded forest habitats.

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 529–532 (1968).

Pteridrys syrmatica (Willd.) C.Chr. & Ching, *Bull. Fan Mem. Inst. Biol.* 5: 131, t. 11, 17 (1934)

Aspidium syrmaticum Willd., *Sp. Pl.* 5: 237 (1810); *Lastrea syrmatica* (Willd.) T.Moore, *Ind. Fil.* 2: 105 (1857); *Nephrodium syrmaticum* (Willd.) Hook. & Baker, *Syn. Fil.* 272 (1868). T: [Chile, Peru], Herb. C.L.Willdenow 19765; holo: B, microfiche seen. Epithet from the Latin *syrma* (a trailing robe), in reference to the long, slender apices of the pinnae.

Illustrations: R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 529, fig. 311, 531, fig. 312 (1968).

Terrestrial fern, usually solitary; rhizome short, erect; scales narrowly ovate, c. 6–8 mm long, auriculate, brown; fronds in a crown. Stipe c. 20–35 cm long, slender, grooved above, with scattered, basal scales. Fronds suberect to arching, c. 23–38 cm long, glabrous, firm-textured, bipinnatisect, the terminal pinna similar to laterals; pinnae oblong, c. 8–15 cm long, subsimilar, pinnatisect, abruptly long-acuminate and serrate, truncate at base with stalks c. 4–12 mm long; lobes narrowly oblong, usually 10–20 mm long, obtuse, serrate, with a prominent, small tooth at sinus base; veins all free. Sori small, circular, in single rows on either side of midveins of pinna lobes; indusium reniform, thin. Fig. 97C–D.

Christmas Is. Frequent in the primary rainforest on the plateau and upper terraces, in deep or sometimes shallow soil, often surrounded by a carpet of *Bolbitis heteroclita*, or among shrubs. The most common species in the genus, distributed in southern India and Sri Lanka, and from Indo-China and the Philippines through Malesia including New Guinea.

Ch.Is.: no precise locality, *C.W.Andrews* (K); Flying Fish Cove, *H.N.Ridley 185* (K); 1 km N of Stewart Hill, *D.J. & B.P.Du Puy CI14* (CBG, K).

This species can be easily distinguished from *Tectaria* species by its uniformly pinnatisect pinnae without any pinnules, and the presence of a conspicuous tooth at the base of each of the sinuses between the lobes.

111. LOMARIOPSIDACEAE

D.J.Du Puy (Ch.Is.)

Terrestrial, climbing or epiphytic ferns; rhizomes creeping or high-climbing, dorsiventral with roots only on the ventral side, often with minutely latticed scales. Stipe with several vascular strands, forming a U-shape in T.S. Fronds simple, pinnate or rarely bipinnate, the fertile frond often reduced; veins free or anastomosing, the areoles without free veins.

Sporangia acrostichoid, densely covering undersurface, or part of it, in fertile fronds; indusium and paraphyses absent.

A largely tropical family containing c. 6 genera; 1 genus on Christmas Is.

BOLBITIS

Bolbitis Schott, *Gen. Fil.* 3, t. 14 (1835); from the Greek *bolbos* (a bulb), in allusion to the vegetative buds which occur on the apical portion of the frond in the type species.

Type: *B. serratifolia* (Mert. ex Kaulf.) Schott

Mainly terrestrial or lithophytic ferns; rhizome creeping, rooting ventrally; scales usually minutely latticed, auriculate at base, on rhizome and stipe base; fronds usually closely spaced. Stipe and rachis weakly Z-grooved above; vascular strands several, forming a U-shape in T.S. Fronds simple or pinnate, not jointed, dimorphic, often with bulbils. Sterile frond: apical pinna similar to lateral pinnae, sometimes long-attenuate; pinnae sessile or subsessile, entire to lobed and toothed, narrowly decurrent, with midvein and lateral veins pinnate, and free or anastomosing veinlets between. Fertile frond usually reduced, the pinnae narrow; sporangia acrostichoid; paraphyses and indusium absent.

A pantropical and subtropical genus containing c. 44 species; 2 species in Australia (Qld); 1 species native to Christmas Is. The species usually occur on rocks but are occasionally terrestrial or climbing and epiphytic. They mostly prefer damp habitats, such as stream gullies, in evergreen or seasonally dry forest.

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 461–470 (1968); E.Hennipman, A monograph of the fern genus *Bolbitis* (Lomariopsidaceae), *Leiden Bot. Ser.* no. 2 (1977); E.Hennipman, *Fl. Males.* ser. II, 1: 314–330 (1978); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 104–106 (1981).

Bolbitis heteroclita (C.Presl) Ching in C.Chr., *Ind. Fil. Suppl.* 3: 48 (1934)

Acrostichum heteroclitum C.Presl, *Rel. Haenk.* 15, t. 2, fig. 2 (1825). T: Luzon, Philippines, *T.P.X.Haenke s.n.*; *n.v.* Epithet from the Greek *heteros* (different, various) and *klitos* (bent), indicating the dimorphic sterile and fertile fronds, the fertile fronds being held more erect.

Acrostichum flagelliferum Wall. ex Hook. & Grev., *Icon. Fil.* t. 23, p.p. (1827); *Gymnopteris flagellifera* (Wall. ex Hook. & Grev.) Bedd., *Suppl. Ferns Brit. Ind.* 27 (1892). T: cult. Calcutta, 1820, *N.Wallich s.n.*; holo: K.

Illustration: R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 464, fig. 271 (1968).

Terrestrial, mat-forming fern; rhizome shortly creeping, sometimes climbing to c. 50 cm; scales narrowly ovate, c. 4 mm long, minutely latticed, dark brown; fronds closely spaced. Fronds dimorphic, the fertile fronds reduced and held above the sterile frond. Sterile frond: stipe c. 15–25 cm long; lamina horizontal, usually with 5–7 pinnae, the apical pinna frequently with an elongated, slender apex to 30 cm long, often bearing a subapical plantlet; pinnae narrowly elliptic, c. 6–15 cm long, acuminate, ±crenate and serrulate, cuneate at base, ±glabrous, subessile; veins pinnate with anastomosing veinlets forming areoles between. Fertile frond: stipe c. 20–30 cm long; lamina erect; pinnae narrow, c. 3–10 cm long, entirely covered by sporangia beneath. Fig. 96B.

Christmas Is. Common, forming extensive mats in the rainforest, usually in shaded habitats, especially where the soil is deep, mainly on the plateau and uppermost terrace. A tropical and subtropical species distributed in SE Asia from India to southern Japan, through Indo-China to Malesia and the SW Pacific islands.

Ch.Is.: Phosphate Hill, *C.W.Andrews 126* (K); plateau, *H.N.Ridley 177* (K); no precise locality, *D.A.Powell 227* (K); Headridge Hill, *B.Molesworth Allen P4* (K); central plateau, *R.Shivas 878* (PERTH).

This is an extremely variable species throughout its range. The above description refers to the variant on Christmas Is. It spreads by vegetative propagation, the long whip-like apex of the sterile frond producing a plantlet near the tip, which eventually touches and forms roots

into the soil at some distance from the parent plant.

112. DAVALLIACEAE

D.J.Du Puy (Ch.Is.)

Small to large, terrestrial or epiphytic ferns; rhizomes erect, creeping or climbing, densely covered with peltate scales; stipe usually articulate on rhizome, with several vascular strands forming a U-shape in T.S. Fronds either simple or variously dissected; veins usually free. Sori solitary at vein tips, dorsal or submarginal; indusium attached and sometimes also along the sides (pouch-shaped), or reniform or sometimes peltate, rarely lacking; paraphyses absent.

A pantropic family of 4 genera; 3 genera on Christmas Is.

KEY TO GENERA

1 Indusium pouch shaped **1. DAVALLIA**

1: Indusium reniform

2 Rhizome wiry, climbing on tree trunks and buttresses, with scattered fronds **2. ARTHROPTERIS**

2: Terrestrial ferns with short, erect rhizomes, the fronds in a crown **3. NEPHROLEPIS**

1. DAVALLIA

Davallia Sm., *Mem. Acad. Sci. Turin* 5: 414, t. 9 (1793); probably after Edmund Davall, a seventeenth century, English botanist.

Type: *D. canariensis* (L.) Sm.

Epiphytic, lithophytic or rarely terrestrial ferns; rhizome thick, creeping, densely scaly; scales peltate, toothed to ciliate, confined to rhizome; fronds scattered. Stipe ±terete to grooved, articulate on short projection from rhizome; vascular strands several, forming a U-shape in T.S. Fronds large, triangular, finely dissected, rarely trifoliolate, sometimes coriaceous, usually ±glabrous, the fertile frond often with slightly narrower segments; pinnae gradually reduced towards frond apex; veins all free. Sori semicircular to narrowly oblong, ±marginal; indusium pouch-shaped, opening only at margin of lamina; paraphyses absent. *Rabbits Foot Ferns*.

A genus of c. 35–40 species, distributed from SE Asia through Malesia to Australia and the Pacific islands, with 2 species occurring in Africa and 1 in SW Europe; 3 species occur in Australia (Qld) and 2 of these are also native to Christmas Is. These 2 species are very similar but occupy distinct niches, one being epiphytic in tall rainforest, the other commonly occurring in exposed sites in old mined areas. The stout rhizome and rather thick-textured fronds, which are articulated to the rhizome and can therefore be deciduous, allow these species to tolerate dry periods in exposed situations.

This genus is popular in cultivation, having attractive, finely divided fronds and a thick, conspicuous rhizome with a dense, soft, red-brown indumentum of narrow scales (giving rise to the common name of Rabbits Foot Ferns).

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 354–363 (1968); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 123–125 (1981).

Epiphyte; fronds thin-textured; false veins absent; sori narrowly oblong, c. 1 mm long, 0.5 mm wide **1. D. solida**

Lithophyte or terrestrial; fronds rather coriaceous; false translucent veins present between veinlets; sori cup-shaped, c. 1 mm long, 1 mm wide **2. D. denticulata**

1. Davallia solida (G.Forst.) Sw., *J. Bot.* (*Schrader*) 1800(2): 87 (1801)

Trichomanes solidum G.Forst., *Prodr.* 86 (1786). T: locality unknown, *G.Forster 308*; syn: BM. Epithet is the Latin word for strong, robust, or sturdy, in reference to the large size.

Illustrations: R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 358, fig. 207 (1968); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 125, fig. 140 (1981); D.L.Jones, *Encycl. Ferns* 207 (1987).

Epiphytic fern, often forming extensive clumps on large branches; rhizome creeping, branched, thick, densely scaly; scales c. 6 mm long, very narrow and tapering to a fine apex, soft, ginger-brown; fronds rather distant. Stipe c. 30–40 cm long, grooved, glabrous, articulated at base. Fronds arching to semi-pendulous, triangular, c. 40–70 cm long, finely 4-pinnatisect, glabrous, deep green; pinnae alternate; pinnules deeply lobed, the lobes narrow, serrate; veins free, branched, without false veins between. Sori narrowly oblong (cigar-shaped), c. 1 mm long, 0.5 mm wide, with 1 or 2 teeth exceeding apex; indusium opening only along outer margin. *Giant Hares Foot*.

Christmas Is. A common species, most plentiful in the taller rainforest on the plateau, mainly high up on the larger branches of tall, canopy or emergent trees such as *Planchonella nitida* and *Syzygium nervosum*, but often seen on fallen branches on the forest floor. Occurs from Taiwan, Indo-China and the Philippines through Malesia to Australia (Qld) and the Pacific islands.

Ch.Is.: no precise locality, Sept.–Oct. 1887, *J.J.Lister* (K); common in forest on trees, *C.W.Andrews 82* (BM, K); no precise locality, 1908, *C.W.Andrews 206* (BM); Irvine Hill, *H.N.Ridley 174* (K); S of field 22 south, *D.J. & B.P.Du Puy CI10* (CBG, K).

A very handsome, epiphytic fern with finely dissected, lacy fronds and softly brown-scaly rhizomes. It is readily grown in cultivation. May be deciduous in the dry season.

2. Davallia denticulata (Burm.f.) Mett. ex Kuhn, *Fil. Deck.* 27 (1867)

Adiantum denticulatum Burm.f., *Fl. Ind.* 236 (1768). T: Java: ?G *n.v.* Epithet from the Latin *dentatus* (toothed), in reference to the small teeth on the pinnule margins.

D. dissecta Sm. ex J.Houlst & T.Moore, *Gard. Mag. Bot.* 3: 325 (1851). T: Java, cult., *Rollisson*; *n.v.*

Illustrations: R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 358, fig. 206 (1968); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 124, fig. 138 (1981).

A lithophytic or terrestrial fern, forming clumps; rhizome creeping, branched, thick, densely scaly; scales very narrow and tapering to a fine apex, c. 6 mm long, soft, chestnut-brown; fronds rather distant. Stipe c. 20–40 cm long, flattened above, glabrous, articulated at base. Fronds arching, triangular, c. 30–50 cm long, finely 4-pinnatisect, glabrous, yellow-green, rather coriaceous; pinnae often subopposite; pinnules deeply lobed, the lobes serrate; veins free, branched, with translucent, false veins between. Sori pouch-shaped, c. 1 mm long, 1 mm wide, with 1 or 2 teeth exceeding apex; indusium opening only along outer margin. Fig. 66.

Christmas Is. Common on old mined areas with limestone pinnacles and poor, thin soil, and occasionally on exposed limestone cliffs and scree, especially on the plateau and upper terrace. It is rarely epiphytic. A widely distributed species in SE Asia, from southern India and SW China, through Indo-China, the Philippines and Malesia to Australia (Qld) and the New Hebrides.

Ch.Is.: common on cliffs, *C.W.Andrews 81* (BM); Flying Fish Cove, *H.N.Ridley 173* (K); limestone ridge, 0.8 km S of camp 4, *D.A.Powell 109* (K); plateau, fallen *Ficus* bole, *D.J. & B.P.Du Puy CI19* (K); Ross Hill, exposed limestone cliff and boulder slope, *D.J. & B.P.Du Puy CI55* (CBG, K).

This species closely resembles *D. solida*, differing distinctly in the shape of the sori. They

are usually separated by habitat preference, but occasional specimens of *D. denticulata* occur as forest epiphytes, along with *D. solida*, and intermediate specimens appear to occur, perhaps through hybridisation. May be deciduous in the dry season.

2. ARTHROPTERIS

Arthropteris J.Sm. in J.D.Hooker, *Fl. Nov.-Zel.* 2: 43, t. 82 (1854); from the Greek *arthron* (a joint) and *pteris* (a fern), in reference to the jointed fronds and pinnae.

Type: *A. tenella* (G.Forst.) J.Sm. ex Hook.f.

Small, climbing ferns, sometimes epiphytic or lithophytic; rhizome very long, slender, creeping, branched; scales peltate, on rhizome and stipe; fronds scattered. Stipe articulate on short projections from the rhizome, grooved; vascular strand circular. Fronds erect to pendulous, pinnate to bipinnatisect; rachis shortly hairy with multiseptate hairs; pinnae articulate on rachis, entire to deeply lobed, oblique at base, often with acroscopic auricles, the apical pinna similar to the lateral pinnae, or a pinnatifid, tapering lamina; veins much-branched, free. Sori intramarginal, at ends of veinlets; indusium present and reniform, or absent; paraphyses absent.

A genus of 15–20 species, distributed throughout the Old World tropics from Africa and the Indian Oceanic islands through Indo-China, southern China and Malesia to Australia and the Pacific islands; 1 species on Christmas Is. They are usually found as climbers or epiphytes on trees in damp, shaded forest.

R.E.Holttum, The genus *Arthropteris* J.Sm. in Malesia, *Blumea* 14: 225–229 (1966); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 80–81 (1981); R.M.Tryon & A.F.Tryon, *Ferns & Allied Pl.* 590–591 (1982).

Arthropteris palisotii (Desv.) Alston, *Bol. Soc. Brot.* ser, 2, 30: 6 (1956)

Aspidium palisotii Desv., *Ges. Naturf. Freunde Berlin Mag. Neusten Entdeck. Gesammten Natuurk.* 5: 320 (1811). T: Oware, W Africa, *A.M.F.J.Palisot de Beauvois*; *n.v.* Named after A.M.F.J.Palisot de Beauvois (1752–1820), a French traveller and botanist.

Aspidium ramosum P.Beauv., *Fl. Oware* 2: 54, t. 91 (1821); *Nephrolepis ramosa* (P.Beauv.) T.Moore, *Ind. Fil.* 104 (1858). T: Oware, W Africa, near Buonopozo, *A.M.F.J.Palisot de Beauvois*; *n.v.*

Illustration: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 80, fig. 62 (1981).

Climbing fern to c. 6 m., sometimes epiphytic; rhizome climbing, branched, wiry; scales peltate, dark brown, appressed; fronds c. 3–8 cm apart. Fronds horizontal to drooping, subsessile, jointed to a 1–3 mm long spur, 12–40 cm long, pinnate, the pinnae reduced towards base and apex, the terminal pinna resembling laterals or fused with uppermost pinnae; rachis grooved above, pubescent; pinnae alternate, closely spaced, sessile, jointed, oblong, c. 1–3 mm long, strongly unequal-sided, rounded, weakly sinuate, truncate and auriculate at base; midvein pubescent; veins pinnately branched, free. Sori circular, in a single row on either side of pinna midvein, sometimes also in auricles; indusium reniform, glabrous.

Christmas Is. Occasional in the primary rainforest on the plateau, usually climbing on tree trunks and buttresses in deep shade. A widespread species, distributed throughout tropical Africa, and from the Mascarenes, Sri Lanka, Burma and southern China through Malesia to the Pacific islands and Australia (Qld, N.S.W.).

Ch.Is.: no precise locality, *H.N.Ridley 175* (K); sheltered valley close to Aldrich Hill, *D.A.Powell 458* (K); no precise locality, *D.A.Powell 466* (K); Headridge Hill, *B.Molesworth Allen P3* (K); behind Ross Hill lookout point, *D.J. & B.P.Du Puy CI56* (CBG, K).

Rarely seen fertile.

3. NEPHROLEPIS

Nephrolepis Schott, *Gen. Fil.* 1, t. 3 (1834); from the Greek *nephros* (a kidney) and *lepis* (a scale), in reference to the reniform indusia in this genus.

Type: *N. exaltata* (L.) Schott

Terrestrial or epiphytic ferns; rhizome usually short, erect, with slender, plantlet-bearing stolons; scales slender, often finely ciliate, peltate, dense on rhizome and stipe base; fronds in a crown. Stipe grooved; vascular strands several. Fronds erect to pendulous, usually simple pinnate; pinnae numerous, sessile, articulate on rachis, becoming reduced towards apex and base, toothed, often auriculate, minutely white-spotted around margins above; veins free, branched. Sori circular to semicircular, rarely linear, in single rows on either side of pinnae, sometimes submarginal, occasionally on marginal lobes; indusium reniform; paraphyses absent. *Sword Ferns, Fishbone Ferns*.

This genus has a pantropical and subtropical distribution, sometimes extending into warm-temperate zones. It includes c. 30 species, many of which are adventives in disturbed or open ground and have very wide distributions. They are often tolerant of a wide range of habitats, but most frequently occur in damp habitats with light shade. They are stoloniferous and can rapidly form large, dense colonies by vegetative proliferation. Christmas Is. has 2 native species, both of which are common throughout SE Asia. They have become much more common on Christmas Is. since mining and roads have created suitable disturbed habitats.

Several species are important in cultivation as ornamentals and house plants, including *N. falcata* (Cav.) C.Chr. and *N. exaltata* (L.) Schott. They both have many cultivars which are more horticulturally desirable than the wild species, including the Fish Tail Ferns with forked pinnae, the Lace Ferns with finely divided pinnae, and the frequently cultivated series of variations known as the Boston Ferns.

The upper surfaces of the pinnae have a marginal ring of minute white spots. These are deposits of calcium carbonate, secreted by hydathodes at the veinlet apices.

R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 372–383 (1968); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 172–176 (1981); R.M.Tryon & A.F.Tryon, *Ferns & Allied Pl.* 656–662 (1982).

Fronds arching, soft-textured; pinnae mostly 12–22 cm long, slightly reduced towards frond base, not distinctly auriculate; rachis and pinnae ±glabrous; sori on lamina of pinnae, c. 2–3 mm from margin **1. N. biserrata**

Fronds ±erect, firm-textured; pinnae 1–9 cm long, gradually becoming greatly reduced towards frond base, usually with distinct, acute auricles; rachis and pinnae with many scattered, hairy scales, and pubescent on midvein of pinnae above; sori ±marginal on pinnae **2. N. multiflora**

1. Nephrolepis biserrata (Sw.) Schott, *Gen. Fil.* sub t. 3 (1834)

Aspidium biserrata Sw., *J. Bot.* (*Schrader*) 1800(2): 32 (1801). T: Mauritius, *C.F.Grondahl* s.n.; holo: S *n.v.* Epithet from the Latin *bis* (twice) and *serratus* (saw-toothed), the major serrations of the pinna margins sometimes with a second series of minor teeth in the sinuses (doubly serrate).

Aspidium acutum Schkuhr, *Deutschl. Krypt. Gew.* 1: 32, t. 31 (1810); *Nephrolepis acuta* (Schkuhr) C.Presl, *Tent. Pterid.* 79 (1836). T: not designated.

Illustrations: R.E.Holttum, *Fl. Malaya* (*Ferns*) 2nd edn, 2: 373, fig. 217 (1968); D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 173, fig. 232 (1981); D.L.Jones, *Encycl. Ferns* 303 (1987).

Large, terrestrial, clump-forming fern; rhizome short, erect, with many stolons and persistent stipes in a crown; scales, slender, 3–5 mm long, ciliate, dark brown, glossy. Stipe c. 25–50 cm long, stout, grooved, with spreading, basal scales. Fronds arching, 50–150 cm long, pinnate, herbaceous, ±glabrous, glossy; pinnae not overlapping, slightly reduced towards frond base, narrowly oblong, c. 7–25 cm long, acuminate, shallowly serrate, but becoming distinctly crenate on fertile pinnae, truncate at base, sometimes with a weak

auricle on the upper side. Sori circular, in a row c. 2–3 mm from margin, on each side of the pinnae; indusium circular with a narrow sinus, glabrous. *Broad Sword Fern*.

Christmas Is. Abundant on the plateau and upper terraces in any semi-shaded situations in the primary rainforest. It may be found in open parts of the forest itself or in clearings, but more usually forms very dense stands along roadsides and drill lines through the forest, and on the forest margins. A common, pantropical species including Australia (Qld).

Ch.Is.: common in forest everywhere, *C.W.Andrews 85* (BM, K); Flying Fish Cove, *H.N.Ridley 169* (K); Headridge Hill, *B.Molesworth Allen P11* (K); central plateau, *R.Shivas 800* (PERTH); track to Grants Well, *D.J. & B.P.Du Puy CI8* (CBG, K).

An adventive species, often invasive when cultivated, and frequently becoming naturalised.

2. Nephrolepis multiflora (Roxb.) F.M.Jarrett ex C.V.Morton, *Contr. U.S. Natl. Herb.* 38: 309–310 (1974)

Davallia multifora Roxb., *J. Nat. Hist. Calcutta* 4: 515, t. 31 (1844). T: India, Herb. W.Roxburgh; lecto: BR *n.v., fide* C.Morton, *Contr. U.S. Natl. Herb.* 30: 309 (1974). Epithet from the Latin *multus* (many) and *flos* (a flower), obviously inappropriate for a fern species.

[*N. exaltata auct. non* (L.) Schott: C.W.Andrews, *Monogr. Christmas Is.* 195 (1900)]

Illustrations: D.L.Jones & S.C.Clemesha, *Austral. Ferns & Fern Allies* 2nd edn, 175, fig. 234 (1981), as *N. hirsutula*, S.W.Andrews, *Ferns Queensland* 251, fig. C (1990).

A terrestrial, clump-forming fern; rhizome short, erect, with many stolons and persistent stipes; scales ovate, 3–4 mm long, ciliate, dark brown. Stipe c. 5–25 cm long, grooved, appressed-scaly. Fronds erect, narrow, c. 20–150 cm long, pinnate, firmly herbaceous, the rachis and pinnae with scattered, pale, hairy scales, the midveins of the pinnae pubescent with a row of short, erect hairs above; pinnae ±overlapping, becoming greatly reduced towards frond base, oblong, c. 1–9 cm long, usually obtuse, shallowly crenate or finely serrate, truncate at base, usually with a distinct auricle on the upper side. Sori circular, in a submarginal row on either side of pinnae; indusium circular with a narrow sinus, glabrous. *Scurfy Sword Fern*.

Christmas Is. An abundant coloniser of old mined areas, and disturbed ground in exposed situations. In areas with poor thin soil and limestone pinnacles it is often the dominant, if rather sparse, plant species. The largest specimens form dense thickets in the damper, more shaded, deep gullies towards the margins of old mines, and may form dense thickets over 2 m tall, while more exposed plants may barely reach 30 cm. Also common along exposed roadsides and railway embankments. A widespread species in tropical SE Asia, from India and southern China through Indo-China and Malesia to Australia (Qld) and the Pacific islands. It has also become naturalised in the New World, where it can compete successfully with the native *N. exaltata* as an adventive species.

Ch.Is.: N coast, *C.W.Andrews 130* (BM, K); South Point Road, on railway cutting, *A.Pearson P19* (K); central plateau, between railway track and adjacent rainforest, *R.Shivas 886* (PERTH); old mine site, 0.5 km N of airport, *R.Shivas 940* (PERTH); Irvine Hill road, *D.J. & B.P.Du Puy CI3* (CBG, K).

The larger, more leafy specimens, from damper and more shaded areas, are less hairy, with larger pinnae, and may be confused with *N. biserrata* (e.g. *C.W.Andrews 130*).

Nephrolepis multiflora differs from *N. hirsutula* (G.Forst.) C.Presl in having short hairs on the upper surface of the pinna midveins. These two species are obviously closely related, and further revision may unite them under the name *N. hirsutula*.

113. BLECHNACEAE

A.E.Orchard (M.Is.)

Medium to large ferns, usually terrestrial but sometimes climbing or epiphytic, often with dimorphic sterile and fertile fronds; rhizome small to large, erect or creeping, scaly. Fronds usually pinnate, rarely entire or bipinnate, tinged pink to red when young; stipe scaly at base, with several separate vascular strands. Sori parallel to midrib, continuous or interrupted; indusium opening towards midrib.

A widely distributed family of 8 or 9 genera and 180–230 species; in Australia 4 genera and about 28 species, almost confined to the eastern coast; 1 genus extends to Macquarie Is.

BLECHNUM

Blechnum L., *Sp. Pl.* 2: 1077 (1753); *Gen Pl.* 5th edn, 485 (1754); from the Greek *blekhnon*, the name of a fern.

Type: *B. occidentale* L.

Rhizome short and erect, sometimes forming a small trunk, or shortly or extensively creeping, covered in narrow, shining, often brown scales. Fronds usually leathery, pinnate, rarely entire or lobed or bipinnate, usually dimorphic; fertile fronds (when dimorphic) longer with narrower pinnae; sterile pinnae entire or minutely serrate. Sori linear, continuous, parallel to midrib; indusium opening toward midrib. *Water Ferns*, *Hard Ferns*.

A genus of 150–200 species, widely distributed throughout the world; in Australia there are about 18 species; 1 extends to Macquarie Is.

T.F.Cheeseman, *Vasc. Fl. Macquarie Is.* 38–39 (1919), as *Lomaria*; B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* 152–154 (1955); H.H.Allan, *Fl. New Zealand* 1: 77–86 (1961); G.R.Copson, An Annotated Atlas of the Vascular Flora of Macquarie Island, *ANARE Res. Notes* 18: 25 (1984).

Blechnum penna-marina (Poir.) Kuhn, *Filic. Afric.* 92 (1868)

Polypodium penna-marina Poir., in J.B.A.P. de Lamarck, *Encycl.* 5: 520 (1804); *Struthiopteris penna-marina* (Poir.) Mason & C.V.Morton, *Bull. Torrey Bot. Club* 66: 44 (1939). T: Straits of Magellan, Dec. 1767–Jan. 1768, *P.Commerson*; *n.v.*

Lomaria alpina (R.Br.) Spreng., *Syst. Veg.* 4: 62 (1827); *Stegania alpina* R.Br., *Prodr.* 152 (1810). T: [Tas.], *R.Brown*; *n.v.*

Lomaria penna-marina Trevis., *Atti Ist. Venet. Sci.* 14: 570 (1869). T: protologue not seen.

Illustrations: B.W.Taylor, *Fl. Veg. Soils Macquarie Is.* t. 35 (1955); D.M.Moore, *Fl. Tierra del Fuego* fig. 25 (1983); P.J.Brownsey & J.C.Smith-Dodsworth, *New Zealand Ferns & Allied Pl.* pl. 33F, fig. 189 (1989).

Terrestrial ferns; rhizome black, slender, creeping, glabrous in older parts, sparsely clad in papery brown, entire, ovate scales near growing tip; scales of frond sparse at base, occasional among pinnae, otherwise frond glabrous; fronds erect, 5–24 cm tall, dimorphic. Sterile frond to 16 cm long; lamina lanceolate, once-pinnate, 3–8 cm long, 0.6–1.3 cm wide; pinnae coriaceous, about 15–20 pairs, closely spaced or sub-imbricate, oblong to ovate, 4–8 mm long, 2–6 mm wide, entire, with prominent venation, attached by broad base. Fertile frond stiffly erect, equalling or exceeding sterile fronds; pinnae more widely spaced than on sterile fronds, twisted at right angles to rachis, oblong, curved, coriaceous. Sori in two continuous bands occupying almost entire undersurface; indusia membranous, with irregular margins.

Macquarie Is. Localised in the north and east in herbfield in sheltered sites with good drainage. Extends from S America (southern Brazil, Chile, Argentina) to Falkland, South

Georgia, Tristan da Cunha, Gough, Prince Edward, Crozet, Kerguelen and Macquarie Islands, Australia (Vic., N.S.W. and Tas.), New Zealand (North, South, Stewart, Chatham, Auckland, Campbell and Antipodes Islands).

M.Is.: Pyramid Peak, 17 Jan. 1949, *N.R.Laird* (HO); Green Gorge, 18 Jan. 1949, *N.R.Laird* (HO); N end of plateau, 21 Jan. 1949, *N.R.Laird* (HO); Finch Ck, Sandy Bay, *R.D.Seppelt 12667* (AD, AK, CANB, HO, MEL, NSW); NW side of Green Gorge, *R.D.Seppelt 12682* (HO, MEL).

APPENDIX

New taxa, combinations and lectotypifications

New taxa, combinations and lectotypifications occurring in this volume of the *Flora of Australia* are formally published here. Taxa are arranged in the order they appear in the text. For economy the entries are brief; the treatment in the main text is more comprehensive. Accepted names are in **bold**, basionyms and synonyms in *italic*. The date of publication of this Volume will be given in Volume 49.

PANDANACEAE

PANDANUS

B.C.Stone

Pandanus tectorius Parkinson ex Du Roi as Z., *Naturforscher* 4: 250 (1774)

var. **cocosensis** B.C.Stone, var. nov.

Phalangibus 6–7.5 cm longis, 4.5–5 cm latis, c. 9–11-carpellatis, subtruncatis vel leviter convexis, lateraliter fere non-sulcatis; stigmatibus 2–3 mm latis et longis; endocarpio centrale; aerenchymate subdense; mesocarpio apicale crasso; foliis infra glaucis; floribus masculis 9–14 mm longis, c. 25–36-staminatis, antheris (mucro excepto) c. 2 mm longis, mucro 0.5 mm longo.

T: top of beach, Cocos (Keeling) Is., 26 June 1961, *H.St.John 26414*; holo: BISH.

The epithet comes from Cocos and the Latin *-ensis* (place of growth) referring to the type locality of the variety.

JUNCACEAE

LUZULA

E.Edgar

Luzula crinita Hook.f., *Fl. Antarct.* 1: 84, t. 48 (1844)

T: Auckland Islands, *J.D.Hooker*; lecto (here chosen): K.

J.D.Hooker described *L. crinita* from the Auckland Islands and Campbell Is. In his herbarium at Kew there are 3 sheets:- Lord Auckland's Islands, Rendezvous Harbour, Dec. 1840; Campbell Island, *J.Hooker*, [dated 1845]; Campbell Island, *Lyall* 17. All specimens have congested heads and none matches the large plant with pedunculate heads in the plate in J.D.Hooker, *loc. cit.* The specimen from Auckland Islands is chosen as lectotype because it comprises 5 complete tufts ranging in height from 4–25 cm. The 2 Campbell Island specimens each comprise small tufts and the upper part of culms from a larger plant.

POACEAE

PUCCINELLIA

E.Edgar

Puccinellia macquariensis (Cheeseman) Allan & Jansen, *Trans. & Proc. Roy. Soc. New Zealand* 69: 268 (1939)

Triodia macquariensis Cheeseman, *Vasc. Fl. Macquarie Is.* 34 (1919). T: Macquarie Is., *H.Hamilton*; lecto (here chosen): AK 1732.

T.F.Cheeseman based his description of *T. macquariensis* on specimens from 'Macquarie Island: Rocks and cliffs near the coast. H.Hamilton (1912–1913)'. There are 2 sheets in Cheeseman's herbarium: AK 1732 – coastal form only found near sea, undated, Macquarie Is., *H.Hamilton*; and AK 1733 – a common coastal grass, in crevices on bare rocks and cliffs, N end, Macquarie Is., undated, *H.Hamilton*. The three tufts on AK 1732 are more mature than the single tuft on AK 1733 but otherwise the two specimens are similar. AK 1732 is chosen as lectotype because T.F.Cheeseman has annotated H.Hamilton's original label '*Triodia macquariensis* Cheesm. *n. sp.*'

ORCHIDACEAE

CORYBAS

D.L.Jones

Corybas dienemus D.L.Jones *sp. nov.*

C. macrantho (Hook.f.) Rchb.f. affinis, a qua foliis crassioribus, semi-erectis et sub anthesin cupularibus, et flore minore semi-erecto, pallide viridi et rubro-purpureo in pedunculo distincto ad basin folii cordati inserto, differt.

T: N of Bauer Bay, Macquarie Is., 27 Nov. 1989, *J.R.Croft 10445*; holo: CBG; iso: CBG, HO, MEL, NSW, WELT.

Endemic on Macquarie Is.

The specific epithet, from the Greek *dienemos* (windswept), refers to the bleak, exposed habitat of this species.

This species was first reported as *C. macranthus* (Hook.f.) Rchb.f. by M.J.Brown *et al.*, *New Zealand J. Bot.* 16: 405–407 (1978). However the collection made by J.R.Croft revealed that it is a new taxon.

ASPLENIACEAE

ASPLENIUM

D.J.Du Puy

Asplenium listeri C.Chr., *Ind. Fil.* 118 (1906)

A. centrifugale Baker, *J. Linn. Soc., Bot.* 25: 360 (1890), *non* Baker (1874), *nom. illeg.* T: [Christmas Is., Sept.–Oct. 1887, *J.J.Lister s.n.*; holo: missing from BM & K]. Gannet Hill, in exposed crevices on limestone rocks of lookout point over Margaret Knoll, Christmas Is., 29 Apr. 1987, *D.J. & B.P.Du Puy CI88A*; neo (here nominated): K; isoneo: CBG.

SUPPLEMENTARY GLOSSARY

acarodomatia: domatia adapted to provide shelter to beneficial mites.

acumen: a long, tapering point.

aerophore: a small patch of aerating tissue on the stipe below a pinna-base, becoming much-enlarged in some species; a pale ±raised line, overlying aerating tissue, running along each side of a stipe.

aestivation: the arrangement of sepals and petals or their lobes in an unexpanded flower bud. cf. **vernation**.

amplexicaul: *of a leaf base*, stem-clasping.

bigeminate: in two pairs; in pinnate leaves referring to only two pairs of pinnae.

bilamellate: consisting of two plates or lamellae.

biternate: twice ternate, the three pinnae each divided into three pinnules.

calycine: belonging to the calyx; with a well-developed calyx.

chasmogamous: *of flowers*, pollination effected in open flower. cf. **cleistogamous**.

cilia: hairs more or less confined to the margins of an organ. sing. **cilium**; adj. **ciliate**.

ciliolate: minutely ciliate.

costa: a rib; when single, a midrib or middle-nerve.

crisped: curled.

cupule: a small cup.

decurved: bent downwards from axis, attachment, or point of reference and curved or curled.

denticle: a small tooth; thick papillate tubercles on the margin of the interpetiolar stipules in *Coprosma* (Rubiaceae).

domatia: small structures on the lower surface of a leaf in some woody dicotyledons, usually consisting of depressions, partly enclosed by leaf tissue or hairs, located in the axils of the primary veins. sing. **domatium**.

episepalous: *of stamens*, borne on the sepals.

extrastaminal: outside the stamens.

fimbriate: *of a margin*, fringed with long, slender, hair-like processes (**fimbriae)**.

fimbrillate: minutely fimbriate.

flagelliform: long and very slender, like a whip-lash.

gemmae: bud or bud-like organ capable of reproducing the plant.

gynomonoecious: having bisexual and female flowers on the same plant cf. **gynodioecious**.

gynostegium: the staminal crown in *Asclepias*, the stamens being fused to the gynoecium.

hesperidium: fleshy indehiscent fruit derived from a single pistil, with an outer leathery rind and septate interior (eg. *Citrus*).

mentum: *of Orchidaceae*, an extension of the foot of the column which forms a spur.

microphyll: small leaf.

mucronulate: with a very small mucro; diminutive of **mucronate**.

muticous: pointless, blunt, awnless.

navicular: boat-shaped.

palmatinerved: *of leaves*, palmately nerved, i.e. with the (main) nerves radiating from one basal point.

paraphyses: sterile filaments in the fruiting bodies of non-vascular plants.

pectinate: comb-like.

pleurogram: lateral marking.

polygamomonoecious: with bisexual and unisexual flowers on the same plant.

poricidal: *of anthers or capsules*, opening by pores.

porrect: directed outwards and forwards.

pulvinate: cushion- or pad-shaped, resembling a pulvinus.

process: a projecting outgrowth or appendage.

rachilla: *of palms and woody monocots*, the lateral or secondary branches of the inflorescence.

scaberulous: slightly or minutely rough to the touch, minutely scabrous.

seta: a bristle or stiff hair. adj. **setaceous**.

sporangiate: bearing spores (or pollen).

stipel: stipule-like appendage at the base of a leaflet (in unifoliolate leaves, inserted on the petiole, not on the stem). pl. **stipellae**. adj. **stipellate**.

stylopodium: a disc-like enlargement of the base of the style.

ternate: in groups of three; *of leaves*, arranged in whorls of three; *of a single leaf*, having the leaflets arranged in groups of three.

ternatifid: *of leaves*, deeply cut into three lobes.

tomentellous: minutely tomentose.

verrucose: covered with wart-like outgrowths, warty.

verticil: a whorl or circular arrangement of similar parts around an axis.

viscidium: *of orchids*, a viscid part of the rostellum which is clearly defined and removed with the pollinia as a unit, serving to attach the pollinia to an insect or other pollination vector.

Abbreviations and Contractions

Literature

Author abbreviations follow R.K.Brummitt & C.E.Powell, *Authors of Plant Names* (Royal Botanic Gardens, Kew, 1992).

Journal titles are abbreviated in accordance with G.H.M.Lawrence *et al.*, *Botanico-Periodicum-Huntianum* (Hunt Botanical Library, Pittsburgh, 1968).

Other literature is abbreviated in accordance with F.A.Stafleu & R.S.Cowan, *Taxonomic Literature*, 2nd edn (Bohn, Scheltema & Holkema, Utrecht, 1976–1987), except that upper case initial letters are used for proper names and significant words. The *Flora of Australia* is abbreviated to *Fl. Australia*.

Herbaria

Abbreviations of herbaria are in accordance with P.K.Holmgren, N.H.Holmgren & L.C.Barnett, *Index Herbariorum* Part I, 8th edn (New York Botanical Garden, 1990). Those most commonly cited in the *Flora* are:

AD	State Herbarium of South Australia, Adelaide
BM	The Natural History Museum, London
BRI	Queensland Herbarium, Brisbane
CANB	Australian National Herbarium, Canberra
CBG	Australian National Botanic Gardens Herbarium, Canberra
DNA	Northern Territory Herbarium, Darwin
HO	Tasmanian Herbarium, Hobart
K	Royal Botanic Gardens, Kew
MEL	National Herbarium of Victoria, Melbourne
NSW	National Herbarium of New South Wales, Sydney
PERTH	Western Australian Herbarium, Perth
QRS	Australian National Herbarium, Atherton

States, Territories

Abbreviations of Australian States and Territories and nearby countries as used in statements of distribution and citation of collections.

A.C.T.	Australian Capital Territory
N.Caled.	New Caledonia
N.S.W.	New South Wales
N.T.	Northern Territory
N.Z.	New Zealand
P.N.G.	Papua New Guinea
Qld	Queensland
S.A.	South Australia
Tas.	Tasmania
Vic.	Victoria
W.A.	Western Australia

General abbreviations

alt.	altitude
app.	appendix
auct.	*auctoris/auctorum* (of an author or authors)
auct. mult.	*auctorum multorum* (of many authors)
c.	*circa* (about)
Ck	Creek
cm	centimetre
col.	colour
coll.	collector
colln	collection
comb.	*combinatio*/combination
cons.	conservation
cult.	cultivated
Dept	Department
diam.	diameter
E	east
ed.	editor
edn	edition
et al.	*et alii*/and others
eds	editors
fam.	*familia/*family
f.	*forma/*form
fig./figs	figure/figures (in other works)
Fig.	Figure (referring to a Figure in this volume of the *Flora*)
gen.	*genus/*genus
holo	holotype
hort.	*hortus* (garden) or *hortensis* (of a garden)
Hwy	Highway
in litt.	*in litteris* (in correspondence)
Is.	Island/s
iso	isotype
km	kilometre
lat.	latitude
lecto	lectotype
loc. cit.	*loco citato* (in bibliographic citations: in the same work and page as just cited)
loc. id.	*loco idem* (in specimen citations: in the same place as just cited)
long.	longitude
L.S.	longitudinal section
m	metre
mm	millimetre
Mt	Mount
Mts	Mounts
Mtn	Mountain
Mtns	Mountains
N	north
n	haploid chromosome number
2n	diploid chromosome number
Natl	National
nom. cons.	*nomen conservandum* (conserved name)
nom. illeg.	*nomen illegitimum* (illegitimate name)
nom. inval.	*nomen invalidum* (name not validly published)

nom. nud.	*nomen nudum*
nom. prov.	*nomen provisorium* (provisional name)
nom. rej.	*nomen rejiciendum* (rejected name)
nom. superfl.	*nomen superfluum* (superfluous name)
nov.	*novus*/new
n. ser.	new series
n.v.	*non vidi* (not seen)
op. cit.	*opere citato* (in the work cited above)
orth.	orthography, orthographic
p./pp.	page/pages
pers. comm.	by personal communication
pl./pls	plate/plates
p.p.	*pro parte* (in part)
R.	River
Ra.	Range
Rd	Road
S	south
sect.	*sectio*/section
SEM	Scanning Electron Micrograph
ser.	series
s. lat.	*sensu lato* (in a wide sense)
s. loc.	*sine loco* (without locality)
s.n.	*sine numero* (without number)
sp./spp.	species (singular/plural)
s. str.	*sensu stricto* (in a narrow sense)
St	Street
stat.	*status*/status
Stn	(pastoral) Station
subg.	subgenus
subsp	subspecies
suppl.	supplement
syn	syntype
synon.	synonym
T	Type (collection)
t.	*tabula* (plate)
trib.	*tribus*/tribe
trig.	trigonometric station
T.S.	transverse section
typ. cons.	*typus conservandus* (conserved type)
var.	*varietas*/variety
W	west
x	basic chromosome number

Symbols

†	taxon included in key but not treated further in text
*	naturalised taxon
[ ]	misapplied name or *nomen invalidum*; also, in localities, denotes a place name later than that originally cited or on the herbarium sheet
±	*in species descriptions*, more or less

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Volume 18	8 June 1990
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For the publication date of Volume 50, see Volume 49.

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