# FLORA OF AUSTRALIA

## *Volume 16*
## *Elaeagnaceae, Proteaceae 1*

# FLORA OF AUSTRALIA

**Volume 16 is the first of two volumes describing the family Proteaceae. It also includes the Elaeagnaceae, a predominantly Northern Hemisphere family represented in Australia by a single species.**

**The Proteaceae are a mainly Southern Hemisphere family of ancient origin with major centres of diversity in southern Africa and south-western Australia. Forty-six genera and about 1100 species occur in Australia (37 genera and almost all the species are endemic).**

**Twenty authors have contributed to this volume which provides an introduction to the family in Australia and a synoptic classification of the family worldwide, as well as discussion of the affinities of Proteaceae, morphological features, the fossil record, pollination biology and utilisation. It also contains identification keys and full descriptions of 488 taxa in 2 families and 7 subfamilies. Among the genera included are *Persoonia* (98 species), *Conospermum* (53 species), *Petrophile* (53 species), *Synaphea* (50 species), *Isopogon* (35 species) and *Adenanthos* (33 species). Bibliographic and habitat notes, a full Australian synonymy and a distribution map are provided for each taxon, more than half of which are illustrated, many in colour. There are 2 newly described subfamilies, 3 new genera and over 70 new species and infraspecific taxa.**

**The remainder of the Proteaceae, about 665 species in the tribes Grevilleeae and Banksieae of subfamily Grevilleoideae, will be published in Volume 17.**

**Cover: *Isopogon sphaerocephalus* Lindl. from south-western Australia. Painting by Margaret Menadue.**

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# Errata

## *Flora of Australia*
## Volume 16
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Please note the following changes:

page 7, last paragraph, 4th sentence:
Replace with 'The flowers of Persoonioideae have thick tepals each with a distal spine or process which represents the development of the distal adaxial meristem of the tepals, analagous to bifacial leaves and *Acacia* phyllodes (Kaplan, 1973), and the adaxial margin of each tepal is usually expanded. This distal spine is also found in other proteaceous taxa (e.g. *Isopogon*).'

page 8, 1st paragraph, 3rd line:
Delete the words 'very large'

page 9, last paragraph:
Replace the first 2 words with '(3) Some Embothrieae (subtribe Embothriinae) are ...'

page 10, 4th paragraph, 7th line:
Replace 'the stamens are free for most of their length' with 'the stamens are partially free'

page 19, 3rd paragraph, 2nd sentence:
Replace with 'Evidence from Chase *et al.* (1993) and Drinnan *et al.* (1994) suggests that the plesiomorphic condition of the fruit in Proteaceae could have been a pseudo-drupe or an achene, but no comprehensive scheme comparable to that of Johnson & Briggs has yet been developed.'

page 128, 3rd last paragraph:
Amend 1st sentence to read: 'As pointed out by A.C.Rozefelds (*pers. comm.*), the nut is...'.

FLORA OF AUSTRALIA

*Isopogon sphaerocephalus* Lindl. Painting by Margaret Menadue.

AUSTRALIAN BIOLOGICAL RESOURCES STUDY, CANBERRA

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*Volume 16*
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This work may be cited as:

*Flora of Australia* Volume 16, Elaeagnaceae, Proteaceae 1. Melbourne : CSIRO Australia (1995)

Individual contributions may be cited as:

P.H.Weston, *Persoonia*, *Flora of Australia* 16: 50–125 (1995).

**National Library of Australia**
**Cataloguing-in-Publication entry**

Flora of Australia. Volume 16, Elaeagnaceae, Proteaceae 1.

Bibliography.
Includes index.
ISBN 0 643 05692 0 (hard cover).
ISBN 0 643 05693 9 (soft cover).
ISBN 0 643 05702 1 (hard cover set).
ISBN 0 643 05695 5 (soft cover set)
1. Botany – Australia – Classification. 2. Plants – Identification. I. Australian Biological Resources Study. II. CSIRO. III. Title: Elaeagnaceae, Proteaceae 1.
581.994

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# INTRODUCTION

Volume 16 is the first of two books which will describe the family Proteaceae. This part contains introductory chapters outlining some of the more important features of the family in Australia, including relationships, morphology, palaeobotany, pollination biology and uses. The key to genera covers the entire family within Australia. Volume 17 will complete the treatment of this ubiquitous Australian family with descriptions of the Tribes Grevilleeae and Banksieae. The only other family ascribed to Proteales by Cronquist, Elaeagnaceae, is also included in Volume 16.

This volume includes descriptions of 2 families, 41 genera and 430 species (488 taxa at species and infraspecific level).

Because of their essentially Southern Hemisphere distribution, Proteaceae have long been of interest to biogeographers. The two major centres of diversification are Australia and southern Africa, but significant numbers of taxa are also found on other Gondwanan fragments, particularly Madagascar, India, Papua New Guinea, New Zealand, New Caledonia and South America. Secondary radiation has apparently also taken place into tropical Africa, southern and SE Asia, Malesia, Central America and Mexico. Untangling and understanding this complex distributional pattern is a continuing challenge, assisted in recent years by major palaeobotanical studies.

Proteaceae have challenged taxonomists from an early date. Robert Brown made the first major contribution to understanding of this family in 1810, in a paper which helped establish him as the leading systematist of his time. Later modifications were made to the Brownian classification by Meisner in 1856, and to the understanding of the Australian taxa by Bentham in 1870. However it was not until publication of a series of major papers by Venkata Rao (1957) and by Johnson & Briggs in 1963 and 1975 that Brown's classification was seriously challenged. Johnson & Briggs' classification has been widely accepted in the last 20 years, and is adopted in this work, with minor additions and modifications resulting from recent work. However, research continues, and new ideas on intra-familial classification can be expected to emerge in coming years. This *Flora* treatment, providing detailed descriptions of nearly two thirds of the genera and species of the family, will provide a sound baseline for this taxonomic reinterpretation.

## Scope and Presentation of the Flora

The geographical area covered by the *Flora* includes the six Australian States, the Northern Territory, the Australian Capital Territory and immediate offshore islands. Other Australian and State-administered territories such as Christmas Is. and Lord Howe Is. are excluded, but the occurrence in those territories of species included in the *Flora* is added to the notes on distribution. Floras of the oceanic islands are described in Volumes 49 and 50.

Descriptions and discussion in the *Flora* are concise and supplemented by important references, synonymy, and information on type collections, chromosome numbers, distribution, habitat, and published illustrations. Descriptions are based on Australian material except for some taxa not confined to Australia for which the collections in Australian herbaria are inadequate. Synonymy is restricted to names based on Australian types or used in Australian literature. Misapplied names are given in square brackets together with an example of the misapplication. Alien taxa established in one or more localities, other than under cultivation, are considered naturalised and are included and asterisked (*).

Families are arranged in the system of A.Cronquist, *An Integrated System of Classification of Flowering Plants* (Columbia University Press, New York, 1981). Within families, genera and species are arranged to show natural relationships as interpreted by contributors. Although

relationships cannot be shown adequately in a linear sequence, such an arrangement in a *Flora* assists comparison of related taxa. Infraspecific taxa are keyed out under the relevant species. Up to seven collections are cited for each species and infraspecific taxon.

Maps showing distribution in Australia are arranged in the same sequence as the descriptions and are grouped together at the end of the main text (pp. 437–470). The term 'Malesia' is sometimes used in the notes on geographical distribution for species that occur widely in the region covered by *Flora Malesiana*, i.e. Malaysia, Singapore, Indonesia, the Philippines, New Guinea and adjacent islands.

Type citations under taxa in the main body of the text reflect the authors' belief in their current status (holotype, isotype, syntype, etc) and where they are held. In cases where the type specimen has not been examined, this is indicated by *n.v.* These type statements are not to be interpreted as lectotypifications. Where lectotypifications have been made previously, these are cited with *fide*, followed by a reference to the author and place of publication (or, sometimes, to a secondary reference). Any formal lectotypifications required for this volume, as in previous parts of the *Flora*, are confined to the Appendix.

New taxa and lectotypifications are included in an Appendix, where they are formally published in accordance with the *International Code of Botanical Nomenclature* (Koeltz Scientific Books, Königstein, 1994). Abbreviations, contractions and notes on format are listed after the Appendix.

A key to families of flowering plants and a glossary of technical terms are provided in Volume 1 of the *Flora*. Supplementary glossaries are included in each volume as necessary.

## Acknowledgments

There are 45 contributors, including illustrators and photographers, to Volume 16. Their co-operation is gratefully acknowledged.

The Librarians at the Australian National Botanic Gardens were ever cheerful in assisting to locate references, and their assistance is much appreciated.

The co-operation of many referees, usually working to tight deadlines, is also acknowledged.

The production of this volume would not have been possible without the substantial assistance of the Australian State and University Herbaria. Their willingness to provide staff time and resources for this project of national importance is an outstanding example of co-operation between the States and the Commonwealth. Overseas institutions have also assisted preparation of the volume with loans of specimens and by making facilities available to contributors and illustrators.

The continuing support of the Australian Research Council for their work on the palaeobotany of Proteaceae is acknowledged by Bob Hill and his associates. Glynn Maynard acknowledges the assistance of Greg Davis, who wrote the computer program to extract and format the data for Table 3 from the *Zoological Catalogue of Australia Volume 10 – Hymenoptera: Apoidea* database. Alex George is grateful to Murdoch University, Perth, and to the Western Australian Herbarium for providing research space, and to those who have kindly collected specimens to assist his study (*Synaphea*). Don Foreman gratefully acknowledges the assistance of Clyde Dunlop (Northern Territory Herbarium), who provided, at short notice, descriptions and distributional data for the three *Stenocarpus* species in the Darwin region, and the assistance of John Clarkson of the Mareeba Herbarium for information on the distribution, flowering times and ecology of *Stenocarpus angustifolius*.

The Executive Editor acknowledges with great pleasure the input by staff of the Australian Biological Resources Study. The leading role in coordination and editing of this volume has been taken by Patrick McCarthy, closely assisted by Katy Mallett. Without their

conscientious attention to detail and logistical abilities in managing so many different contributors, this volume would have been much longer in preparation. Other staff at ABRS also played their part, in editing, in writing link passages, in preparation of illustrations, and in all the 101 other tasks needed to bring a book such as this to completion.

The Australian National Botanic Gardens slide collection provided a number of the colour photographs used in this volume, and these are individually identified by the initials ANBG in the captions. Similarly, slides from the institutional collection of the National Herbarium of NSW are identified by the initials NSW. We are grateful to the various copyright holders for permission to reproduce figures in this volume: Murray Fagg (Figs 16, 23, 32, 52, 57, 124, 135, 147, 149, 153); *Australian Systematic Botany* (Fig. 35A); Cambridge University Press (Fig. 35B); the Association of Australasian Palaeontologists (*Alcheringa*) (Fig. 35D & F).

The co-operation of CSIRO Information Services in bringing this book to press is gratefully acknowledged.

**Figure 1.** *Elaeagnus triflora* var. *triflora*.
Photograph — R.Purdie.

**Figure 2.** *Placospermum coriaceum*.
Photograph — J.Plaza (NSW).

**Figure 3.** *Acidonia microcarpa*.
Photograph — A.George.

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Photograph — P.Richards (NSW).

**Figure 5.** *Persoonia adenantha* bark: finely fissured. Photograph — P.Richards (NSW).

**Figure 6.** *Persoonia iogyna* bark: smooth. Photograph — P.Richards (NSW).

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**Figure 9.** *Persoonia asperula.*
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**Figure 14.** *Persoonia rufa.*
Photograph — P.Richards (NSW).

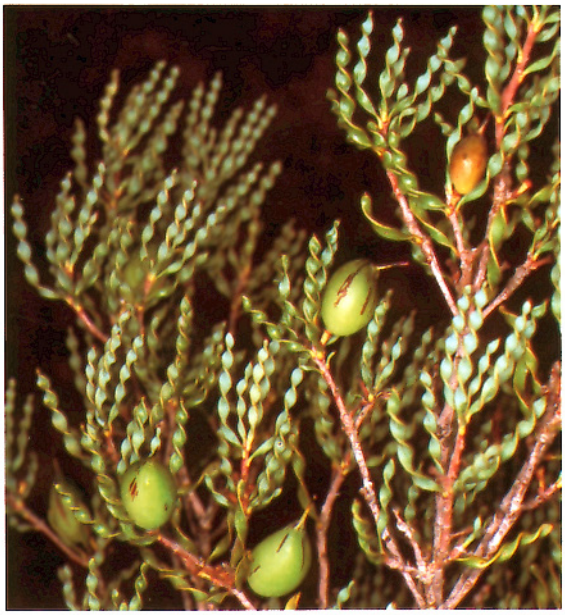


**Figure 15.** *Persoonia iogyna.*
Photograph — P.Richards (NSW).

**Figure 16.** *Persoonia helix* (reproduced with permission).
Photograph — M.Fagg.

**Figure 17.** *Persoonia graminea.*
Photograph — A.George.

**Figure 18.** *Persoonia chapmaniana.*
Photograph — B.Lester.

**Figure 19.** *Persoonia quinquenervis.*
Photograph — D.Tomlinson.

**Figure 20.** *Persoonia stricta.*
Photograph — M.Fagg.

**Figure 21.** *Persoonia saccata.*
Photograph — A.George.

**Figure 22.** *Cenarrhenes nitida.*
Photograph — M.Fagg.

**Figure 23.** *Agastachys odorata* (reproduced with permission).
Photograph — I.Telford (ANBG).

**Figure 24.** *Bellendena montana.*
Photograph — I.Adler (ANBG).

**Figure 25.** *Stirlingia abrotanoides.*
Photograph — A.George.

**Figure 26.** *Symphionema montanum.*
Photograph — M.Fagg.

**Figure 27.** *Stirlingia simplex.*
Photograph — A.George.

**Figure 28.** *Petrophile helicophylla.*
Photograph — A.George.

**Figure 29.** *Petrophile longifolia.*
Photograph — M.Fagg.

**Figure 30.** *Petrophile pulchella.*
Photograph — M.Fagg.

**Figure 31.** *Petrophile circinata.*
Photograph — M.Fagg.

**Figure 32.** *Petrophile biloba* (reproduced with permission).
Photograph — M.Fagg.

# ELAEAGNACEAE

*G.P.Guymer*

Shrubs, woody climbers or (not in Australia) trees, often thorny, densely covered with peltate scales or stellate hairs. Leaves alternate or (not in Australia) opposite, simple, entire, pinnately veined, exstipulate. Flowers axillary, solitary or in umbels, fascicles or cymes, actinomorphic, unisexual or bisexual, strongly perigynous. Perianth 1-whorled, 2- or 4-lobed, rarely 5–8-lobed; lobes valvate, often petaloid; hypanthium tubular, commonly constricted just above ovary. Stamens inserted in throat of hypanthium, as many as and alternate with perianth lobes or twice as many as and both alternate with and opposite to them; anthers 2-locular, dehiscing longitudinally. Nectary disc commonly present on inner surface of hypanthium, lobed. Ovary superior, unilocular; placentation basal; ovule 1, anatropous; style elongate, slender; stigma linear to capitate. Fruit drupe-like or berry-like; consisting of a dry achene that is enveloped by the persistent mealy or fleshy base of hypanthium; endosperm scanty or none.

A family of 3 genera and c. 50 species, occurring mostly in temperate and subtropical regions of the Northern Hemisphere, with an extension into tropical Asia and northern Australia; 1 genus and 1 species represented in Australia.

Elaeagnaceae is included here in the Proteales in accordance with the Cronquist classification used in this Flora. The family has doubtful affinities with the Proteaceae and has been variously placed also in the Myrtales and Rhamnales.

S.A.Graham, The Elaeagnaceae in the southeastern United States, *J. Arnold Arbor*. 45: 274–287 (1964); V.S.Rao, The nature of the perianth in *Elaeagnus* on the basis of floral anatomy with some comments on the systematic position of Elaeagnaceae, *J. Indian Bot. Soc.* 58: 156–161 (1974); J.F.Veldkamp, Elaeagnaceae, *Fl. Males.* ser. I, 10(2): 151–156 (1986).

## ELAEAGNUS

*Elaeagnus* L., *Sp. Pl.* 1: 121 (1753); from the Greek *elaia* (olive tree) and *agnos* (chaste tree) or *heleagnos* (a willow).

Type: *E. angustifolia* L.

Woody climbers or shrubs; older stems usually armed with thorns derived from short shoots, lepidote. Leaves alternate, deciduous or persistent. Inflorescences axillary or pseudo-terminal. Flowers solitary or in cymes. Perianth 4-lobed, rarely 5–8-lobed. Stamens 4, rarely 8, alternitepalous; anthers versatile, introrse. Disc usually inconspicuous, intrastaminal. Stigma lateral. Fruit usually with 8 longitudinal ribs when dried; exocarp fleshy; mesocarp woody; endocarp villous or (not in Australia) glabrous inside.

A genus of c. 45 species from Central and North America, Europe, temperate and tropical Asia and Australia; 1 species in eastern Qld.

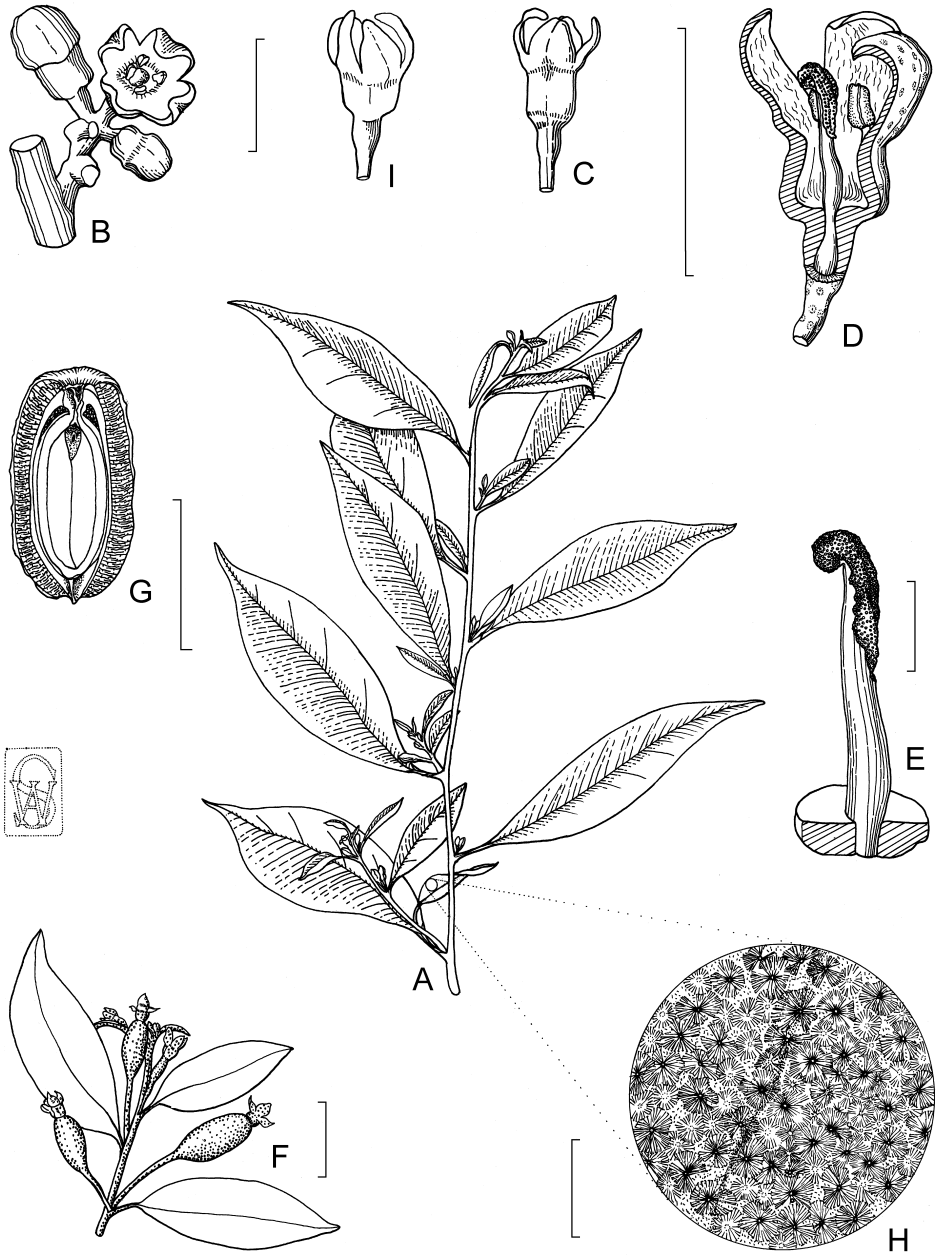
E.'t Hart & J.F.Veldkamp, A revision of *Elaeagnus* (Elaeagnaceae) in Malesia, *Blumea* 26: 398–401 (1980).

### **Elaeagnus triflora** Roxb., *Fl. Ind.* 459 (1820)

T: Calcutta Botanic Gardens [India], *W.Roxburgh s.n.*; holo: BM (photo BRI).

[*Elaeagnus latifolia auct. non* L.: G.Bentham, *Fl. Austral.* 6: 39 (1873)]

Woody climber or scandent shrub. Leaves rusty or silvery-lepidote below, glabrous and punctate above, persistent; petiole 5–15 mm long; lamina ovate to lanceolate, 3–13 cm long, 1–6 cm wide; base obtuse; apex acute or acuminate; secondary veins 5–8 pairs. Inflorescence




**33.** *Elaeagnus*. **A–H**, *E. triflora* var. *triflora*. **A**, flowering branchlet (L.Smith 3327, BRI); **B**, inflorescence; **C**, flower; **D**, half flower; **E**, style and stigma (**B–E**, P.Sharpe 3580, BRI); **F**, fruiting branchlet (S.Blake 15158, BRI); **G**, T.S. fruit (P.Sharpe 3580, BRI); **H**, abaxial leaf surface view of scales (S.Blake 15158, BRI). **I**, *E. triflora* var. *brevilimbata*, flower (L.Brass & C.White 133, BRI). Scale bars: **A** = 4 cm; **B**, **D**, **I** = 5 mm; **C**, **F**, **G** = 1 cm; **E**, **H** = 1 mm. Drawn by W.Smith.

axillary, 5–20 mm long, with flowers solitary or in 3-flowered cymes; peduncles to 2 mm long; pedicels 1–4 mm long, elongated in fruit to 8 mm long. Flowers 4–9 mm long, white to pale yellow; tube 3.5–6.5 mm long; lobes 4, ovate, 2–5 mm long; stellate-pubescent inside. Stamens 4, rarely 8; filaments slender, 0.3–1 mm long. Ovary 1–2 mm long, glabrous; style 2–4 mm long, glabrous. Fruit red to dark brown, ellipsoidal, 10–17 mm long.

Extends from SE Asia to New Guinea and eastern Qld. There are two varieties.

Perianth tube 2–4 mm long above constriction, c. equal to or twice as long as lobes **a**. var. **triflora**

Perianth tube 1–1.5 mm long above constriction, c. half as long as lobes **b.** var. **brevilimbata**

### a. *Elaeagnus* **triflora** Roxb. var. **triflora**

Flowers 6–9 mm long; upper part of tube 2–4 mm long; lobes 2–5 mm long, 2–3 mm wide. Figs 1, 33A–H.

Occurs in several types of rainforest in eastern Qld from the Claudie River to Beachmont; also in Malesia. Flowers July–Dec.; fruits Oct.–Jan. Map 1.

Qld: Malanda, *S.T.Blake 15158* (BRI); Mt Wolvi, E of Gympie, *L.W.Jessup 490* (BRI).

### b. *Elaeagnus* **triflora** var. **brevilimbata** E.'t Hart, *Blumea* 26: 400 (1980)

T: Balim R., New Guinea [Papua New Guinea], Dec. 1938, *L.J.Brass 11703*; holo: L; iso: BRI.

Flowers 4–7.5 mm long; upper part of tube 1–1.5 mm long; lobes 2–3 mm long, 1.5–2.5 mm wide. Fig. 33I.

Occurs in mesophyll or notophyll vine forest from Atherton to Eungella, Qld, usually above 600 m; also in New Guinea. Flowers July–Oct.; fruits Oct.–Dec. Map 2.

Qld: 16 km SE of Atherton, *T.Hartley & B.P.M.Hyland 14088* (BRI); Ravenshoe, *L.J.Brass & C.T.White 133* (BRI); Eungella Ra., *C.T.White 13014* (BRI).

# PROTEACEAE

Prostrate to erect shrubs, or short to tall trees, sometimes lignotuberous, usually with short, 3-celled hairs, occasionally with glandular hairs. Clusters of short, lateral roots ('proteoid roots') often produced. Leaves alternate, less commonly opposite or whorled, simple, pinnatifid, pinnate or bipinnate, rarely palmate, usually coriaceous, exstipulate. Inflorescence simple or compound, axillary or terminal, racemose, paniculate or condensed (corymbose, capitate or cone-like). Flowers zygomorphic or actinomorphic, usually bisexual, solitary or paired in the axils of bracts, rarely ebracteate. Perianth of 4 valvate, free or variously united tepals; each with a slightly expanded limb. Stamens 4, usually all fertile, opposite tepals; filaments partly or wholly adnate to tepals, rarely free. Hypogynous glands usually present, (2–) 4, scale-like or fleshy, free or fused. Gynoecium of 1 carpel. Ovary usually superior, rarely perigynous, sessile or stipitate, 1-locular; ovules l to many, variously inserted; style simple, often persistent, often with the apex expanded as a pollen presenter; stigma small, terminal or subterminal. Fruit dehiscent, tardily dehiscent or indehiscent, a woody or coriaceous follicle, an achene, nut or a succulent or non-succulent drupe. Seeds 1 to many, sometimes winged, usually endospermic.

This essentially Southern Hemisphere family of 79 genera and c. 1700 species has Australia and southern Africa as its centres of greatest diversity. Smaller numbers of species are known from Mexico, Central and South America, tropical Africa, Madagascar, India, eastern and south-eastern Asia, Malesia, New Caledonia, New Zealand and Fiji.

In Australia, the family is represented by 46 genera and almost 1100 species and is found in all but the most arid regions. Speciation is most pronounced in south-western W.A., where prostrate to erect, usually sclerophyllous shrubs of large, ±locally endemic genera such as *Petrophile*, *Conospermum*, *Synaphea*, *Adenanthos* and *Dryandra* grow in oligotrophic, sandy soils and lateritic gravels. Similarly, species of other largely extratropical genera such as *Isopogon*, *Grevillea*, *Hakea* and *Banksia* are numerous in the south-west. Diversity is also high in the eastern states where Proteaceae tend to inhabit siliceous soils. A small but mainly disjunct and relictual component comprising 16 small genera occupies the rainforests of north-eastern Qld. Table 1 illustrates the distribution of Australian genera by State or Territory.

The family name comes from that of the Greek sea-god, Proteus, who could change form at will, and was used by Linnaeus because the first representatives of this family seen by him were very variable. Coincidentally, it is an appropriate allusion for the rest of this morphologically diverse family.

In an apparent adaptation to growth in poor soils, many taxa exhibit a specialised form of seasonal root growth known as 'proteoid roots'. These are short, very dense root masses, produced laterally on the normal roots and heavily invested with root hairs. They are formed mainly in the leaf litter layer during seasonal growth flushes, usually shrivelling at the end of the season to be replaced again next year. Soil bacteria appear to play a role in their initiation. Proteoid roots probably function in an analogous way to mycorrhiza in other families, providing a greatly increased absorption surface for scarce nutrients and water. Mycorrhiza are not found in Proteaceae, although common in other Australian plant families growing in nutrient-poor soils.

The inflorescences of Proteaceae are complex, and (particularly in Grevilleoideae) represent a reduced compound structure, which many authors prefer to describe as a conflorescence. However, for simplicity in the key and introduction, we have used the more generic term inflorescence to refer to all types of structure.

Many taxa contain poisonous substances, mainly cyanogenetic glycosides, and skin irritants, and have been implicated in stock illnesses and deaths. Very few cases of human poisoning have been reported (Everist, 1981).

**Table 1.** Numbers of species of Proteaceous genera in Australian States and Territories

[Numbers for *Grevillea*, *Hakea*, *Banksia* and *Dryandra* are approximate]

| | W.A. | N.T. | S.A. | Qld | N.S.W. | A.C.T. | Vic. | Tas. |
|---|---|---|---|---|---|---|---|---|
| *Acidonia* | 1 | – | – | – | – | – | – | – |
| *Adenanthos* | 31 | – | 2 | – | – | – | 1 | – |
| *Agastachys* | – | – | – | – | – | – | – | 1 |
| *Alloxylon* | – | – | – | 3 | 1 | – | – | – |
| *Athertonia* | – | – | – | 1 | – | – | – | – |
| *Austromuellera* | – | – | – | 1 | – | – | – | – |
| *Banksia* | 62 | 1 | 2 | 9 | 12 | 1 | 7 | 3 |
| *Bellendena* | – | – | – | – | – | – | – | 1 |
| *Buckinghamia* | – | – | – | 2 | – | – | – | – |
| *Cardwellia* | – | – | – | 1 | – | – | – | – |
| *Carnarvonia* | – | – | – | 1 | – | – | – | – |
| *Catalepidia* | – | – | – | 1 | – | – | – | – |
| *Cenarrhenes* | – | – | – | – | – | – | – | 1 |
| *Conospermum* | 42 | – | 1 | 3 | 5 | – | 4 | 1 |
| *Darlingia* | – | – | – | 2 | – | – | – | – |
| *Dryandra* | 75 | – | – | – | – | – | – | – |
| *Eidothea* | – | – | – | 1 | – | – | – | – |
| *Floydia* | – | – | – | 1 | 1 | – | – | – |
| *Franklandia* | 2 | – | – | – | – | – | – | – |
| *Gevuina* | – | – | – | 1 | – | – | – | – |
| *Grevillea* | 164 | 29 | 19 | 29 | 49 | 7 | 32 | 1 |
| *Hakea* | 93 | 13 | 18 | 28 | 26 | 3 | 15 | 8 |
| *Helicia* | – | 1 | – | 9 | 2 | – | – | – |
| *Hicksbeachia* | – | – | – | 2 | 1 | – | – | – |
| *Hollandaea* | – | – | – | 2 | – | – | – | – |
| *Isopogon* | 27 | – | 1 | 1 | 7 | – | 2 | 1 |
| *Lambertia* | 9 | – | – | – | 1 | – | – | – |
| *Lomatia* | – | – | – | 4 | 5 | – | 3 | 3 |
| *Macadamia* | – | – | – | 6 | 2 | – | – | – |
| *Megahertzia* | – | – | – | 1 | – | – | – | – |
| *Musgravea* | – | – | – | 2 | – | – | – | – |
| *Neorites* | – | – | – | 1 | – | – | – | – |
| *Opisthiolepis* | – | – | – | 1 | – | – | – | – |
| *Orites* | – | – | – | 2 | 2 | 1 | 1 | 4 |
| *Persoonia* | 42 | 1 | 1 | 16 | 47 | 3 | 11 | 4 |
| *Petrophile* | 47 | – | 1 | 3 | 4 | – | – | – |
| *Placospermum* | – | – | – | 1 | – | – | – | – |
| *Sphalmium* | – | – | – | 1 | – | – | – | – |
| *Stenocarpus* | 2 | 3 | – | 6 | 2 | – | – | – |
| *Stirlingia* | 7 | – | – | – | – | – | – | – |
| *Strangea* | 2 | – | – | 1 | 1 | – | – | – |
| *Symphionema* | – | – | – | – | 2 | – | – | – |
| *Synaphea* | 50 | – | – | – | – | – | – | – |
| *Telopea* | – | – | – | – | 4 | – | 1 | 1 |
| *Triunia* | – | – | – | 4 | 1 | – | – | – |
| *Xylomelum* | 2 | – | – | 3 | 2 | – | – | – |

R.Brown, On the Proteaceae of Jussieu, *Trans. Linn. Soc. London* 10: 15–226 (1810); C.F.Meisner, Proteaceae, *in* A.L.P.P. de Candolle, *Prodr.* 14: 209–482 (1856); G.Bentham, Proteaceae, *Fl. Austral.* 5: 315–584 (1870); H.Sleumer, Studies in Old World Proteaceae, *Blumea* 8: 1–95 (1955); C.Venkato Rao, Cytotaxonomy of the Proteaceae, *Proc. Linn. Soc. New South Wales* 82: 257–271 (1957); L.A.S.Johnson & B.G.Briggs, Evolution in the Proteaceae, *Austral. J. Bot.* 11: 21–61 (1963); L.A.S.Johnson & B.G.Briggs, On the Proteaceae – the evolution and classification of a southern family, *Bot. J. Linn. Soc.* 70: 83–182 (1975); S.L.Everist, *Poisonous Plants of Australia*, 2nd edn, 589–596 (1981); L.A.S.Johnson & B.G.Briggs, Proteaceae, *in* B.D.Morley & H.R.Toelken, *Flowering Plants of Australia* 238–244 (1983); A.S.George, *An Introduction to the Proteaceae of Western Australia* (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs and Grevilleas and all other plants in the Australian Proteaceae family* (1989); G.J.Harden (ed.), Proteaceae, *Fl. New South Wales* 2: 2–71 (1991); R.J.Carpenter, Cuticular morphology and aspects of the ecology and fossil history of North Queensland forest Proteaceae, *Bot. J. Linn. Soc.* 116: 249–303 (1994).

## AFFINITIES

*Andrew W.Douglas*

### Affinities with other Angiosperms

Identification of the most closely related extant non-proteaceous angiosperm is important to our understanding of diversity within Proteaceae. Broadly speaking, there are two schools of thought on this matter, both of which are based on interpretations of floral morphology. The first identifies Proteaceae as a distinct and highly derived family, the flowers of which have evolved from an ancestor with two perianth series, by reduction of the corolla to nectaries, and subsequent reduction to a single carpel. Angiosperm groups from which Proteaceae have been hypothetically derived include Thymelaeaceae (Bentham & Hooker, 1883; Hutchinson, 1959; Eames, 1961), Rosales/Sapindales (Hallier, 1912), Sapindales (Bessey, 1915), Santalales (Lawrence, 1954), Leguminosae and Thymelaeanae (Dahlgren, 1975), Elaeagnaceae (Cronquist, 1968, 1988), Santalaceae/Loranthaceae and Balanophoraceae (Venkata Rao, 1971) and Leguminosae (Thorne, 1968). The likelihood of a close relationship between Proteaceae and Elaeagnaceae has been challenged and dismissed by several studies including that of Venkata Rao (1974) who provided empirical justification for the exclusion of Elaeagnaceae from Proteales.

The second school of thought on the affinities of the Proteaceae emphasises the apocarpous nature of the gynoecium rather than the structure of the perianth. The presence of an apocarpous carpel, a feature of less specialised angiosperms, has led to the hypothesis that the flowers are those of an ancient angiosperm lineage, and are analogous to 'nature's *experimental stages* in the evolution of more derived dichlamydeous taxa' (Venkata Rao, 1971). Taxonomists who have supported this concept have allied the group with Santalales (Rendle, 1959) or suggested uncertain affinities (Wettstein, 1935). On the basis of their detailed, comparative morphological analysis, Johnson & Briggs (1975) supported the view that the family represented a basal lineage among angiosperms, specifically as a pre-Rosidae lineage. Thus, they considered the flowers to be primitively simple and derived from an apocarpous ancestor with little or no differentiation of perianth parts.

A consensus among morphologists who have worked with selected taxa of Proteaceae in comparative angiosperm studies of particular organs or structures points to the Proteaceae having had a long and isolated history. Thus, the family cannot be allied with any single angiosperm group by morphological characters alone. Comparative morphological studies have included the adaptive peaks of correlated floral features among angiosperms (Stebbins, 1951), leaf architecture (Hickey & Wolfe, 1975; Melville, 1975) and anther morphology within Rosidae (Endress & Stumpf, 1991). Floral features appear to be derived both morphologically and functionally.

Gene sequence comparisons have provided a new perspective on relationships of Proteaceae to other angiosperms. The chloroplast-encoded *rbc*L, the *atp*B and 18S ribosomal genes have been sequenced in several proteaceous taxa and the sequences compared with other angiosperms. Results of phylogenetic comparisons suggest a relationship between Proteaceae and Platanaceae, Sabiaceae *s. str*. and Nelumbonaceae near the base of the angiosperm tree (Chase *et al*., 1993; Drinnan *et al.*, 1994). For Chase *et al.* (1993) Proteaceae-Sabiaceae-Platanaceae-Nelumbonaceae represent a clade positioned between Ranunculidae-Magnoliidae and Hamamelidae-Rosidae. Although only one taxon from each of Sabiaceae and Proteaceae was used in the Chase *et al*. analysis, additional proteaceous taxa have since been sequenced and the position of Proteaceae as a basal component among angiosperms appears to be valid (Drinnan *et al.*, 1994; D.Soltis, pers. comm.). In the more detailed phylogenetic analysis of Drinnan *et al*. (1994), Proteaceae appears to be the sister taxon to Platanaceae, with the positions of *Sabia* Colebr. and *Nelumbo* Adans. unresolved. The basal position of Proteaceae relative to other angiosperms suggests that Proteaceae could represent a very early angiosperm lineage, as suggested by Wettstein (1935), Rendle (1959) and Johnson & Briggs (1975). Additional studies are currently in progress.

## Affinities within Proteaceae

The family was first formally recognised and published by Jussieu (1789). In 1810 Robert Brown published a major monograph on the family. He divided the then known 38 genera into two subfamilies based on the indehiscent or dehiscent nature of their fruits. He also erected seven tribes based primarily on floral and inflorescence features. Subsequently, the character of paired flowers (two flowers in a single bract axil) was introduced to separate Grevilleoideae from Proteoideae and this led to the removal of several indehiscent-fruited genera (e.g. *Hicksbeachia* and *Brabejum* L.) from Proteoideae to Grevilleoideae. This scheme persisted until Johnson & Briggs (1963) included newly-discovered genera in a neo-Brownian classification. In a later monograph, Venkata Rao (1971) did not deviate greatly from Brown's scheme.

In 1975, Johnson & Briggs produced a detailed account of the natural history of Proteaceae based on comparative morphological, anatomical and karyological characters. Their classification remains pivotal to all studies of the family and is adopted in the current treatment (Table 2). Johnson & Briggs (1975) divided the subfamily Proteoideae into Persoonioideae and Proteoideae, created two monotypic subfamilies (Sphalmioideae and Carnarvonioideae) and maintained Grevilleoideae thereby recognising five subfamilies. While there have been few challenges to their classification, questions were raised and subtle changes were made in Nelson's (1978) monograph of *Adenanthos*, Rourke's (1984a, b) and Midgley's (1987) accounts of some South African Proteeae, Weston's (1994) revision of Western Australian Persooniinae and by Johnson & Briggs who questioned (in Wrigley & Fagg, 1989) the relationship of *Bellendena* to other Persoonioideae. Two new subfamilies, Bellendenoideae and Eidotheoideae, are described in the current treatment.

### *Persoonioideae*

This subfamily, as redefined here, includes two tribes, the monogeneric Placospermeae and the speciose Persoonieae with two genera. Johnson & Briggs (1975) hypothesised that Persoonioideae represented the more basal elements within the family, suggesting that *Placospermum* retains numerous 'primitive' or general features. Persoonioideae have a haploid chromosome number of 7, with flowers arranged on axillary inflorescences or solitary in leaf axils along an auxotelic shoot. The flowers have thick tepals, each with a distal spine or process (Kaplan, 1973) and the adaxial margin of each tepal is usually expanded. The stamen filaments are partly fused to the tepals and the hypogynous nectaries are rather large. In addition, the inflorescences of *Placospermum* are andromonoecious and the flowers are strongly zygomorphic; the perianth is curved, the style and stigma curve abaxially and only the adaxial anther is fertile. The fruits vary quite dramatically, with succulent drupes characterising *Persoonia* and tangentially oblate follicles with numerous winged seeds in *Placospermum.*

*Bellendenoideae*

Weston (this volume) recognises *Bellendena montana* as representing a new subfamily distinct from Persoonioideae (*sensu* Johnson & Briggs, 1975). Johnson & Briggs (1975) included it in Persoonioideae on the basis of its very large chromosomes, even though the haploid number is 5 rather than 7. The flowers of this Tasmanian endemic are arranged in a terminal inflorescence with suppressed floral bracts. The tepals of the actinomorphic flowers are equally reflexed at anthesis, the filaments and anthers are not fused to the tepals and the carpel is relatively simple and contains 2 orthotropous ovules. The red fruit is dry and sagittally flattened. The exclusion of *Bellendena* is well-justified because it shares no synapomorphies with Persoonioideae. While its relationship to other Proteaceae is not resolved, it probably represents an ancient lineage.

*Eidotheoideae*

Douglas & Hyland (this volume) recognise a new monotypic subfamily from north-eastern Queensland based on *Eidothea zoexylocarya*. Although known to be proteaceous since the early 1960s, sufficient evidence for formal description has only recently become available. The tree is andromonoecious and has numerous features that do not ally it with any one proteaceous group. It is characterised by having pseudo-whorled leaves with small bract-like structures spirally ascending the stem proximal to the 5–8 leaves, short capitulate inflorescences with only a single perfect flower and several functionally male flowers and a short floral tube proximal to the free portions of the tepals. It also possesses free latrorse anthers, a scarcely modified bifid stigma, a single orthotropous ovule and a large nut resembling a condylar fruit of Menispermaceae. While the morphology of the plant does not help to define taxonomic relationships, it is believed that *Eidothea* diverged relatively early in the history of the family, perhaps on a lineage leading to Persoonioideae and Proteoideae.

*Proteoideae*

This subfamily is geographically and morphologically diverse. Flower morphology includes features of suppression (of the abaxial anther and abaxial thecae of the lateral anthers in *Conospermum*, of the opposing structures in *Synaphea*, and of three anthers (or parts of three) in some species of *Adenanthos* (sect. *Eurylaema*)), adnations between tepals and stamens and between stamens and carpel, and connation between anthers, filaments and tepals. In some cases there is a true floral tube (a result of intercalary growth between and beneath the tepal lobes). Pollen presenters, when they occur, can be elongate or spathulate in *Adenanthos* or radially symmetrical with brush-like hairs in Petrophilinae. Nectariferous scales or hypogynous glands are present in Cenarrheninae and Adenanthinae but are absent in all other Australian Proteoideae. Inflorescence morphology varies from simple axillary racemes (*Franklandia* and *Cenarrhenes*) to reduced, single-flowered inflorescences (*Adenanthos*), to many-branched terminal racemes (*Symphionema* and *Stirlingia*) or broad heads (Petrophilinae).

Proteoideae is characterised by non-follicular fruit, and flowers that are not arranged in pairs. Fruit and seed morphologies are fundamental to the classification of the genera of Proteoideae. Most fruits are single-seeded, usually as a result of abortion of one of two ovules early in the development of the flowers (Douglas, 1994). In addition, the fruits of *Franklandia* are compound, the receptacle forming a pseudocarp. Johnson & Briggs (1975) divided the subfamily into three tribes:

(1) Proteeae includes 13 genera all of which are endemic in Africa.

(2) Conospermeae is divided into five subtribes. The loosely knit Cenarrheninae have actinomorphic, bisexual flowers, with or without hypogynous glands, lack a pollen presenter, and have drupaceous or dry fruits. They include five genera, *Beauprea* Brongn. & Gris and *Beaupreopsis* Virot from New Caledonia, *Cenarrhenes* and *Agastachys* from Tasmania, and *Symphionema* from New South Wales. The monogeneric Dilobeiinae from Madagascar is dioecious with relatively simple flowers, has a single orthotropous, pendulous ovule and lacks a pollen presenter. Conosperminae includes the Australian endemics *Conospermum* and *Synaphea* which are united by the strongly zygomorphic perianth and the partial sterilisation

of the lateral anthers. The ovule is solitary, orthotropous and subapical; the anthers are apically fused and, as in *Stirlingia*, lack an extension of the connective appendage. The monogeneric Stirlingiinae is a morphologically unique subtribe probably closely related to Conosperminae. It possesses an andromonoecious inflorescence, with an actinomorphic perianth and four fertile connate anthers. The ovule is anatropous and sub-basally attached. Petrophilinae (*Petrophile* and *Isopogon*) is defined by the presence of numerous flowers usually in condensed cones, as well as a true floral tube and a unique pollen presenter proximal to the terminal, porate stigma.

(3) Franklandieae has two monogeneric Australian subtribes, Adenanthinae and Franklandiinae, and is characterised by glandular cavities in its simple to ±dichotomous leaves and the presence of hypogynous glands.

*Sphalmioideae*

Briggs *et al.* (1975) recognised this monotypic subfamily from montane rainforest in north-eastern Queensland. The plant is thought to represent an early offshoot of a pre-grevilleoid lineage. *Sphalmium* is andromonoecious and has follicles similar to those of *Orites*, apart from the presence of an interseminal layer. The flowers maintain fairly plesiomorphic features such as the absence of a pollen presenter and the occurrence of free stamens.

*Carnarvonioideae*

Johnson & Briggs (1975) recognised this monotypic subfamily based on the north-eastern Queensland rainforest genus *Carnarvonia*, which they hypothesised to be another offshoot of a pre-grevilleoid line. Such an hypothesis is based primarily on the presence of a lax and irregular racemose panicle. Palynological studies have also supported the phylogenetic position of the genus near Grevilleoideae (Feuer, 1986). The adult leaves are palmate, this being unique within Proteaceae. The flowers are lightly perfumed and the anther filaments are adnate to the opposing tepals. The carpel is composed of a distinct style, stigma, ovary and stipe. The distal end of the style is not modified as a pollen presenter although, following dehiscence, the pollen is often held to the upper portion of the style. The mechanisms and physiological features that result in the pollen adhering to the style are unknown. The fruit is a follicle, but unlike other follicles within the family the opened valves resemble a pair of wooden clogs.

*Grevilleoideae*

Grevilleoideae is the most widely distributed subfamily as well as having the largest number of genera and species of the subfamilies. A unifying feature of grevilleoid taxa is the presence of flower pairs subtended by a common bract. The subfamily is found in Australia, southern Africa, Madagascar, India, south-eastern and eastern Asia, Malesia, New Caledonia, New Zealand, Fiji, Mexico and Central and South America.

Johnson & Briggs (1975) recognised seven tribes in Grevilleoideae:

(1) Oriteae, consisting of *Orites* and *Neorites*, is separated from other Grevilleoideae by its comparatively simple, actinomorphic flowers and the absence of a true pollen presenter. *Megahertzia* is possibly related to Oriteae but its position remains unresolved.

(2) Knightieae is divided into two subtribes, the monotypic Cardwelliinae (*Cardwellia sublimis*) and Knightiinae which includes *Darlingia* and the New Zealand and New Caledonian genera *Knightia* R.Br. and *Eucarpha* (R.Br.) Spach. These subtribes have multi-ovulate carpels and a common 'peduncle' to the flower pairs. The flowers themselves are generally actinomorphic although *Cardwellia* is strongly zygomorphic.

(3) Embothrieae is characterised by flowers adapted for ornithophily (a red, elongate perianth tube that does not open fully) and by multi-ovulate carpels. The tribe is separated from other Grevilleoideae by karyological characters ($n$ = 11) and is composed of four subtribes. Embothriinae contains the Australian *Alloxylon* and *Telopea* and the South American *Embothrium* J.R.Forst. & G.Forst. and *Oreocallis* R.Br. These genera have usually pink or red flowers in a shortly racemose or capitate raceme and winged seeds with a raphe

running through the wing. Stenocarpinae (*Strangea* and *Stenocarpus*) possess a fasciculate, wheel-like or 1-flowered inflorescence and a distinctive interseminal layer. Buckinghamiinae comprises *Buckinghamia* and *Opisthiolepis*, both of which have the carpel cleft facing a lateral tepal; in the other Embothrieae the carpel cleft faces the point of intersection between two tepals. The monotypic Lomatiinae has a distinctive pericarp anatomy.

(4) Helicieae is a heterogeneous group of three subtribes: Heliciinae (*Helicia* and *Xylomelum*) has 2-ovulate flowers on a common stalk ('peduncle'). The relationship between these genera appears tenuous. The zygomorphic flowers of the monogeneric Triuniinae are unique in the tribe, while Hollandaeinae has elongate inflorescences, a follicular fruit and wingless seeds.

(5) Banksieae is characterised by elongate trichomes, 2-porate pollen and its leaf venation (Johnson & Briggs, 1975) and comprises two subtribes. Musgraveinae, in north-eastern Queensland, has lax, racemose or paniculate inflorescences and follicles with a scarcely formed interseminal dissepiment. The speciose and mainly southern and south-western Banksiinae (*Banksia* L.f. and *Dryandra* R.Br.) has dense cone-like or capitate inflorescences and a 1- or 2-layered dissepiment between the seeds.

(6) Macadamieae is the largest tribe of Grevilleoideae. It was characterised by Johnson & Briggs (1975) on the basis of its two pendulous, orthotropous ovules. Six subtribes are recognised. Lambertiinae contains the genus *Lambertia* and is separated from other subtribes by its capitate raceme usually composed of seven flowers (sometimes reduced to one). Macadamiinae contains three genera, the Australian and Malesian *Macadamia*, the African *Brabejum* and the South American *Panopsis* Salisb. ex Knight. Its juvenile leaves are simple, the stamens are free for most of their length and the solitary seed is thick and wingless. Floydiinae is monotypic (*Floydia praealta*) and is separated from the other subtribes by its entire juvenile leaves. Roupalinae contains two genera, *Roupala* Aubl. from Mexico and Central and South America and the New Caledonian *Kermadecia* Brongn. & Gris. Hicksbeachiinae includes the Australian *Hicksbeachia*, *Athertonia* and *Catalepidia* as well as the Madagascan genus *Malagasia*, the Malaysian *Heliciopsis* Sleumer and the New Caledonian *Virotia* L.A.S.Johnson & B.G.Briggs. Gevuininae is the sixth subtribe and, in many ways, is not easily separated from Hicksbeachiinae. In the past, Gevuininae was separated on the basis of floral zygomorphy, although Johnson & Briggs (1975) claimed that it is 'a monophyletic grade with inferred ancestors which would fit into the Hicksbeachiinae. Both subtribes have indehiscent fruits with large seeds and divided preadult (or adult) leaves...'.

(7) Grevilleeae is a well-accepted tribe containing three genera, the Malesian *Finschia* Warb., the endemic Australian *Hakea* Schrad. and the species-rich *Grevillea* R.Br. ex Knight, principally Australian but extending to Malesia. The group is easily recognised by the diagonal orientation of the carpel, strongly zygomorphic flowers, and follicular fruit. Johnson & Briggs (1975) also characterised the tribe by the presence of hairs with two-branched terminal cells and a chromosome number of $n = 10$.

**Table 2.** Synoptic classification of the Proteaceae

(Updated and slightly modified from Johnson & Briggs, 1975)
Genera in *italics* are entirely extra-Australian, genera in ***bold italics*** occur in Australia.
***** = Australian genera with additional extra-Australian species.

Subfamily Persoonioideae
- Tribe Placospermeae
  - ***Placospermum***
- Tribe Persoonieae
  - ***Acidonia***, *Toronia*, *Garnieria*, ***Persoonia***

Subfamily Bellendenoideae
- ***Bellendena***

Subfamily Eidotheoideae
- ***Eidothea***

Subfamily Proteoideae
- Tribe Conospermeae
  - Subtribe Cenarrheninae
    - ***Agastachys***, ***Cenarrhenes***, *Beauprea*, *Beaupreopsis*, ***Symphionema***
  - Subtribe Dilobeiinae
    - *Dilobeia*
  - Subtribe Stirlingiinae
    - ***Stirlingia***
  - Subtribe Petrophilinae
    - ***Petrophile***, ***Isopogon***
  - Subtribe Conosperminae
    - ***Conospermum***, ***Synaphea***
- Tribe Franklandieae
  - Subtribe Franklandiinae
    - ***Franklandia***
  - Subtribe Adenanthinae
    - ***Adenanthos***
- Tribe Proteeae
  - Subtribe Proteinae
    - *Faurea*, *Sorocephalus*, *Orothamnus*, *Spatalla*, *Diastella*, *Paranomus*, *Protea*, *Vexatorella*, *Leucospermum*, *Mimetes*, *Serruria*
  - Subtribe Aulacinae
    - *Aulax*, *Leucadendron*

Subfamily Sphalmioideae
- ***Sphalmium***

Subfamily Carnarvonioideae
- ***Carnarvonia***

Subfamily Grevilleoideae

Tribe Oriteae

***Orites****, ***Neorites***

Genus incertae sedis, prope Trib. Oriteas

***Megahertzia***

Tribe Knightieae

Subtribe Knightiinae

***Darlingia***, *Eucarpha*, *Knightia*

Subtribe Cardwelliinae

***Cardwellia***

Tribe Embothrieae

Subtribe Stenocarpinae

***Strangea***, ***Stenocarpus****

Subtribe Buckinghamiinae

***Buckinghamia***, ***Opisthiolepis***

Subtribe Lomatiinae

***Lomatia****

Subtribe Embothriinae

***Alloxylon****, ***Telopea***, *Embothrium*, *Oreocallis*

Tribe Helicieae

Subtribe Hollandaeinae

***Hollandaea***

Subtribe Heliciinae

***Helicia****, ***Xylomelum***

Subtribe Triuniinae

***Triunia***

Tribe Macadamieae

Subtribe Gevuininae

*Euplassa*, *Sleumerodendron*, *Turrillia*, ***Gevuina****

Subtribe Hicksbeachiinae

*Malagasia*, *Heliciopsis*, ***Hicksbeachia***, *Virotia*, ***Athertonia***, ***Catalepidia***

Subtribe Floydiinae

***Floydia***

Subtribe Macadamiinae

***Macadamia****, *Brabejum*, *Panopsis*

Subtribe Lambertiinae

***Lambertia***

Subtribe Roupalinae

*Roupala*, *Kermadecia*

Tribe Grevilleeae

***Grevillea****, ***Hakea***, *Finschia*

Tribe Banksieae

Subtribe Musgraveinae

***Musgravea***, ***Austromuellera***

Subtribe Banksiinae

***Banksia****, ***Dryandra***

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## MORPHOLOGICAL FEATURES

*Andrew W.Douglas*

### Leaves

Leaf shape and venation patterns are complex among Proteaceae. Morphological diversity can be expressed within a species or within an individual at different stages of its development. An in-depth treatment of leaf shape transitions was provided by Johnson & Briggs (1975). Leaves of adult plants can be simple or pinnately or palmately compound. They can be terete, acicular, revolute, dissected, or lobed with simple, dentate or even lobate margins (Hyland & Whiffin, 1993). Recent work on the leaf cuticle has provided a new line of evidence that will be extremely helpful, particularly in the identification of fossilised leaves (Carpenter, 1994).

### Inflorescence

The inflorescences of Proteaceae serve as an integral part of the architecture of these plants and are of primary diagnostic importance, especially at and above the generic level.

A feature of all non-grevilleoid taxa is the development of a single flower in the bract (or leaf) axil on the principal axis. Many species of *Persoonia* lack distinctive inflorescences, flowers being borne in leaf axils and arranged on auxotelic shoots. *Bellendena* has an ebracteate, anauxotelic raceme, while *Eidothea* has a rather simple, axillary, andromonoecious inflorescence.

Among Proteoideae, the inflorescence can be an axillary (*Cenarrhenes*) or terminal raceme (*Stirlingia*, *Faurea*) with simple or paniculate branching (*Beaupreopsis* and *Symphionema*).

Others exhibit a condensed head (Petrophilinae, Proteinae), an umbelliform head (*Conospermum*), or reduction to a single flower (*Adenanthos*). Sphalmioideae has an elongate raceme, whereas *Carnarvonia* possesses a lax racemiform panicle.

Grevilleoideae are broadly characterised by the presence of a pair of flowers in the axil of a common bract. In a minority of taxa (*Hicksbeachia*, *Banksia*, Musgraveinae) each flower of a pair has a single subtending floral bract in addition to the common bract. In most taxa, however, the floral bracts are suppressed after initiation and become obscured by the enlargement and further development of the inflorescence and flowers. The flower pair syndrome represents a synapomorphy, unifying Grevilleoideae. Current hypotheses suggest that the flower pairs are the product of either a reduction event of a secondary inflorescence axis (Johnson & Briggs, 1975; Douglas, 1994) or an amplification event of first order meristems (Douglas, 1994). The study of floral bracts subtending the flowers of Grevilleoideae has clarified the lines of symmetry of the flowers in each pair so that it is now possible to establish and understand patterns of zygomorphy and positions of organs among the taxa.

Grevilleoid inflorescences are architecturally as diverse as those of other proteaceous taxa and include terminal (*Grevillea*) and axillary principal axes (*Macadamia*), simple (*Hicksbeachia*) and complex branching systems (*Cardwellia*, *Lomatia*), condensation of the primary axis to small or massive heads (*Telopea* and Banksiinae), and reduction of the flower number to several (*Lambertia*) or even one flower (*Strangea*).

**Flowers**

Within Proteaceae, the flowers are the most important feature in delimiting natural groups. Those of all taxa are composed of four valvate tepals, four epitepalous stamens and a single carpel.

*Tepals*

The flowers include a single whorl of four valvate tepals that can be coloured and protective, functions usually attributed to petals and sepals respectively. Developmental studies indicate that there are no vestigial organs present alternating with or opposite to the four tepals. Three major hypotheses offer explanations for the origin of a single perianth whorl in Proteaceae: (i) the loss of petals via reduction to a nectary (Kausik, 1938, 1940, 1941; Haber, 1959, 1961, 1966), (ii) the loss of sepals (Venkata Rao, 1971), or (iii) the perianth is derived from a group of angiosperms that had a poorly differentiated perianth and are primitively simple (Johnson & Briggs, 1975). Evidence from recent developmental studies (Douglas, 1994) and molecular systematics (Chase *et al*., 1993) supports the Johnson & Briggs (1975) hypothesis that the perianth is primitively tepaloid, having been derived from an ancestor with a poorly differentiated perianth. However, the reasons for four and only four tepals remain a source of speculation. Detailed accounts of tepal morphology and aestivation have been provided by Douglas (1994).

*Stamens*

Directly opposite each tepal is a single stamen. In all taxa, four stamens are present, although some may be staminodia or reduced in stature. Generally, the anthers are tetralocular, having four fertile thecae. In some taxa the septum separating adjacent thecae can break down prior to maturity, resulting in the appearance of a 2-locular anther, e.g. *Stirlingia* and *Conospermum*. Anther orientation varies from latrorse (*Eidothea*, *Sphalmium*) to slightly introrse (*Persoonia p.p.*, Cenarrheninae) to strongly introrse (most taxa) and dehiscence is usually through longitudinal slits. The stamen filaments are usually adnate to the opposing tepal to varying degrees among different taxa and, in all Proteaceae, the anthers are basifixed and some have connective appendages that can be highly attenuate (*Cenarrhenes*). In *Symphionema*, Stirlingiinae and Conosperminae the distal portions of the filaments of neighbouring anthers are connate and can even have enlarged fused areas above the tepal-filament interface (*Isopogon*). While the anthers usually remain free, in some taxa they can become fused or connate (*Cenarrhenes*) and the thecae of neighbouring anthers can become confluent at maturity (*Stirlingia*, Conosperminae). The fusion of the anthers and filaments is generally present in bud and subsequently is not obvious at maturity, although some taxa

(Conosperminae, Stirlingiinae) maintain the connate status even after anthesis. This feature is probably important in the pollination mechanisms of these taxa.

*Hypogynous Glands*

Four hypogynous glands alternate with the tepal-stamen complexes in most Proteaceae. These glands were hypothesised to be reduced petals by Haber (1959, 1961, 1966) and Kausik (1938, 1940), but there is little developmental evidence to support such a suggestion. The glands develop late in the ontogeny of the flower, after the primary organs have differentiated, and their morphological variation in the family appears to be related to a combination of spatial, temporal and genetic constraints (Douglas, 1994). Morphological variation includes four glands (laminar or pileate), three or two glands, semicircular rings or full rings. Johnson & Briggs (1975) considered the presence of four glands to represent the plesiomorphic condition followed by multiple patterns of reduction, loss and fusion.

*Gynoecium*

All Proteaceae have a single carpel consisting of a distinct ovary, a variously distinct style and a stigmatic area. Many also have a stipe and most have a pollen presenter. The pollen presenter is a structural modification of the distal portion of the style that provides a means of pollen adherence after the anthers dehisce during anthesis (Johnson & Briggs, 1963, 1975). Phylogenetically, it appears that pollen presenters have developed twice within the family, once among Proteoideae and once among Grevilleoideae. The morphology of the pollen presenters varies greatly among taxa within both groups and can be useful taxonomically. Whether or not the pollen presenter can also serve as an enlarged area for pollen reception has not been tested. The function and morphology of pollen presenters in Proteaceae and other families has recently been reviewed by Ladd (1994).

Variation in gynoecial orientation among Grevilleoideae is such that the suture can face either a tepal or the intersection between two tepals (Johnson & Briggs, 1975). Developmental studies indicate that among Grevilleoideae, the orientation of the carpel is in one of six possible directions. Evidence for the position and orientation of the carpel comes from ontogenetic studies of the median sagittal and frontal planes of the flowers based on the position of the reduced floral bracts relative to the tepals (Douglas, 1994). In some taxa, the orientation of the carpel appears highly constrained (e.g. ventral-dorsal orientation of *Cardwellia*), but in others (*Floydia* and *Macadamia*) it can vary between two or even three orientations. It should be noted that the orientation of the carpel among Persoonioideae, Sphalmioideae and Proteoideae is adaxial, the suture facing the adaxial tepal. Among some flowers in Proteoideae and Persoonioideae the orientation can be diagonal (*Persoonia chamaepitys*, *Cenarrhenes*) or lateral (*Stirlingia latifolia*). The mechanisms that are responsible for the diverse orientations are as yet unknown although Douglas (1994) has found some correlation between the size and shape of the floral meristem after stamen initiation and carpel orientation.

*Symmetry*

The question of floral symmetry in Proteaceae was first examined in detail by Venkata Rao (1957), and developed further by Johnson & Briggs (1963). These authors showed that symmetry in this family is very complex, operating at a number of levels, and offers considerable information of value for phylogenetic considerations.

The symmetry among flowers in Proteaceae ranges from actinomorphic to zygomorphic. Strictly speaking the presence of a single carpel in Proteaceous flowers inherently makes them zygomorphic or bilateral. However, in this discussion and in the descriptive part of this volume, it is the actinomorphy/zygomorphy of the remaining floral parts which is considered.

Actinomorphic flowers, considered the basic condition by Johnson & Briggs (1975), are present in several taxa of Persoonieae, *Bellendena*, *Eidothea* and *Sphalmium*, as well as among Proteoideae and Grevilleoideae. Zygomorphy is expressed in the perianths of numerous taxa including *Adenanthos*, *Stenocarpus* and *Grevillea*. The most highly zygomorphic flowers are found in Conosperminae, and feature curvature of the perianth,

enlargement of the individual lobes, partial sterility of the lateral anthers and full sterility of either the adaxial or abaxial anther, curvature of the style and enlargement of stigmatic hoods or spathulate structures. Other forms of zygomorphy include unequal enlargement of the receptacle (Embothrieae, Grevilleeae).

Patterns of symmetry can vary not only among taxa, but also within an individual flower, with some floral parts being actinomorphic while others are zygomorphic. For example, the perianth in *Cenarrhenes nitida* is actinomorphic, all four tepals spreading away from the polar axis of the flower equally, yet the adaxial anther has an elongate and attenuate connective appendage, is connate to the other anthers and is held centrally around the style, thus creating a zygomorphic flower. In taxa such as *Placospermum* and *Persoonia falcata*, the style actually curves away from the cleft side, resulting in the stigma being abaxial within the flower, while in *Leucospermum*, *Macadamia*, *Hakea* and other genera, the style curves towards the cleft, and the stigma is adaxial in the flower. In *Macadamia* the perianth reflexes laterally at anthesis, the tepals all pointing down relative to the principal axis, whereas among flowers of *Cardwellia*, the perianth lobes reflex abaxially relative to the floral axis and laterally in relation to the principal axis.

In addition to symmetry within the flower, there are secondary expressions of zygomorphy present as a result of floral orientation and positioning in the inflorescence. In those taxa lacking paired flowers (i.e. all except Grevilleoideae) floral orientation in relation to the principal axis or bracts (if present) can be anterioposterior (i.e. the plane in which the inflorescence axis lies and which bisects the floral bract also bisects the posterior and anterior tepals and the ovary) or diagonal (i.e. the plane of symmetry bisecting the ovary passes between the tepals and bisects two of the glands).

In Grevilleoideae a further level of zygomorphy operates, this time in the orientation of the two flowers making up the characteristic floral pairs. They can show a range of different orientations, both to each other and to the floral axis (Johnson & Briggs, 1963). In zygomorphic flowers these orientations are usually constant within species and often within genera, but in actinomorphic flowers the orientation can vary within a pair of flowers.

At the level of the inflorescence a further kind of orientation becomes apparent. For example, the flowers of *Macadamia tetraphylla* are zygomorphic yet the even arrangement of flowers around the primary axis at anthesis gives the general impression of an actinomorphic flower, reminiscent of the pseudanthium common in the Asteraceae and Dipsacaceae. In other groups, zygomorphic flowers are arranged asymmetrically on the axis to provide various specialised inflorescence shapes, probably related to pollination mechanisms (e.g. the 'toothbrush' inflorescences of some *Grevillea* species).

The plethora of diverse expressions of zygomorphy among the different groups provides an argument for multiple origins and analagous patterns of floral evolution, probably related to pollen vectors and architectural constraints.

**Fruit**

The fruits of Proteaceae are extremely variable, either indehiscent or dehiscent, and succulent or non-succulent. They have been variously described as drupes, achenes, nuts, and dehiscent and tardily dehiscent follicles. The most comprehensive recent surveys of fruit types and their development in this family are those of Johnson & Briggs (1963, 1975). Their work in turn drew heavily on that of Filla (1926), Sleumer (1955a, b), Virot (1968) and Venkata Rao (1971).

Johnson & Briggs recognised 13 major fruit types, which they found to be only loosely linked to higher level classifications derived from other morphological characters and from cytology. They considered that various fruit types (particularly the indehiscent, more or less fleshy types of rainforest taxa) had probably arisen several times, and that superficially similar fruits (e.g. the woody follicles of *Xylomelum*, *Hakea* and *Banksia*) frequently represented convergent evolution rather than common ancestry.

The 13 groups of fruits recognised by Johnson & Briggs can be briefly characterised as follows:

(1) Many-seeded follicle with numerous pinnately spreading second-order vascular bundles with external fibre caps (but without radiating branches into the outer mesocarp); mesocarp parenchymatous with a few scattered sclereids; inner epidermis forming a stony, non-crystalliferous endocarp by inward proliferation, but not penetrating between the seeds. (*Placospermum*).

(2) Many-, 2- or 1-seeded drupe with succulent mesocarp, second-order vascular system weakly or not developed; mesocarp without sclereids and ±3-layered; inner epidermis proliferating inwards to form a uniform, non-crystalliferous, stony endocarp which penetrates between the seeds if more than one develops. (*Acidonia*, *Toronia*, *Garnieria*, *Persoonia* (including *Pycnonia*), *Cenarrhenes*, *Beauprea* and *Beaupreopsis* (a subtype).

(3) One-seeded drupe with a second-order vascular system weakly or not developed; mesocarp parenchymatous and not markedly 3-layered; inner epidermis proliferating inwards to form a uniform, non-crystalliferous, stony endocarp. (*Dilobeia*).

(4) Finally dry, thin walled, sac-like, 1-seeded fruit, dorsally or laterally winged; mesocarp scanty and parenchymatous; inner epidermis neither proliferating nor modified. (*Bellendena*, *Agastachys*).

(5) Small, dry, 1-seeded hairy fruit ('nut') without a second-order vascular system; mesocarp often 3-layered, sclerenchymatous / parenchymatous; inner epidermis neither proliferating nor modified. (*Stirlingia*, *Conospermum*, *Synaphea*, *Franklandia*, *Faurea* and *Protea*).

(6) Small, dry, 1-seeded, hairy or glabrous fruit ('nut') without a second-order vascular system; mesocarp often 3-layered, sclerenchymatous / parenchymatous; inner epidermis modified and occasionally proliferating inwards to form an endocarp 1–5 cells thick of densely crystalliferous and ±columnar cells. (*Symphionema*, *Petrophile*, *Isopogon*, *Adenanthos*, *Orothamnus*, *Spatalla*, *Paranomus*, *Leucospermum*, *Serruria*, *Aulax*, *Leucadendron*).

(7) Follicle with 2 flat, winged seeds pendulous from a false dissepiment formed from their enlarged fused funicles; third-order radial vascular and sclerenchyma branches absent; mesocarp with rounded sclereid clusters; inner mesocarp with radially elongated sclereids. (*Sphalmium*).

(8) Follicle with 2–many, flat, winged seeds (seeds in *Hollandaea* thick, wingless), or tardily dehiscent to indehiscent 'nuts' or 'drupes' with 1 thick wingless seed; third-order radial vascular bundles present, branching from tangential bundles and spreading into the outer mesocarp; mesocarp parenchymatous with scattered or clumped isodiametric or elongated sclereids. (*Carnarvonia*, *Darlingia p.p.*, *Cardwellia*, *Buckinghamia p.p.*, *Hollandaea*, *Helicia p.p.*, *Xylomelum*, *Euplassa*, *Sleumerodendron*, *Gevuina*, *Heliciopsis*, *Hicksbeachia*, *Athertonia*, *Virotia*, *Floydia*, *Macadamia*, *Brabejum*, *Lambertia*, *Kermadecia*, *Musgravea* and *Austromuellera*).

(9) Follicle with 2–many, flat, winged seeds (1 thick wingless seed in *Panopsis*); third-order radial vascular tissue absent or almost absent, strands of fibres or fibre-sclereids radiating into the outer mesocarp; mesocarp parenchymatous sometimes with scattered sclereids. (*Orites*, *Neorites*, *Darlingia p.p.*, *Buckinghamia p.p.*, *Telopea*, *Embothrium*, *Oreocallis* and *Panopsis*).

(10) Follicle with many, (1 in *Strangea*) flat, winged seeds; radial vascular tissue and radial sclerenchyma strands absent; individual sclereids or fibre-sclereids present in mesocarp; a compact sclerotic layer sometimes present in inner mesocarp. (*Strangea*, *Stenocarpus*, *Opisthiolepis* and *Lomatia*).

(11) Follicle with 2 flat, winged seeds or indehiscent fruit with 1 thick seed; radial vascular and sclerenchyma branches absent; compact isolated clusters or masses of sclereids present in outer mesocarp; scattered sclereids also often present. (*Grevillea* and *Finschia*).

(12) Woody follicle with 2 ±flattened, winged seeds; similar to thicker Type 11 fruits but with a proximal region of secondary thickening often forming a dorsal hump; secondary thickening by a continuous cambium producing fibres outside the primary xylem and sclereids in the interfascicular region. (*Hakea*).

(13) Follicle with 2 winged seeds usually separated by a single or double false dissepiment formed from their outer integuments; numerous vascular bundles and sclerenchyma strands

present, tangentially orientated and often at different levels in the mesocarp; innermost mesocarp and inner epidermis together constituting a continuous zone of sclereids. (*Banksia* and *Dryandra*).

Johnson & Briggs suggested that *Placospermum* fruits (Type 1) may approximate the ancestral fruit state. From this they suggested that the drupaceous Persooniinae developed, with *Bellendena* representing a further derivation. The drupaceous Proteoideae fruit was postulated to be an independent derivation from a *Placospermum*-like follicle, with *Agastachys* and *Beaupreopsis* also representing separate lines of development. The crystalliferous fruits of Type 6 were seen as derived from drupaceous fruits, probably on several different occasions. Type 8 may be ancestral within Carnarvonioideae and Grevilleoideae, with Type 9 independently derived in Oriteae, Embothrieae and *Panopsis*. Type 10 was thought to be a further development, arising independently in 3 tribes of Embothrieae. Type 11 was hypothesised to be a derivation of Types 9 or 10, or possibly 8, and in turn has given rise to Type 12. Type 13 was thought to be derived from Type 8.

Subsequent work by Midgeley (1987) and Janson (1992) challenged the Johnson & Briggs classification and called for a reassessment of fruit anatomy and homology. Chase *et al*. (1993) and Drinnan *et al*. (1994), have suggested alternative fruit phylogenies, including derivation from an ancestral pseudo-drupe or achene, but no comprehensive scheme comparable to that of Johnson & Briggs has yet been developed.

**Seeds and Seed Dispersal**

Parallel to the development of multifarious fruit types, Proteaceae have produced a wide range of seed types and seed dispersal mechanisms. Johnson & Briggs (1975) again point out that superficially similar seed types have probably arisen several times in different lines within the family, as parallel adaptations to ecological factors involved in dispersal.

If, as suggested by Johnson & Briggs, the follicular fruit is closest to the ancestral type, then winged seeds are probably also ancestral. Johnson & Briggs (1963) discussed the development of the seed wing, showing that its final form varies considerably, particularly in the position of the raphe. It runs around the outside of the wing in *Lomatia*, is surrounded internally and externally by the wing in *Carnarvonia*, *Knightia*, *Telopea* and *Oreocallis*, and is internal to the wing in *Orites*, *Xylomelum*, *Banksia* and *Dryandra*. These variations possibly reflect differing ontogenies, and additional developmental studies may shed further light on phylogeny.

In several genera the woody follicular fruits are an adaptation to fire-prone environments, and only open after burning to release the winged seeds into ash-primed seedbeds. The differing anatomical structure of these woody follicles, however, in genera such as *Banksia*, *Hakea* and *Xylomelum*, suggest that they have been independently derived on several occasions.

In those taxa where the fruit is indehiscent and becomes part of the propagule there has also been development of a wide range of dispersal mechanisms.

Drupe-like fruits have arisen several times, mainly in rainforest and moist forest taxa, as a secondary adaptation to dispersal by fruit-eating mammals (including bats) and birds. Dry indehiscent fruits with wings or feathery comas or awns have also arisen several times in taxa that are thought to have moved out of the wetter forests into more open habitats where wind dispersal is feasible.

With the exception of *Bellendena* the seeds of all Proteaceae are endospermic. Other taxa can have invasive haustorial growth of the endosperm, particularly among Grevilleoideae (Venkata Rao, 1971).

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# THE FOSSIL RECORD OF AUSTRALIAN PROTEACEAE

*Robert S.Hill, Leonie J.Scriven & Gregory J.Jordan*

The Proteaceae have a long and instructive fossil record, especially in Australia which has the best understood Cretaceous-Cenozoic palaeobotanical record of any of the southern land masses. Fossils of the highly distinctive pollen grains and leaves are common (Fig. 34B, D, F, G; Fig. 35B–F), while wood and reproductive structures (Fig. 35A) are less frequent but very informative.

It is important to be clear about what the fossil record does and does not tell us. There are excellent data on the time of the first appearance of several taxa within the Proteaceae, and on their relative diversity at various times. There is also limited evidence of evolution within narrowly defined monophyletic groups. However, the fossil record is so heavily dominated by taxa which are referable to extant genera or tribes that there is little evidence of macroevolution within the family. It is probable that this is less of a weakness in the fossil record than an indication of major diversification at an early stage in the history of the family followed by a long period of relative stasis. A number of publications dealing with important aspects of the fossil record of the family will not be considered in detail in this brief review. However, the following provide a useful introduction for those wishing to gain more information: Cookson & Duigan (1950), Christophel (1984), Hill & Christophel (1988), Dettmann (1989), Dettmann & Jarzen (1991), Rozefelds (1992), Hill (1994), Jordan (in press).

Fossil Proteaceae pollen has been intensively studied in recent years, and is now offering important insights into the early history of the family. The macrofossil record has also been reasonably well-studied, but is more difficult to interpret. This is because fossil leaves have been assigned to the Proteaceae for more than a century, and most of the early reports were inaccurate to at least some degree. Thus, while there has been some controversy regarding the identification of fossil proteaceous pollen (e.g. Martin, 1973; Martin & Harris, 1974), it is relatively minor in comparison with the macrofossil record. However, an impressive list of unambiguous proteaceous fossils is available, and this summary briefly examines the important details of this record, especially from an Australian point of view.

Given its mainly Southern Hemispheric distribution, with strong centres of diversity in Australia and the southern tip of Africa, the Proteaceae are a very interesting family from an Australian perspective both in terms of their evolution and past distribution. The work of Johnson & Briggs (1963, 1975, 1981) on the extant species and their phylogeny has provided an excellent background to the fossil record.

Cretaceous pollen data provides compelling evidence for the time and place of appearance of proteaceous taxa (Dettmann, 1989, 1994; Dettmann & Jarzen, 1990, 1991) and strongly supports the hypothesis that the family originated in northern Gondwana (Dettmann, 1989). Dettmann & Jarzen (1991) have reported pollen of both rainforest and sclerophyllous types of Proteaceae in the Late Cretaceous of the Otway Basin in south-eastern Australia, thus strengthening the argument for a diversification of the family at that time. However, the major expansion of the family is recorded in the pollen and macrofossil record of the early Palaeogene (e.g. Martin, 1978, 1982).

Johnson & Briggs (1975) proposed several hypotheses relating to the evolution and past distribution of elements of the family, and recent fossil data supports some of these hypotheses. For example, they proposed that 'The ancestors of Cenarrheninae, Dilobeiinae, Proteeae, Hicksbeachiinae, Gevuininae, Macadamiinae and Roupalinae...must have evolved by the early Upper Cretaceous' and they considered that *Dilobeia*, Hicksbeachiinae, Gevuininae and Macadamiinae were probably distributed by land in the Mid-Cretaceous rather than by distance dispersal over marine barriers at a later date. Dettmann (1989, 1994) concluded that an array of Proteaceae, possibly including *Beauprea*, *Knightia*, *Xylomelum*, *Gevuina*/*Hicksbeachia* and *Macadamia* were introduced into Antarctica during the Campanian-Maastrichtian. Moreover, she hypothesised that south-eastern Australia may have been the site of evolution of *Knightia*, which today occurs in New Caledonia and New

Zealand and the *Gevuina*/*Hicksbeachia* alliance which now has a disjunct distribution between eastern Australia and Chile. Furthermore, she suggested that *Macadamia* was present in Antarctica and southern Australasia by the Campanian and that this may also have been the source area for *Beauprea* (Dettmann & Jarzen, 1990, 1991).

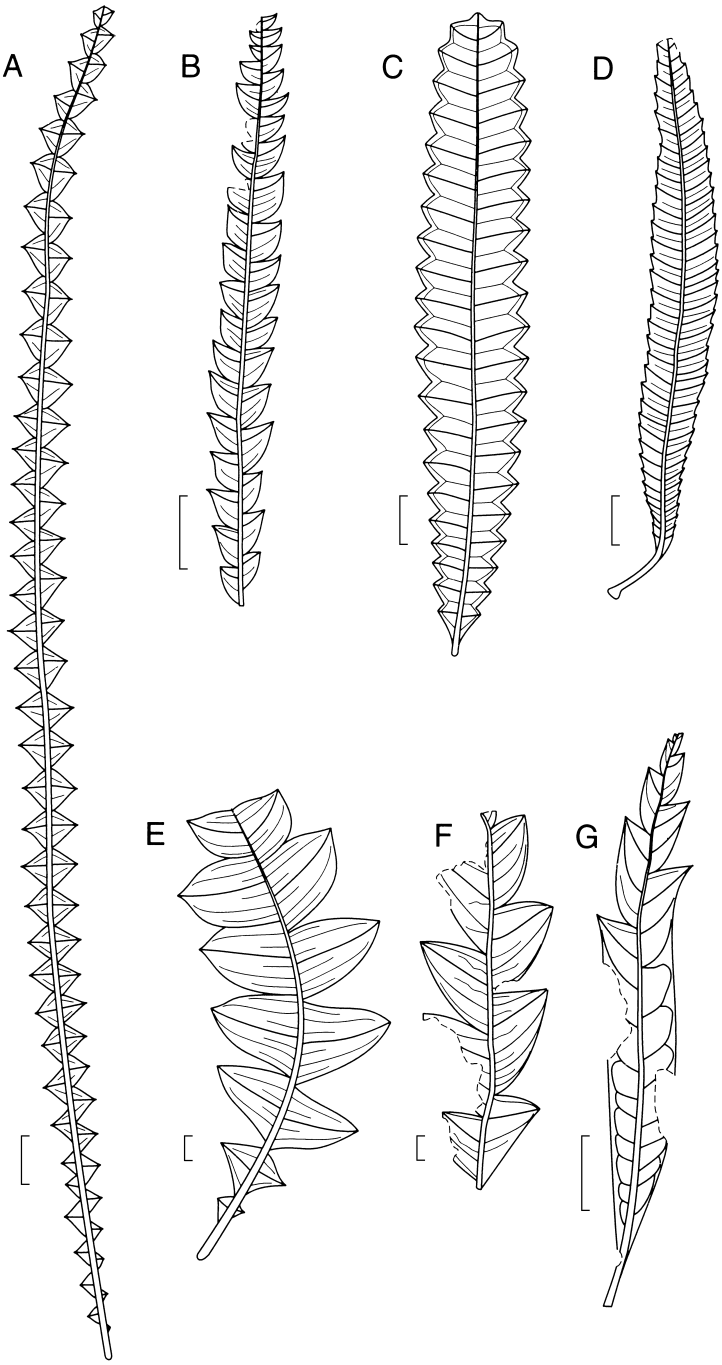
This pollen evidence is somewhat controversial, since there are large gaps in the Palaeogene fossil records of many of the taxa cited by Dettmann (1989, 1994) and Dettmann & Jarzen (1990, 1991). This in turn leads to two possibilities. Firstly, there were Cretaceous taxa with pollen types morphologically close to modern proteaceous genera but not closely related to them. If these taxa existed, they must now be extinct. Secondly, the taxa involved persisted, but made little contribution to fossil pollen floras, either because they occurred in other habitats not represented in the fossil record or they had greatly reduced pollen production. If the latter is true, then some causative agent should be identifiable. Before discussing this, it is instructive to consider the rest of the pollen record into the early Palaeogene.

The major diversity of proteaceous pollen occurs in the early Palaeogene, but many taxa disappear abruptly at about the end of the Eocene, and this is readily apparent from stratigraphic range charts (e.g. Stover & Partridge, 1973). This high diversity and abundance of proteaceous pollen in the early Palaeogene has been treated with some suspicion for two reasons (Hill, 1994). Firstly, relatively low percentages of pollen are retrieved from surface samples in extant dry Australian forests where the family is abundant and diverse (Martin, 1978). Martin (1982) noted that Palaeogene species may have been trees that produced more pollen than a comparable extant sclerophyllous shrub layer. She added that low pollen counts have been recorded from extant proteaceous trees in Queensland rainforests. Martin further suggested that many of the Palaeogene Proteaceae may have dominated the vegetation. With regard to the second reason for scepticism, Christophel & Blackburn (1978) concluded that the Middle Eocene Maslin Bay flora contained 35–40% proteaceous pollen, but relatively few macrofossils. They, and Christophel (1981), who noted the same trend at Nerriga, considered that one factor contributing to this discrepancy may be the difficulty experienced in identifying the pollen. It is now apparent that the major difficulty may have been the very preliminary nature of work on macrofloras at the time. Recent research has demonstrated that the Maslin Bay macroflora has a very diverse proteaceous component (Scriven, 1993). There is little doubt that the assessment of high diversity and abundance of proteaceous Palaeogene pollen was accurate. It remains, therefore, to account for their demise in the late Eocene.

Explanations are required not only for the extinction of several proteaceous species at about the end of the Eocene, but also for the disappearance of many of the pollen types that first appeared in the Cretaceous, but which apparently have a large gap in their record during the Palaeogene (see earlier discussion).

One possibility involves a shift in pollination strategies. Extant Proteaceae rely on biotic pollination, either by insects, which is considered to be the ancestral state, or by birds or mammals (Johnson & Briggs, 1975). However, there is circumstantial evidence that wind pollination may have been significant in a Palaeogene group of now extinct proteaceous species. About half of the proteaceous species which became extinct in south-eastern Australia by the end of the Eocene had pollen grains with diameters of 20–40 µm, which

**Figure 34.** Leaves of living *Banksia* species and fossils attributed to the tribe Banksieae. **A**, *Banksia candolleana* Meisn., extant in south-western Australia. **B**, *Banksieaephyllum taylorii* R.J.Carp., G.J.Jord. & R.S.Hill, from Late Paleocene sediments in south-eastern N.S.W. (University of Tas. LB-024). (See Carpenter *et al*., 1994a.) **C**, *Banksia burdettii* Baker f., extant in south-western Australia. **D**, *Banksieaeformis dentatus* R.S.Hill & Christophel, from Early Oligocene sediments in north central Tas. (University of Tas. C-703). (See Hill & Christophel, 1988.) **E**, *Banksia grandis* Willd., extant in south-western Australia. **F**, *Banksieaephyllum incisum* D.T.Blackburn, from Middle Eocene sediments near Adelaide, S.A. (Adelaide University S-1884). (See Hill & Christophel, 1988.) **G**, *Banksieaeformis decurrens* R.S.Hill & Christophel, from Middle Eocene sediments near Adelaide, S.A. (Adelaide University S-1497). (See Hill & Christophel, 1988.) Scale bars = 1 cm. Drawn by R.Hill.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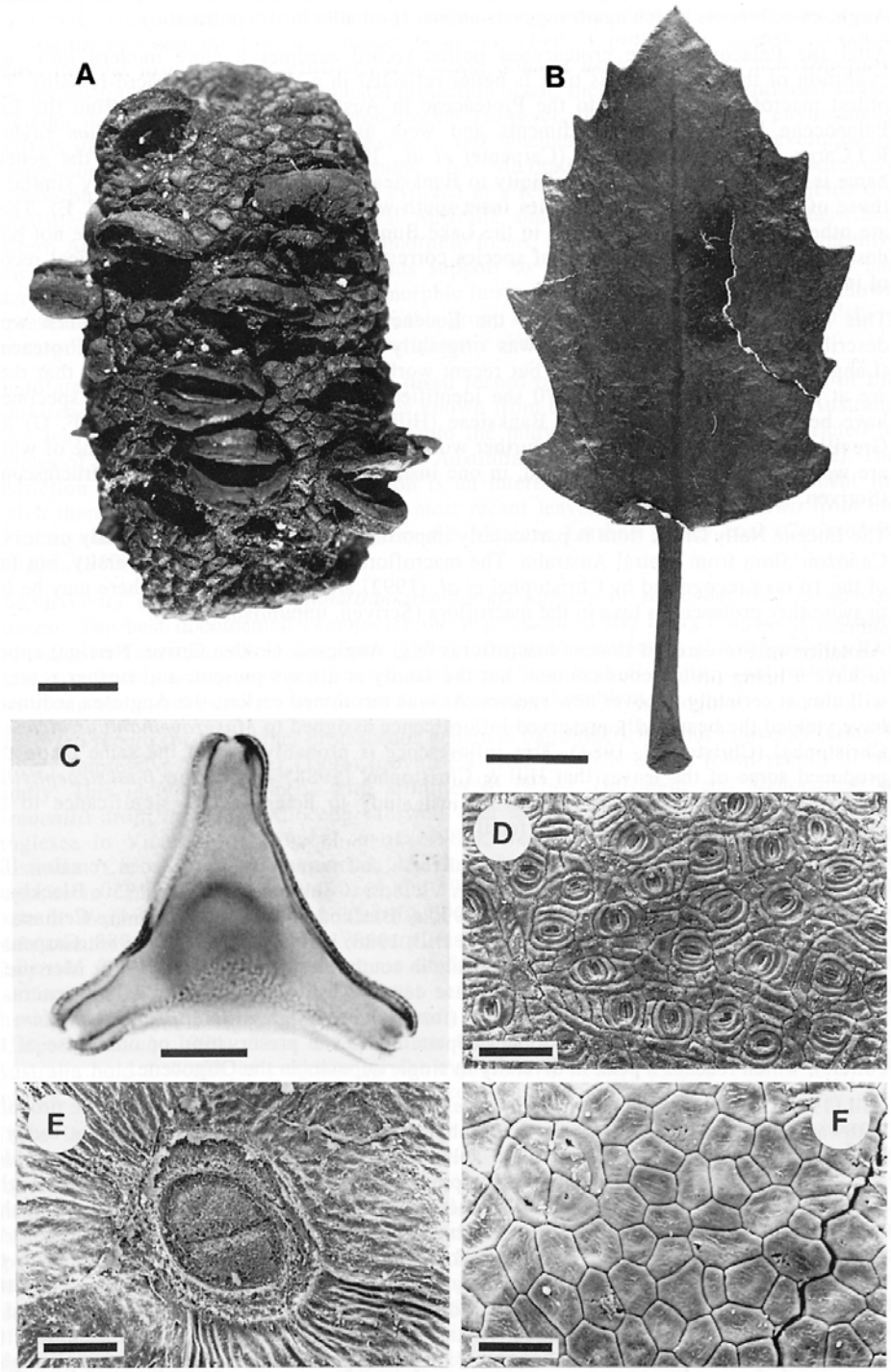
Muller (1979) considered optimal for wind pollination. The remaining species had much larger grains (some over 100 µm in diameter) which may reflect early animal pollination strategies. The smaller proteaceous species are often quite abundant, being comparable with other, well-known wind-pollinated taxa such as species of *Nothofagus* Blume and Casuarinaceae occurring in the same sediments (Hill, 1994). Faegri & van der Pijl (1979) gave some examples of species in families which are basically entomophilous but which have apparently become secondarily anemophilous. The same process may have occurred in the Proteaceae.

The reason for the extinction of a large number of proteaceous taxa by the end of the Eocene may have either directly or indirectly involved climatic change. This may have involved an increase in the abundance of mammal and/or bird pollinators, or a change in vegetation type, which in turn, may have made wind pollination a less competitive strategy. For example, if the Proteaceae were not canopy trees, wind pollination would only be a viable method if the vegetation was relatively open. The development of closed vegetation would have meant that subcanopy taxa relying on wind pollination would become extinct or restricted in range to marginal habitats where fossilisation is unlikely. Closing of the vegetation may also have adversely affected some animal-pollinated species if the animals involved were obligate, open forest species.

Another factor that may have accounted for the closure of the vegetation canopy was the changing latitudinal position of Australia. During the Cretaceous and early Palaeogene southern Australia was at very high latitudes (Wilford & Brown, 1994), and vegetation existed under polar photoperiods. With the sun at a low angle during summer, and tracking an almost circular path around the horizon during the day, it is likely that the structure of forests, which were growing in a high rainfall environment, was very open compared with that observed in wet regions of Australia today. Thus there was room for a high diversity of subcanopy species in the understorey. As Australia moved into lower latitudes, the angle of insolation increased and a closed forest structure would have developed as the most efficient way of utilising the incoming solar radiation, thus leading to the loss of understorey plants with a relatively high light requirement. Later in the Cenozoic, the Australian climate became drier, and open canopied forests again began to predominate. At this time, the subcanopy proteaceous taxa that had survived in marginal habitats may have returned to prominence, and, consequently, their pollen once again appears in the fossil record. This hypothesis requires testing, but it offers an explanation of the observed data.

While the emphasis here is on wind pollination, it should be noted that there were probable bird-pollinated Proteaceae present in Australia by the Eocene. MacNamara and Scott (1983) described a *Banksia* infructescence from early Eocene silcretes in the Stirling Ranges of north-western Australia and noted that one follicle had apparently been removed from the infructescence in a similar fashion to that employed by parrots today. This suggests a plant-animal interaction which may have extended to pollination. Given the current pollination strategies of *Banksia* (Hopper, 1980; Hopper & Burbidge, 1982; Turner, 1982), either bird-

**Figure 35.** Proteaceous fossils. **A**, Cone of probable *Banksia kingii* G.J.Jord. & R.S.Hill, from Pleistocene sediments in south-western Tas. (University of Tas. ME-031). (See Jordan & Hill, 1991.) (Reproduced with permission from *Austral. Syst. Bot.* vol. 4.) **B**, Leaf of *Orites truncata* G.J.Jord., from Pleistocene sediments in western Tas. (University of Tas. RPU-560). (See Jordan, in press.) (Reproduced with permission from *History of the Australian Vegetation: Cretaceous to Recent*.) **C**, Pollen grain assigned to *Proteacidites pachypolus* Stover & Partridge. **D**, Scanning electron micrograph (SEM) of the stomatal surface of a leaf from Middle Eocene-Oligocene sediments in south-western Australia compared to *Alloxylon* by Hill & Merrifield (1993) (WAM P.84.73). (Reproduced with permission from *Alcheringa* vol 17.) **E–F**, SEMs of the leaf surfaces of unknown species from Middle Eocene-Oligocene sediments in south-western Australia described by Hill & Merrifield (1993) (**E**, WAM P.84.79; **F**, WAM P.88.155). The specimens show typical multicellular proteaceous trichome bases. (**F**, reproduced with permission from *Alcheringa* vol 17.) Scale bars: **A**, **B** = 1 cm; **C** = 10 µm; **D** = 50 µm; **E**, **F** = 25 µm. Photographs by: **A–B**, G.Jordan; **C**, M.Macphail; **D–F**, R.Hill.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or small mammal-pollination is indicated. Christophel (1984) described an inflorescence closely related to the extant genera *Musgravea* and *Austromuellera* from the Middle Eocene Anglesea sediments which again suggests animal (probably bird?) pollination.

After the Palaeogene, the proteaceous pollen record assumes a more modern look, and evolution of the family at this time is better reflected in a study of the macro-remains. The oldest macrofossils assigned to the Proteaceae in Australia were recovered from the Late Palaeocene Lake Bungarby sediments and were assigned to *Banksieaephyllum taylorii* R.J.Carp., G.J.Jord. & R.S.Hill (Carpenter *et al*., 1994a; Fig. 34B). Although the generic name is only indicative of tribal affinity to Banksieae, these fossil leaves are very similar to those of some extant *Banksia* species from south-western Australia (Fig. 34A, C, E). There are other proteaceous macrofossils in the Lake Bungarby sediments, but they have not been described. However, the richness of species corresponds well with the palynological record of increased diversity at that time.

This high diversity carried on into the Eocene, where several floras have been well-described. The Maslin Bay flora was originally regarded as depauperate in Proteaceae (Lange, 1970; Christophel, 1981), but recent work by Scriven (1993) has shown that there are at least 15 taxa among the 170 she identified from leaf remains. Identified specimens have been assigned to the tribes Banksieae (Hill & Christophel, 1988; Fig. 34F, G) and Grevilleeae (Blackburn, 1981), but further work is required on the other taxa, some of which are well-preserved, large-leaved, and, in one instance, even with an attached infructescence (Scriven, 1993).

The Eocene Nelly Creek flora is particularly important, as it is the only organically preserved Cenozoic flora from central Australia. The macroflora is relatively low in diversity, but four of the 16 taxa recognised by Christophel *et al*. (1992) are proteaceous, and there may be one or two other proteaceous taxa in the macroflora (Scriven, unpublished data).

All other well-researched Eocene macrofloras (e.g. Anglesea, Golden Grove, Nerriga) appear to have a lower proteaceous content, but the family is always present, and further research will almost certainly uncover new species. As was mentioned earlier, the Anglesea sediments have yielded the beautifully preserved inflorescence assigned to *Musgraveinanthus alcoensis* Christophel (Christophel, 1984). This infloresence is probably part of the same taxon that produced some of the leaves that Hill & Christophel (1988) assigned to *Banksieaephyllum* Cookson & Duigan. It is in need of critical study to determine its significance to the evolution of an important part of the family.

Some Oligocene macrofloras also contain diverse and numerous proteaceous remains. The best examples are the Latrobe Valley coal in Victoria (Cookson & Duigan, 1950; Blackburn, 1985; Hill & Christophel, 1988; Hill, 1990a; Blackburn & Sluiter, 1994), Cethana in Tasmania with at least 20 taxa (Carpenter & Hill, 1988; Hill & Christophel, 1988; Carpenter, 1991; Carpenter *et al.*, 1994b), and West Dale in south-western Australia (Hill & Merrifield, 1993). Many of the proteaceous taxa in these deposits can be assigned to extant genera, in particular, the *Banksia*/*Dryandra* group (fossils are assigned to *Banksieaephyllum* or *Banksieaeformis* R.S.Hill & Christophel depending on the preservation or otherwise of the cuticle), which reaches a peak in diversity in single deposits in the Oligocene.

Hill (1990b, 1994) has hypothesised that *Banksieaephyllum* fossils demonstrate the probable pathway of the development of the sclerophyllous heath flora which is prominent today in areas of Australia with oligotrophic soils and a mediterranean climate. The oldest *Banksieaephyllum* leaves have several typically sclerophyllous characters (thick, highly vascularised leaves etc.), suggesting that they occurred in oligotrophic soils. However, they occur in typical rainforest associations and have relatively few morphological adaptations for stomatal protection. This suggests that water was plentiful, which is in keeping with the climatic reconstruction for that time (Quilty, 1994). However, Hill (1990b, 1994) suggested that such leaves may have been preadapted to xeromorphic conditions which increased in intensity and spread geographically later in the Cenozoic. For example, the *Banksieaephyllum* species in the Latrobe Valley coal show a mixture of leaf morphologies. According to Blackburn (1985), those associated with rainforest species still show little or no stomatal protection, whereas those associated with more open (xerophytic) vegetation show

some adaptations for stomatal protection (e.g. dense trichomes, stomata in pits between the veins, revolute leaf margins). Such adaptations were probably associated with reduced water availability, since they must substantially reduce the carbon dioxide uptake (and hence photosynthesis) and must be advantageous to the plant if protection against excessive transpirational loss was of particular importance. Among modern *Banksia* and *Dryandra* species several extreme forms of stomatal protection occur, including those mentioned above, although these are often far more pronounced. However, there has been no phylogenetic analysis of fossil *Banksieaephyllum* leaves to test whether this represents an evolutionary progression within monophyletic groups. An alternative hypothesis, that extremely xeromorphic *Banksia*/*Dryandra* species evolved at a relatively early stage in restricted dry microsites, or in remote areas in central Australia and later expanded into southern and eastern Australia replacing the less xeromorphic forms, cannot be discounted. The recently described *Banksieaephyllum taylorii* lends support to this latter hypothesis, since it has encrypted stomata, and is relatively xeromorphic in structure, despite being the oldest known representative of the genus. In either case, this group offers an excellent opportunity to study the responses of a restricted taxon to major climatic change over a long period.

There are other important aspects of the fossil record of the tribe Banksieae. Many of the *Banksieaephyllum/Banksieaeformis* species known from eastern and south-eastern Australia have leaves with serrations which extend into the midvein, a condition now restricted to species of *Banksia* and *Dryandra* in Western Australia (Fig. 34B, F, G, cf. Fig. 34A, E). The restriction of this leaf form to that region is an interesting evolutionary development for which there is, currently, no answer. The most recent leaves of this form known from the fossil record of eastern Australia are from the Miocene Latrobe Valley coal (Cookson & Duigan, 1950).

The diversity of *Banksieaephyllum*/*Banksieaeformis* species in some deposits is also of interest. The best documented example is the macroflora of the Early Oligocene Cethana sediments in Tasmania, where Carpenter (1991) recognised a minimum of five species which must have been growing within a limited catchment. Such high diversity is not restricted to this group alone, but poses an interesting palaeoecological problem.

The fossil record for most other proteaceous genera is more restricted, but in overall terms, it is very impressive. Carpenter (1994) provided a brief synopsis of the fossil record of the family. This includes specimens with affinities to *Orites*, *Darlingia* and *Stenocarpus* or *Oreocallis* from the Oligo-Miocene Morwell coal seams (Blackburn, 1985), *Orites* from Anglesea in Victoria (Christophel *et al*., 1987), *Neorites* from Golden Grove in South Australia (Christophel & Greenwood, 1987), *Athertonia* from Oligocene and Miocene deposits in central Queensland (Rozefelds, 1992), *Alloxylon* and *Stenocarpus* from West Dale in Western Australia (Hill & Merrifield, 1993) and *Darlingia*, Gevuininae, Banksieae and *Lomatia* from near Kalgoorlie, Western Australia (Carpenter & Pole, in press). Although Carpenter (1994) noted that these taxa are similar to species now growing in the wet-tropical rainforests of northern Queensland, he was somewhat non-commital about the accuracy of the identifications. Similar listings have been made for Oligocene fossils from Tasmania (Carpenter *et al.*, 1994). Thus it seems clear that the Palaeogene macrofloras of southern Australia hold a wealth of evidence for the evolution of the Proteaceae of the extant wet-tropics, but much more research is required to confirm this.

There is relatively little evidence available of proteaceous macrofossils in Quaternary sediments, but Jordan (in press) has summarised the evidence from Tasmania. This shows convincingly that in the Early Pleistocene there was a mixture of extant and extinct species, many of the latter presumably indistinguishable via the pollen record, since they belong to extant genera. However, soon afterwards the extinct species decline markedly, with only one species being recorded, i.e. *Banksia kingii* G.J.Jord. & R.S.Hill, from the Late Pleistocene of Melaleuca Inlet (Jordan & Hill, 1991). An important feature of the Tasmanian Quaternary record is that it demonstrates that in an area of Australia particularly ravaged by the effects of glaciations, many proteaceous species were in place by at least one million years ago, and there is no evidence of massive speciation in response to alternating glacial/interglacial conditions.

The fossil record from outside Australia is relatively limited, but one interesting area is New Zealand, which has a surprisingly diverse proteaceous element. The extant New Zealand flora contains only two species of Proteaceae, *Knightia excelsa* R.Br. and *Toronia toru* (A.Cunn.) L.A.S.Johnson & B.G.Briggs. The pollen record indicates a higher diversity in the past (e.g. Dettmann & Jarzen, 1990, 1991), but it is the macrofossil record that provides the most interesting data. Carpenter (1994) noted that dispersed cuticle floras from the Miocene in New Zealand contain taxa similar to Gevuininae/*Hicksbeachia* and *Macadamia*, while Pole (1995) listed fossils of *Orites* and Banksieae from Eocene sediments there. It seems likely that the fossil flora of New Zealand will have much more to offer regarding the history of the Proteaceae than may have been realised before the macrofossil work of Pole (1995) was undertaken. The role of long distance dispersal across major seaways is now firmly on the agenda in biogeographical studies of the Proteaceae (Pole, 1995).

This brief overview of the Proteaceae has developed only a few of the important themes. Unlike the living flora, most of the fossil record of the Proteaceae has yet to be discovered. This ancient family is particularly accessible to fossil studies, and we anticipate that over the next few years there will be major developments in our understanding of the biogeography and evolution of the family based on fossil evidence.

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## POLLINATORS OF AUSTRALIAN PROTEACEAE

*Glynn V.Maynard*

Proteaceous flowers are known to have some unusual methods of pollination involving birds, mammals and insects. Some are said to exhibit a 'pollination syndrome', i.e. they possess structural attributes indicative of a relationship with a particular group of animal pollinators (Rourke & Wiens, 1977; Carpenter, 1978; Armstrong, 1979). However, in Australia, it has been shown that the notion of pollination syndromes is not supported by field observations and that flowers are usually visited by a broad range of pollinators.

Because of the various and intriguing structures of the Proteaceae, there has been considerable speculation as to pollinators of this family. Porsch (1934) first described the floral structures suitable for potential pollen transfer by vertebrates. Since then numerous published accounts have speculated on the effectiveness of birds and mammals as vectors. Moreover, it is only in recent times that evidence of pollen gathering and/or transfer has become available.

The term 'pollinator' as it is used here refers to a vector that carries pollen in a manner that is likely to cause its transfer to the stigma of a receptive flower.

**Birds**

Floral characters that have been suggested to facilitate bird pollination include inflorescences that are exposed in the foliage, red, pink or orange flower colour, a tubular or gullet-shaped perianth, a straight style, little odour, hypogynous glands with crepuscular or diurnal nectar production and the presence of a pollen presenter (Ford *et al.*, 1979). In addition, species of *Grevillea* often have a stiff perianth tube which requires a beak to access the nectaries (Morecombe, 1968).

At least 16 species of birds, mostly honeyeaters (Meliphagidae), are known to visit species of *Adenanthos*, *Telopea*, *Lambertia*, *Grevillea*, *Hakea*, *Banksia* and *Dryandra* (Ford *et al.*, 1979). Honeyeaters exploit a broad range of floral types (Lamont *et al.*, 1985) and are considered to be major pollinators of *Grevillea* (Ford *et al.*, 1979), while spinebills (*Acanthorhynchus*), wattle birds (*Anthochaera*) and some honeyeaters (*Phylidonyris*) appear to be significant pollinators of *Banksia*. A classic photograph in Morecombe (1968) shows pollen of an *Adenanthos obovatus* flower daubed on the crown of a spinebill (*Acanthorhynchus* sp.) by the pollen presenter. Interestingly, however, Wiens *et al.* (1979) showed that while *Banksia attenuata* R.Br. possessed floral characteristics that suggested bird pollination, the birds that visited the flowers (New Holland Honeyeater (*Phylidonyris novaehollandiae* Latham), Western Spinebill (*Acanthorhynchus superciliosus* Gould) and White-cheeked Honeyeater (*Phylidonyris nigra* Bechstein)) did not carry pollen on their feathers. Furthermore, the beaks of these birds are too long to effect pollen transfer.

**Mammals**

Accounts of repeated observations of mammals pollinating Proteaceae are few. Several infer mammal pollination from the floral structures while others are anecdotal (e.g. Carpenter, 1978; Holm, 1978b).

*Bats*

Three species of bat (the Spectacled Flying-fox (*Pteropus conspicillatus* Gould), Little Red Flying-fox (*Pteropus scapulatus* Peters) and the Queensland Blossom Bat (*Syconycteris australis* Peters)) have been reported from flowers of *Grevillea* and *Banksia* (Turner, 1982).

Floral characters that may serve to facilitate pollination by bats include large, strong flowers or inflorescences, large separation between stigma and hypogynous glands, anthers on long, exserted filaments, pale, strongly odoriferous flowers held away from the foliage, nocturnal nectar and pollen presentation and stigma receptivity, and abundant nectar and pollen (Turner, 1982).

*Non-flying mammals*

Flower characters that may encourage pollination by non-flying mammals include inconspicuous or cryptic inflorescences hidden deep within the foliage, dull colours, hooked styles and pollen presenters, nectar and pollen presented nocturnally and crepuscularly, and a strong odour (Armstrong, 1979).

Twenty-five species of marsupial are known to visit flowers of Proteaceae, but only five have been shown to feed regularly at flowers and to have a potential role in pollination. One mammal that shows strong modifications for feeding on pollen and nectar is the Honey Possum (*Tarsipes rostratus* Gervais & Verreaux). These modifications include a very small size, a prehensile tail which enables the animal to dangle from a plant and forage on flowers, an etiolated, almost tubular snout and teeth highly reduced or absent (Armstrong, 1979). Honey Possums have been reported from a wide range of Proteaceae (*Petrophile*, *Adenanthos*, *Grevillea*, *Hakea*, *Banksia* and *Dryandra*; Weins *et al.*, 1979; Hopper, 1980). Weins *et al.*, (1979) also showed that these possums carry large pollen loads of *Banksia attenuata* and that the faeces may contain digested pollen.

The Western Pygmy Possum (*Cercartetus concinnus* Gould) has a short, blunt snout, a modification which allows it to forage on *Banksia* and *Dryandra* flowers. The Brown Antechinus (*Antechinus stuartii* Macleay) and the Bush Rat (*Rattus fuscipes* Waterhouse) have been reported from species of *Banksia* (Armstrong, 1979). Although house mice (*Mus musculus* Linnaeus) have been recorded from various plants, they carry little or no pollen (Hopper, 1980).

**Insects**

Information on the activities of invertebrates other than bees on Australian Proteaceae is very limited. Houston (1989) considered flies from Bombyliidae and Syrphidae as well as bees and argid sawflies as the only potential pollinators of *Conospermum*. Carolin (1961) also suggested that flies might be involved in the pollination of *Conospermum*, and Ford *et al*. (1979) recorded Diptera, butterflies and moths on, and potentially transporting pollen of, *Adenanthos*, *Grevillea* and *Hakea*.

*Melittophily on Proteaceae*

The pollination of *Persoonia* by particular groups of bees has been known for some time. Rayment (1950) recounted a relatively accurate report of *Leioproctus (Cladocerapis)* spp. visiting '*Persoonia mollis*' which had been described to him by amateur naturalist Norman Rodd. He provided a purported illustration of *Leioproctus* (*Cladocerapis*) manipulating the flower. From personal observations of *L.* (*C.*) *speculiferus* on *Persoonia virgata*, the bees worked over the stigma, not beside it as in this illustration. See also Fig. 4.

Although there are a considerable number of reports of insects visiting flowers of Proteaceae (Table 3; Armstrong, 1979), there have been only a few published observations of the pollinating action of bees. Three groups of bees are known to consistently visit species of *Persoonia* and *Conospermum*, and while these two genera are not especially popular forage plants, occasionally large numbers of insects will be found at a particular bush, e.g. *Leioproctus* (*Leioproctus*) *conospermi* species group on *Conospermum* spp. (Houston, 1989), *L.* (*Filiglossa*) *davisi* on *P. arborea* (K.Walker, pers. comm.) and *L.* (*Cladocerapis*) *speculiferus* on *P. virgata* (Maynard, unpublished data).

*Structural adaptations of bees for foraging*

Three groups of short-tongued, solitary bees of the genus *Leioproctus* Smith, 1853 (Hymenoptera: Colletidae) exhibit modifications of the mouthparts and other body parts that are adaptations to foraging at *Persoonia* and *Conospermum* flowers. Species of two subgenera (*Cladocerapis* Cockerell, 1904 and *Filiglossa* Rayment, 1959) are known to forage almost exclusively on *Persoonia*. The nine species of *Cladocerapis* are of medium size (7–11 mm in length; Maynard, 1992) and all, both male and female, have the lower, front part of the face (the clypeus) hairless and flattened to shallowly concave. Moreover, all but *L.* (*C.) clypeatus* have the medial area of the clypeus highly polished; that species has fine longitudinal striae on the clypeus and is only known from *Persoonia teretifolia*. The females of *L.* (*Cladocerapis*) have 2–4 longitudinal rows of long, thick hairs or spines on the anterior surface of the front legs to gather pollen and dense, plumose hairs (scopa) on the anterior tibia of the hind legs for transporting the gathered pollen.

The second group of *Leioproctus*, *Leioproctus* (*Filiglossa*), have only been collected from *Persoonia* spp. The four species of this subgenus are all small (4–6 mm long), and both males and females have the third segment of the labial palps much-elongated and the fourth segment minute and hair-like. The third segment of each palp is basally arched, then straight and apically closely apposed to the third segment of the opposite palp. The apex of the maxillae have 4–12 long, simple hairs. All of these mouthparts are closely appressed, presumably causing the nectar to be ingested by capillary action. Females have a subspherical fifth segment of the front leg with at least 7 long, fine spines on the anterior surface as well as a row of spines in some species on the hind legs which are apparently used to gather pollen. The scopa of these bees is relatively coarse and open.

The *Leioproctus conospermi* species-group are a distinct group of three species of subgenus *Leioproctus* These small bees (5–9 mm long) have only been collected from *Conospermum* and all have very short maxillary palpi. The females have a very sparse scopa to carry the coarse *Conospermum* pollen. Males of two species in this group, *L.* (*L.*) *pappus* and *L.* (*L.*) *tomentosus*, are considered to have modifications for concealment on the plants (Houston, 1989). Thus the dense white long fine hair, whitish compound eyes and milky wing membranes assist in camouflage when the bees are motionless.

*Behaviour of bees foraging at* Persoonia *and* Conospermum

*Leioproctus* (*Cladocerapis*) spp. manipulate *Persoonia virgata* flowers in a manner which should ensure more effective pollination than the honey bee (*Apis mellifera* Linnaeus, 1758). Upon alighting on a flower, *L. speculiferus* (males and females) crawl to the top of the style and force their heads down between the style and the anthers to gain access to the nectaries at the base of the gynoecium. When in this position, females, in particular, rest the underside of the hairy, pollen-bearing abdomen on the stigma.

The females gather pollen by pushing the spines on the front legs down the length of an anther, stripping pollen from the longitudinal slits. The front legs are then wiped along the middle of the body and the pollen is manipulated with the middle legs along the body to the hair on the undersurface of the abdomen and the scopae. The female may repeat this manoeuvre once to several times on one anther and then rotate 90° to manipulate the adjacent organ.

By contrast, honey bees approach the flower over the top of the tepal and usually force their tongue down to the nectaries with little or no contact to the stigma. *Trigona carbonaria* (native stingless bee) crawls all over the flowers with unpredictable stigmatic contact.

*Leioproctus (Filiglossa) prolatus* gathers nectar by perching at the right angles formed by the adjoining recurved tepals of *Persoonia virgata* and inserts its mouthparts into the flower. To gather pollen the female uses the fine spines on the forelegs as well as the thicker spines on the hind legs to access and accumulate the pollen.

An account of the explosive pollination mechanism of some *Conospermum* spp. was provided by Holm (1978a). The unusual trigger mechanism of *Conospermum coerulescens* subsp. *dorrienii* was described with the remark that 'one can release the explosion by touching the triggers with a straw'. While it had been assumed that flies were probably the pollinators of these flowers (Carolin 1961), Houston (1989) demonstrated that the tongues of bees of the *L. conospermi* species-group affect this remarkable pollination. Thus, the bees stand on the outside of the flower inserting the tongue in the tube which releases the trigger. They have shortened maxillary palps, presumably to prevent the bee from being damaged or trapped by the pollination mechanism. The hairy body provides a surface on which to trap some of the pollen released by the explosion.

**Table 3.** Bee species observed on Australian Proteaceae

Based on published records; data mostly from Cardale (1993)

**Records on *Persoonia***

Anthophoridae: Anthophorinae
*Amegilla (Zonamegilla) cingulata* (Fabricius, 1775)

Anthophoridae: Xylocopinae
*Braunsapis simillima* (Smith, 1854)
*Braunsapis unicolor* (Smith, 1854)
*Exoneura (Exoneura) hamulata* Cockerell, 1905

Apidae: Meliponinae
*Trigona (Heterotrigona) carbonaria* Smith, 1854

Colletidae: Colletinae
*Leioproctus (Cladocerapis) bipectinatus* (Smith, 1857)
*Leioproctus (Cladocerapis) carinatifrons* (Cockerell, 1929)
*Leioproctus (Cladocerapis) clypeatus* (Cockerell, 1916)
*Leioproctus (Cladocerapis) ignicolor* Maynard, 1992
*Leioproctus (Cladocerapis) incanescens* (Cockerell, 1913)
*Leioproctus (Cladocerapis) raymenti* Michener, 1965
*Leioproctus (Cladocerapis) speculiferus* (Cockerell, 1921)
*Leioproctus (Filiglossa) filamentosa* (Rayment, 1959)
*Leioproctus (Filiglossa) davisi* (Maynard, 1994)
*Leioproctus (Filiglossa) hamatus* (Maynard, 1994)
*Leioproctus (Filiglossa) prolatus* (Maynard, 1994)

Megachilidae: Megachilinae
*Chalicodoma (Hackeriapis) suffusipennis* (Cockerell, 1906)

**Records on *Conospermum***

Colletidae: Colletinae
*Leioproctus (Leioproctus) conospermi* Houston, 1989
*Leioproctus (Leioproctus) pappus* Houston, 1989
*Leioproctus (Leioproctus) tomentosus* Houston, 1989

**Records on *Lomatia***

Anthophoridae: Xylocopinae
*Braunsapis simillima* (Smith, 1854)
*Exoneura (Exoneura) baculifera* Cockerell, 1922
*Exoneura (Exoneura) perpensa* Cockerell, 1922
*Exoneura (Exoneura) robusta* Cockerell, 1922
*Exoneura (Exoneura) variabilis* Rayment, 1949

Colletidae: Colletinae
*Leioproctus (Cladocerapis) incanescens* (Cockerell, 1913)
*Leioproctus (Leioproctus) irroratus* (Smith, 1853)

Colletidae: Euryglossinae
*Euryglossina (Turnerella) globuliceps* (Cockerell, 1918)
*Pachyprosopis (Pachyprosopis) mirabilis* Perkins, 1908
*Pachyprosopis (Parapachyprosopis) angophorae* Cockerell, 1912

Colletidae: Hylaeinae
*Heterapoides halictiformis* Perkins, 1912
*Hylaeus (Prosopisteron) quadratus* (Smith, 1853)
*Meroglossa punctata* Rayment, 1935

Halictidae: Halictinae
*Homalictus (Homalictus) scrupulosus* (Cockerell, 1930)
*Homalictus (Homalictus) urbanus* (Smith, 1879)
*Lasioglossum (Australictus) odyneroides* (Rayment, 1939)

**Records on *Telopea***

Colletidae: Hylaeinae
*Hylaeus (Sphaerhylaeus) bicolorellus* Michener, 1965

**Records on *Xylomelum***

Colletidae: Hylaeinae
*Hyleoides zonalis* Smith, 1853

**Records on *Grevillea***

Colletidae: Euryglossinae
*Euryglossella neominima* Exley, 1974

Colletidae: Hylaeinae
*Hylaeus (Euprosopoides) ruficeps ruficeps* (Smith, 1853)
*Hylaeus (Gnathoprosopis) euxanthus* (Cockerell, 1910)
*Hylaeus (Hylaeteron) douglasi* Michener, 1965
*Hylaeus (Hylaeteron) hemirhodus* Michener, 1965
*Hylaeus (Hylaeteron) murrumbidgeanus* Houston, 1981
*Hylaeus (Hylaeteron) riekianus* Houston, 1981
*Hylaeus (Hylaeteron) semirufus* (Cockerell, 1914)
*Hylaeus (Sphaerhylaeus) globuliferus* (Cockerell, 1929)

Halictidae: Halictinae
*Homalictus (Homalictus) dotatus* (Cockerell, 1912)
*Nomioides (Ceylalictus) perditellus* Cockerell, 1905

Stenotritidae
*Ctenocolletes nicholsoni* (Cockerell, 1929)
*Ctenocolletes rufescens* Houston, 1983
*Ctenocolletes smaragdinus* (Smith, 1868)
*Ctenocolletes tigris* Houston, 1983
*Ctenocolletes tricolor* Houston, 1983

**Records on *Hakea***

Anthophoridae: Anthophorinae
*Amegilla (Asaropoda) rufa* (Rayment, 1931)

Anthophoridae: Xylocopinae
*Exoneura (Exoneurella) eremophila* Houston, 1976

Colletidae: Colletinae
*Leioproctus (Leioproctus) obscuripennis* (Cockerell, 1905)

Colletidae: Hylaeinae
*Amphylaeus (Agogenohylaeus) obscuriceps* (Friese, 1924)
*Hylaeus (Hylaeteron) semirufus* (Cockerell, 1914)

Halictidae: Halictinae
*Homalictus (Homalictus) dotatus* (Cockerell, 1912)
*Homalictus (Homalictus) urbanus* (Smith, 1879)

Stenotritidae
*Ctenocolletes albomarginatus* Michener, 1965
*Ctenocolletes nicholsoni* (Cockerell, 1929)
*Ctenocolletes rufescens* Houston, 1983
*Stenotritus greavesi* (Rayment, 1930)

**Records on *Lambertia***

Colletidae: Hylaeinae
*Hylaeus (Macrohylaeus) alcyoneus* (Erichson, 1842)

**Records on *Banksia***

Apidae: Meliponinae
*Trigona (Heterotrigona) carbonaria* Smith, 1854

Colletidae: Euryglossinae
*Euryglossa (Euhesma) walkeriana* Cockerell, 1905
*Euryglossina (Euryglossina) kellyi* Exley, 1968

Colletidae: Hylaeinae
*Amphylaeus (Agogenohylaeus) nubilosellus* (Cockerell, 1910)
*Amphylaeus (Agogenohylaeus) obscuriceps* (Friese, 1924)
*Amphylaeus (Amphylaeus) morosus* (Smith, 1879)
*Hylaeus (Euprosopis) violaceus* (Smith, 1853)
*Hylaeus (Euprosopoides) rotundiceps* (Smith, 1879)
*Hylaeus (Macrohylaeus) alcyoneus* (Erichson, 1842)
*Hylaeus (Prosopisteron) bidentatus* (Smith, 1853)
*Hylaeus (Prosopisteron) sanguinipictus* (Cockerell, 1914)
*Hyleoides concinna* (Fabricius, 1775)
*Hyleoides zonalis* Smith, 1853
*Meroglossa impressifrons impressifrons* (Smith, 1853)

Halictidae: Halictinae
*Homalictus (Homalictus) sphecodoides* (Smith, 1853)

**Records on *Dryandra***

Colletidae: Hylaeinae
*Hylaeus (Prosopisteron) sanguinipictus* (Cockerell, 1914)

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# UTILISATION

*A.E.Orchard*

It is not surprising that a family as diverse and ubiquitous, and so prominent in the landscape as Proteaceae is in Australia, should have been used for a wide range of purposes both by the aboriginal peoples and in modern commerce.

## Traditional Aboriginal Usage

Proteaceae were important to aboriginal people as a source of food, medicine, tool-making materials, emergency water supplies, and as the subject of numerous legends (Wrigley & Fagg, 1989). In those communities where a traditional lifestyle is maintained, Proteaceae continue to be utilised for food, medicine and as a source of timber for special purposes.

### *Bush food plants*

The fruits or seeds of some species of *Persoonia*, *Hicksbeachia*, *Floydia*, *Macadamia* and *Hakea* are believed to have been eaten, some after special treatment to remove or neutralise poisonous compounds (Maiden, 1889; Leiper & Hauser, 1987; Wrigley & Fagg, 1989; Wightman & Smith, 1989; Smith & Wightman, 1990; Wightman, Roberts & Williams, 1992). Flowers of *Telopea*, *Lambertia*, *Grevillea* and *Banksia* provided nectar which was sucked out directly, or washed out in water to make a beverage (Maiden, 1889; Levitt, 1981; Leiper & Hauser, 1987; Wrigley & Fagg, 1989; Wightman *et al*., 1991; Wightman, Dixon *et al*., 1992; Wightman, Roberts & Williams, 1992). An exuded gum of *Grevillea wickhamii* Meisn. is eaten by people and the Australian Bustard, *Ardeotis australis* Gray (Wightman, Dixon *et al*., 1992). The roots of *Hakea leucoptera* R.Br. provided fresh water when one end was placed in a slow fire (Leiper & Hauser, 1987; Wrigley & Fagg, 1989).

### *Medicine*

*Persoonia*, *Xylomelum*, *Grevillea*, *Hakea* and *Banksia* yielded medicines (Levitt, 1981; Lassak & McCarthy, 1983; Wrigley & Fagg, 1989; Wightman, Dixon *et al*., 1992; Smith *et al*., 1993; Wightman *et al*., 1994). For example, a hot infusion of the bark of *Hakea arborescens* R.Br. is used to treat skin complaints, a cold infusion of the flowers of *Grevillea dryandri* R.Br. is drunk for general weakness or headache, and a hot infusion of the bark of the same species is rubbed on the body for the same symptoms. Charcoal made from the corky bark of *Hakea chordophylla* F.Muell. is used as a lip salve, either in powdered form or mixed with fat. *Grevillea dimidiata* F.Muell. contains skin irritants, and the sap causes weals or blisters. The fruits and stems of this species are used to produce tribal or ritual markings (Wightman, Roberts & Williams, 1992; Smith *et al*., 1993; Wightman *et al*., 1994). Other *Grevillea* species can also contain irritants (Everist, 1981; Wightman *et al*., 1994).

### *Tools and artefacts*

A bark extract of some *Persoonia* species was used to strengthen and preserve fishing lines and string (Leiper & Hauser, 1987; Wrigley & Fagg, 1989), and a resin from *Grevillea* was used as a cementing compound (Wrigley & Fagg, 1989). Timber from *Grevillea* and *Hakea* is used for tool-making, especially in the manufacture of boomerangs (Wightman *et al*., 1991; Wightman, Dixon *et al*., 1992; Wightman, Roberts & Williams, 1992; Smith *et al*., 1993, Wightman *et al*., 1994).

## Modern Commercial Usage

The family provides a number of commercially important crops.

### *Food crops*

*Banksia*, and to a lesser extent *Telopea*, *Macadamia* and *Grevillea* provide nectar and pollen for the honey industry. *Macadamia integrifolia* and *M. tetraphylla* are the source of

macadamia nuts, an industry pioneered in Hawai'i, but now based on extensive plantations in South Africa, Zimbabwe, Malawi, Kenya, California, Central America, and, belatedly, in Australia, with smaller plantations elsewhere.

*Macadamia* was introduced into Hawai'i experimentally in 1881 and 1892, but production expanded rapidly after widescale plantings of improved varieties in 1948. In Australia small plantings had been made by 1900, but it was not until 1965/66 that commercially viable areas were planted in this country. In the meantime many other countries had established plantations, and by 1987 world production amounted to 6,806 tonnes of kernels from 51,600 acres of plantations. Projections suggested that with new plantations coming on stream, production would rise to about 18,000 tonnes of kernel per annum within 5–10 years (Jodvalkis, 1987). At that time the market was dominated by Hawai'ian growers with 73% of world production. Australia had about 14%, but with extensive plantings coming into production, the projection was that, within 5–10 years, this would rise to about 20%. Nut production in 1987 is given in Table 4.

**Table 4.** World macadamia nut production in 1987

(Source: Jodvalkis, 1987)

| Country | Acres | Bearing acres | 1987 kernel production (tonnes) | Projected production, 5–10 years (tonnes) |
|---|---|---|---|---|
| Hawai'i | 21,900 | 14,000 | 5,000 | 9,000 |
| Australia | 7,100 | 2,400 | 982 | 3,570 |
| South Africa | 6,200 | | 240 | 1,000 |
| Kenya | 2,500 | | 180 | 500 |
| Malawi | 1,900 | | 90 | 600 |
| Costa Rica | 5,000 | 2,000 | 180 | 2,600 |
| Guatemala | 1,000 | | 134 | 180 |
| Others* | 6,000 | | | 500 |
| Totals | 51,600 | | 6,806 | 17,950 |

*Brazil, Florida, Mexico, California, New Zealand, China

*Timber*

Many species, particularly in *Carnarvonia*, *Orites*, *Darlingia*, *Cardwellia*, *Stenocarpus*, *Buckinghamia*, *Athertonia*, *Grevillea*, *Musgravea*, and to a small extent, *Hakea* and *Banksia*, are sources of ornamental cabinet-making timbers, flooring and plywood. Timber descriptions and properties are given in Bootle (1983), and an annotated bibliography of many aspects of the biology and utilisation of one of the more important timber species, *Grevillea robusta* R.Br., was compiled by Harwood (1989).

**Table 5.** Annual harvest of Australian Proteaceae for the export cut flower industry

(Source: Karingal Consultants, 1994)

| Genus | Artificially Propagated[1] No. stems (1992/93) | | Bush Picked & Managed[2] No. of stems (1993) | |
|---|---|---|---|---|
| | No. | Value(A$)[3] | No. | Value (A$)[4] |
| *Adenanthos* | 45,436 | $5452 | 788,375 | $37,893 |
| *Banksia* | 994,912 | $397,965 | 4,457,663 | $1,114,416 |
| *Conospermum* | 15,970 | N/A | 466,610 | $25,664 |
| *Dryandra* | 58,249 | $10,485 | 733,946 | $117,431 |
| *Grevillea* | 25 | $8 | 67,425 | $6,543 |
| *Hakea* | 5,067 | N/A | 223,549 | $78,244 |
| *Isopogon* | 3,143 | N/A | 10 | $1 |
| *Persoonia* | 8,407 | $1,009 | 798,558 | $87,841 |
| *Petrophile* | – | – | 300 | $30 |
| *Stenocarpus* | 220 | N/A | – | – |
| *Stirlingia* | 227,755 | N/A | 2,753,605 | $220,288 |
| *Synaphea* | – | – | 60 | $6 |
| *Telopea* | 2,338 | N/A | 3,725 | $1,118 |
| *Xylomelum* | 3,555 | N/A | 408,042 | $102,011 |
| Totals | 1,365,077 | | 10,701,868 | $1,791,486 |

[1] Figures for export only

[2] Figures cover harvesting for both export and domestic markets

[3] Calculated on average price, farm gate

[4] Price paid to pickers

*Floriculture*

Proteaceae dominate the native cut flower industry in Australia (Karingal Consultants, 1994). In 1993 10.7 million wild-collected stems of *Adenanthos*, *Banksia*, *Conospermum*, *Dryandra*, *Hakea*, *Persoonia*, *Stirlingia* and *Xylomelum*, plus some genera of lesser importance, were harvested. The numbers and values of this wild harvest are summarised in Table 5, which also contains numbers of stems harvested from cultivated plants for the export trade. Plantation-grown stock is gradually replacing wild-collected material, with an estimated 32.5 million stems being produced in 1993. This includes both native and exotic Proteaceae. Figures for this trade are given in Table 6, which also includes planting intentions for 1993/94. Clearly, this will become an increasingly important industry. The retail nursery trade also draws heavily on Australian Proteaceae. Extensive selection and hybridisation has developed many useful cultivars, particularly in *Telopea*, *Macadamia*, *Grevillea*, *Hakea* and *Banksia*. Many other essentially unmodified species are also in cultivation to varying degrees, including representatives of the genera *Persoonia*, *Petrophile*, *Isopogon*, *Adenanthos*, *Stenocarpus*, *Xylomelum* and *Dryandra*. For more details on utilisation of the family, particularly in floriculture, see Wrigley & Fagg (1989).

**Table 6.** Proteaceae in cultivation for the cut flower trade

(Source: Karingal Consultants, 1994)

| Genus | Numbers in cultivation, 1993 | | | Additional planting intentions, 1993/94 |
|---|---|---|---|---|
| | No. plants | No. stems | Value(A$) p.a. | No. plants |
| *Adenanthos* | 6,278 | 1,367,455 | $140,968 | 300 |
| *Banksia* | 152,093 | 7,604,669 | $3,041,868 | 34,000 |
| *Conospermum* | 500 | N/A | N/A | 0 |
| *Dryandra* | 30,413 | 364,959 | $65,693 | 1,600 |
| *Grevillea* | 9,039 | 180,771 | $54,231 | 700 |
| *Hakea* | 667 | N/A | N/A | 500 |
| *Isopogon* | N/A | N/A | N/A | 100 |
| *Leucadendron* | 451,320 | 13,539,599 | $2,437,128 | 77,100 |
| *Leucospermum* | 78,863 | 2,365,895 | $425,861 | 14,300 |
| *Persoonia* | 4 | 28 | $3 | 200 |
| *Protea* | 412,348 | 6,185,223 | $4,638,917 | 39,700 |
| *Serruria* | 12,305 | 369,144 | $184,572 | 2,800 |
| *Telopea* | 28,518 | 570,367 | $855,551 | 4,500 |

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## KEY TO THE GENERA OF PROTEACEAE IN AUSTRALIA

*P.H.Weston*

**1** Leaves opposite or whorled or pseudo-whorled

**2** Fruit falling at maturity, either indehiscent or a tardily dehiscent, leathery, globose follicle

**3** Flowers borne in regular, sessile, or shortly pedunculate pairs on an inflorescence axis; style tip swollen, functioning as a pollen presenter

**4** Perianth strongly zygomorphic; hypogynous glands free, 4 or 2; pericarp fleshy, red to purple to blue **33. TRIUNIA**

**4:** Perianth actinomorphic; hypogynous glands connate, forming a ring around ovary; perianth leathery, green to brown or greyish **39. MACADAMIA**

**3:** Flowers borne singly in the axils of scale leaves or leaves in racemose or capitulate inflorescences; style tip not swollen, not functioning as a pollen presenter

**5** Hypogynous glands absent; staminal filaments free or slightly adnate to the base of tepals; fruit more than 2 cm diam.; pericarp parenchymatous; rainforest trees **5. EIDOTHEA**

**5:** Hypogynous glands present; staminal filaments largely or wholly adnate to tepals; fruit less than 2 cm diam.; pericarp succulent; shrubs and small trees, mostly of sclerophyllous communities **3. PERSOONIA**

**2:** Fruit persistent on plant for several to many years, follicular, woody or cartilaginous

**6** Inflorescence a 7-flowered head, or reduced to a single flower, surrounded by a conspicuous involucre; fruit beaked, often bearing conspicuous horns or spines **40. LAMBERTIA**

**6:** Inflorescence not consistently 1- or 7-flowered, lacking an involucre; fruit not beaked nor horned nor spiny

**7** Inflorescence raceme-like, with a non-woody axis; follicle symmetrical, ellipsoidal to pear-shaped **32. XYLOMELUM**

**7:** Inflorescence cone-like, with a woody axis; follicle asymmetrical, laterally compressed **45. BANKSIA**

**1:** Leaves alternate

**8** Leaves palmately compound with 5, or occasionally 3 radiating segments; some or all of the segments themselves often pinnately compound — **17. CARNARVONIA**

**8:** Leaves simple or pinnately or bipinnately or (pseudo-)dichotomously compound

**9** Leaves (pseudo-)dichotomously dissected or compound

**10** Leaves prominently glandular; perianth basally connate to form a slender tube; free distal perianth segments more than 9 mm long — **14. FRANKLANDIA**

**10:** Leaves lacking glands; perianth segments free, less than 8 mm long — **9. STIRLINGIA**

**9:** Leaves either entire or with dentate margins or pinnately compound or divided

**11** Perianth zygomorphic

**12** Flowers sessile in dense, cone-like, globose to cylindrical inflorescences; inflorescence axis woody — **45. BANKSIA**

**12:** Flowers pedicellate to sessile, but not in cone-like inflorescences; inflorescence axis not woody

**13** Flowers borne singly along the inflorescence axis, or inflorescence umbellate or reduced to a single flower

**14** One anther and 2 half-anthers abortive; loculi of adjacent anthers coherent in bud; each half-anther apparently 1-locular; hypogynous glands absent

**15** Perianth white, blue, grey or pink; lower anther abortive; leaves entire — **12. CONOSPERMUM**

**15:** Perianth yellow; upper anther abortive; leaves usually dissected — **13. SYNAPHEA**

**14:** Anthers not as above, either all developed and fully 4-locular or 1 or 3 infertile; hypogynous glands usually present

**16** Upper stamen fertile, the other 3 reduced to staminodes; plant andromonoecious, most flowers lacking a gynoecium; fruit a follicle in which the winged seeds are oriented transversely — **1. PLACOSPERMUM**

**16:** All stamens fertile, or rarely 1 or all stamens infertile; flowers usually bisexual; fruit either not follicular or follicular but with longitudinally oriented seeds

**17** Gynoecium about half length of perianth, hooked so that tip sits in pouch of ventral tepal below ventral anther; fruit a drupe — **3. PERSOONIA**

**17:** Gynoecium about as long as perianth, exserted; fruit an achene or follicle

**18** Inflorescence reduced to a single flower which is subtended at its base by several imbricate scale leaves; leaf glands present at leaf tip or at tips of leaf lobes or over leaf surface; ovule solitary; fruit an achene — **15. ADENANTHOS**

**18:** Inflorescence usually multi-flowered or rarely reduced to a single flower (but then each flower subtended by a solitary scale leaf or completely lacking a floral bract); leaf glands absent; ovules 2 or more; fruit a follicle

**19** Inflorescence umbel-like or reduced to a single flower; axis of symmetry of gynoecium passing through anterior and posterior tepals; hairs simple, seed enclosed within a membranous envelope

**20** Ovules 2; follicle woody, 1-seeded **23. STRANGEA**

**20:** Ovules more than 2; follicle leathery or cartilaginous, multi-seeded **24. STENOCARPUS**

**19:** Inflorescence raceme-like and multi-flowered or rarely umbel-like or reduced to a single flower; axis of symmetry of gynoecium passing between tepals; hairs mostly bifid, seed not enclosed within a membranous envelope

**21** Fruit usually leathery, rarely woody, lacking secondary thickening, usually not persisting on the plant for more than a year; leaves usually flat or angular in cross-section, usually with dissimilar surfaces, rarely truly terete or unifacial **41. GREVILLEA**

**21:** Fruit with woody secondary thickening, persistent on the plant for several to many years; leaves terete or flat with similar surfaces **42. HAKEA**

**13:** Flowers borne in regular, sessile or pedunculate pairs along inflorescence axis

**22** Hypogynous glands 2, 3 or 4, free

**23** Ovary densely hairy; ovules 2

**24** Leaves with entire to dentate margins; pollen presenter ±radially symmetrical; hypogynous glands alternating with tepals; fruit drupe-like **33. TRIUNIA**

**24:** Leaves pinnatisect; pollen presenter appearing to be lateral on style tip, not radially symmetrical; hypogynous glands opposite tepals; fruit a follicle **41. GREVILLEA**

**23:** Ovary glabrous; ovules more than 2

**25** Hypogynous glands 3; axis of symmetry of gynoecium passing between tepals; follicle leathery; seed wing terminal, diaphanous **27. LOMATIA**

**25:** Hypogynous glands 4; axis of symmetry of gynoecium passing through tepals; follicle woody; seed wing surrounding embryo, opaque **22. CARDWELLIA**

**22:** Hypogynous gland solitary, mostly crescentic or annular or occasionally bifid

**26** Ovules 2; fruit 1–2

**27** Pedicels absent, each flower pair borne on a common peduncle; axis of symmetry of gynoecium passing through tepals; hairs simple; fruit indehiscent; seed not winged **34. GEVUINA**

**27:** Pedicels present; common peduncle of flower pair absent; axis of symmetry of gynoecium passing between tepals; hairs mostly bifid; fruit dehiscent either spontaneously or on drying; seed usually winged

**28** Fruit usually leathery, rarely woody, lacking secondary thickening, usually not persisting on plant for more than a year; leaves usually flat or angular in cross-section, usually with dissimilar surfaces, rarely truly terete or unifacial **41. GREVILLEA**

**28:** Fruit with woody secondary thickening, persistent on plant for several to many years; leaves terete or flat with similar surfaces **42. HAKEA**

**26:** Ovules more than 2; fruit multi-seeded

**29** Axis of symmetry of gynoecium passing through tepals, or flowers asymmetrical; flowers white to cream, sometimes appearing brownish due to hairs on outside of tepals

**30** Lower surface of leaves densely covered in persistent, appressed, shining hairs; intermediate leaves pinnate; perianth c. 3 mm long; hypogynous gland bifid **26. OPISTHIOLEPIS**

**30:** Lower surface of leaves glabrous; intermediate leaves pinnatisect; perianth 7–20 mm long; hypogynous gland crenulate **25. BUCKINGHAMIA**

**29:** Axis of symmetry of gynoecium passing between tepals; flowers bilaterally symmetrical, red (very rare individuals can have white or yellow flowers)

**31** Inflorescence not surrounded by involucral bracts; style gently curved **28. ALLOXYLON**

**31:** Inflorescence surrounded by an involucre of enlarged, sometimes brightly coloured bracts; style strongly curved or bent **29. TELOPEA**

**11:** Perianth actinomorphic

**32** Style tip not differentiated from the rest of the style as a pollen presenter, not swollen

**33** Hypogynous glands 4

**34** Inflorescence racemose, the flowers borne singly in the axils of scale leaves or leaves, frequently growing on into a leafy shoot; fruit a drupe; tepals most frequently yellow, less commonly white, green or marked with red

**35** Leaf margins dentate; posterior anther terminated by a much longer appendage than the lateral or anterior anthers; staminal filaments adnate to tepals only at the base **7. CENARRHENES**

**35:** Leaf margins entire; anthers similar, with or without appendages; staminal filaments largely or wholly adnate to tepals

**36** Anthers and anther appendage gently incurved; endocarp subtransversely ribbed **2. ACIDONIA**

**36:** Anthers straight or recurved to revolute; anther appendage straight to recurved or absent; endocarp smooth **3. PERSOONIA**

**34:** Inflorescence a pseudo-raceme but the flowers borne on the inflorescence axis in lateral pairs subtended by prominent, often striped scale leaves, not growing on into a leafy shoot; fruit a follicle; tepals white to cream

**37** Ovules 2; intermediate leaves simple, entire to dentate or pinnatisect **18. ORITES**

**37:** Ovules 6–8; intermediate leaves pinnate **19. NEORITES**

**33:** Hypogynous glands absent

**38** Flowers ebracteate **4. BELLENDENA**

**38:** Flowers each borne in the axil of a scale leaf

**39** Fruit a follicle; intermediate leaves pinnate; some flowers lacking a gynoecium; rainforest trees [north-eastern Qld] **16. SPHALMIUM**

**39:** Fruit indehiscent; leaves simple, entire to pinnatisect; flowers bisexual; small trees or shrubs, usually in sclerophyllous communities [southern Australia]

**40** Leaves pinnatisect **8. SYMPHIONEMA**

**40:** Leaves entire

**41** Perianth tubular at base; fruit not winged **12. CONOSPERMUM**

**41:** Perianth not tubular at base; fruit prominently winged **6. AGASTACHYS**

**32:** Style tip differentiated from the rest of the style as a pollen presenter, usually swollen

**42** Flowers borne singly in the axils of fleshy bracts in a dense cone-like inflorescence; fruit a nut; ovule solitary

**43** Cone scales falling with the fruits; nut not strongly compressed **11. ISOPOGON**

**43:** Cone scales adhering firmly to the inflorescence axis and opening to release the flattened nuts **10. PETROPHILE**

**42:** Flowers borne in lateral pairs on the inflorescence axis; inflorescence raceme-like or dense and cone-like; fruit dehiscent or indehiscent but then usually with a succulent, outer mesocarp, rarely indehiscent and dry; ovules more than 1

**44** Flowers sessile, densely packed in heads or cone-like, globose or cylindrical inflorescences

**45** Bracts surrounding base of inflorescence enlarged, imbricate, forming a prominent involucre **46. DRYANDRA**

**45:** Bracts surrounding base of inflorescence either absent or inconspicuous, not enlarged **45. BANKSIA**

**44:** Flowers either pedicellate or sessile (but then not densely packed in heads or cone-like inflorescences)

**46** Hypogynous glands fused to form a single, annular or horse shoe-shaped nectary; ovary usually stipitate

**47** Inflorescence a 2–8-flowered umbel, or reduced to a single flower; axis of symmetry of gynoecium passing through anterior and posterior tepals; hairs simple, seed enclosed within a membranous envelope **23. STRANGEA**

**47:** Inflorescence raceme-like and multi-flowered or rarely umbel-like or reduced to a single flower; axis of symmetry of gynoecium passing between tepals; hairs mostly bifid, seed not enclosed within a membranous envelope

**48** Fruit usually leathery, rarely woody, lacking secondary thickening, usually not persisting on the plant for more than a year; leaves usually flat or angular in cross-section, usually with dissimilar surfaces, rarely truly terete or unifacial **41. GREVILLEA**

**48:** Fruit with woody secondary thickening, persistent on plant for several to many years; leaves terete or flat with similar surfaces **42. HAKEA**

**46:** Hypogynous glands distinct, free or basally fused to form a 4-lobed ring; ovary sessile

**49** Hypogynous glands 3; pollen grains 2-porate, curved-ellipsoidal

**50** Mature, hardened leaves glabrous; inflorescence 30–90 cm long, pendulous; perianth c. 20 mm long; intermediate leaves pinnate **44. AUSTROMUELLERA**

**50:** Mature, hardened leaves densely and finely tomentose underneath; inflorescence to 20 cm long, ascending to erect; perianth c. 5 mm long; intermediate leaves simple although sometimes deeply lobed **43. MUSGRAVEA**

**49:** Hypogynous glands 4; pollen grains 3-porate, 3-angled

**51** Adult leaves pinnate, often with a winged rachis **35. HICKSBEACHIA**

**51:** Adult leaves simple, entire to pinnatifid

**52** Ovules more than 2; seeds 2 or more

**53** Inflorescence spreading to erect; tepals cream; ovules 4; seeds winged **21. DARLINGIA**

**53:** Inflorescence pendulous; tepals pink to mauve or red; ovules more than 4; seeds not winged **30. HOLLANDAEA**

**52:** Ovules 2; seeds 1 or 2

**54** Pollen presenter only slightly thicker than the more proximal part of the style; fruit a follicle; seeds 2, winged

**55** Inflorescence ramiflorous, borne on the branches below the leaves; tepals 22–29 mm long; intermediate and some adult leaves with amplexicaul bases **20. MEGAHERTZIA**

**55:** Inflorescence axillary or terminal; tepals 4–8.5 mm long; leaf bases tapered **18. ORITES**

**54:** Pollen presenter c. twice as thick as the more proximal part of the style; fruit indehiscent; seed solitary, not winged

**56** Leaves entire throughout life cycle; fruit brown or red when mature

**57** Plant completely glabrous; tepals pink to red; fruit red; outer pericarp succulent; inner pericarp bony **37. CATALEPIDIA**

**57:** Young stems and outer surface of tepals hairy; tepals cream; fruit brown; pericarp bony **38. FLOYDIA**

**56:** Leaves with toothed margins present in juvenile phase and usually also in adults; sometimes adult leaves entire; fruit pinkish blue to deep blue to purple or black

**58** Ovules orthotropous; intermediate leaves deeply pinnatifid; tepals 19–23 mm long; inflorescence 15–34 cm long; fruit lenticular, 3.6–4.1 cm long **36. ATHERTONIA**

**58:** Ovules anatropous; intermediate leaves not lobed; tepals 6–18 mm long; inflorescence 4–17 cm long; fruit ovoid to globose, 0.6–1.4 cm long **31. HELICIA**

## Subfam. 1. PERSOONIOIDEAE

*P.H.Weston*

*Proteaceae* subfam. *Persoonioideae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 170 (1975).

Type: *Persoonia* Sm.

Sclerophyllous shrubs or small trees, rarely rainforest trees. Proteoid roots absent. Leaves simple, pinnatifid or entire. Inflorescence basically racemose, rarely branching ('paniculate'), bracteate. Flowers actinomorphic or zygomorphic, not in regular pairs. Staminal filaments largely or wholly adnate to tepals. Hypogynous glands usually 4, equal, or occasionally with posterior glands reduced or absent. Style tip not modified as a pollen presenter. Ovules 1–2 or many, orthotropous. Fruit a drupe or follicle. Chromosomes very large, 7–17 µm long at mitotic metaphase; mostly $n = 7$, rarely $n = 14$.

A subfamily of 5 genera and 102 species, mainly Australian but with a monospecific genus in New Caledonia and another in New Zealand. In Australia 3 genera and 100 species, all endemic. The majority are shrubs or trees of sclerophyllous communities, but with a few confined to rainforest.

## Trib. 1. PLACOSPERMEAE

*Proteaceae* trib. *Placospermeae* C.T.White & W.D.Francis, *Proc. Roy. Soc. Queensland* 35: 79 (1924).

*Proteaceae* subtrib. *Placosperminae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 170 (1975). T: *Placospermum* C.T.White & W.D.Francis

Juvenile leaves mostly pinnatifid; seedling and adult leaves entire. Flowers andromonoecious. Posterior stamen fertile; other stamens infertile. Hypogynous glands narrowly triangular, scarcely fleshy. Fruits follicular; endocarp woody, developed from the inner epidermis but not extending between the seeds. Seeds numerous, flat, winged on both sides, transversely oriented in follicle; embryo terminal. Cotyledons obreniform, shortly stalked, flat. $n = 7$.

A monogeneric tribe, the only species being a rainforest tree of north-eastern Qld.

## 1. PLACOSPERMUM

*Placospermum* C.T.White & W.D.Francis, *Proc. Roy. Soc. Queensland* 35: 79 (1924); from the Greek *plax, plakos* (a flat body), and *sperma* (a seed), alluding to the flat, winged seeds.

Type: *P. coriaceum* C.T.White & W.D.Francis

Trees. Leaves alternate, shortly petiolate, with brochidodromous venation. Inflorescence elongate, terminal and lateral, mostly paniculate, with 1–2 orders of branching, or rarely racemose, anauxotelic; ultimate branches racemose. Flowers zygomorphic, andromonoecious, subtended by scale leaves. Tepals free, curved to anterior. Hypogynous glands 4, subequal. Staminal filaments adnate to tepals. Fertile anther linear-oblong, introrse; connective slightly wider than loculi, extending beyond loculi as terminal appendage. Staminodes resembling stamen but narrower. Gynoecium absent in male flowers; ovary obloid, sessile; style curved to anterior; stigma anterolateral. Ovules and seeds 15–22. Follicle dorsiventrally compressed-ovoid to -ellipsoidal. Cotyledons 2. $n = 7$, L.A.S.Johnson & B.G.Briggs, *Austral. J. Bot.* 11: 24 (1963).

A monospecific genus, endemic in Australia.

C.Venkata Rao, Studies in the Proteaceae II. Tribes Placospermeae and Conospermeae, *Proc. Natl Inst. Sci. India* 27B: 126–151 (1961); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 511–512 (1989).

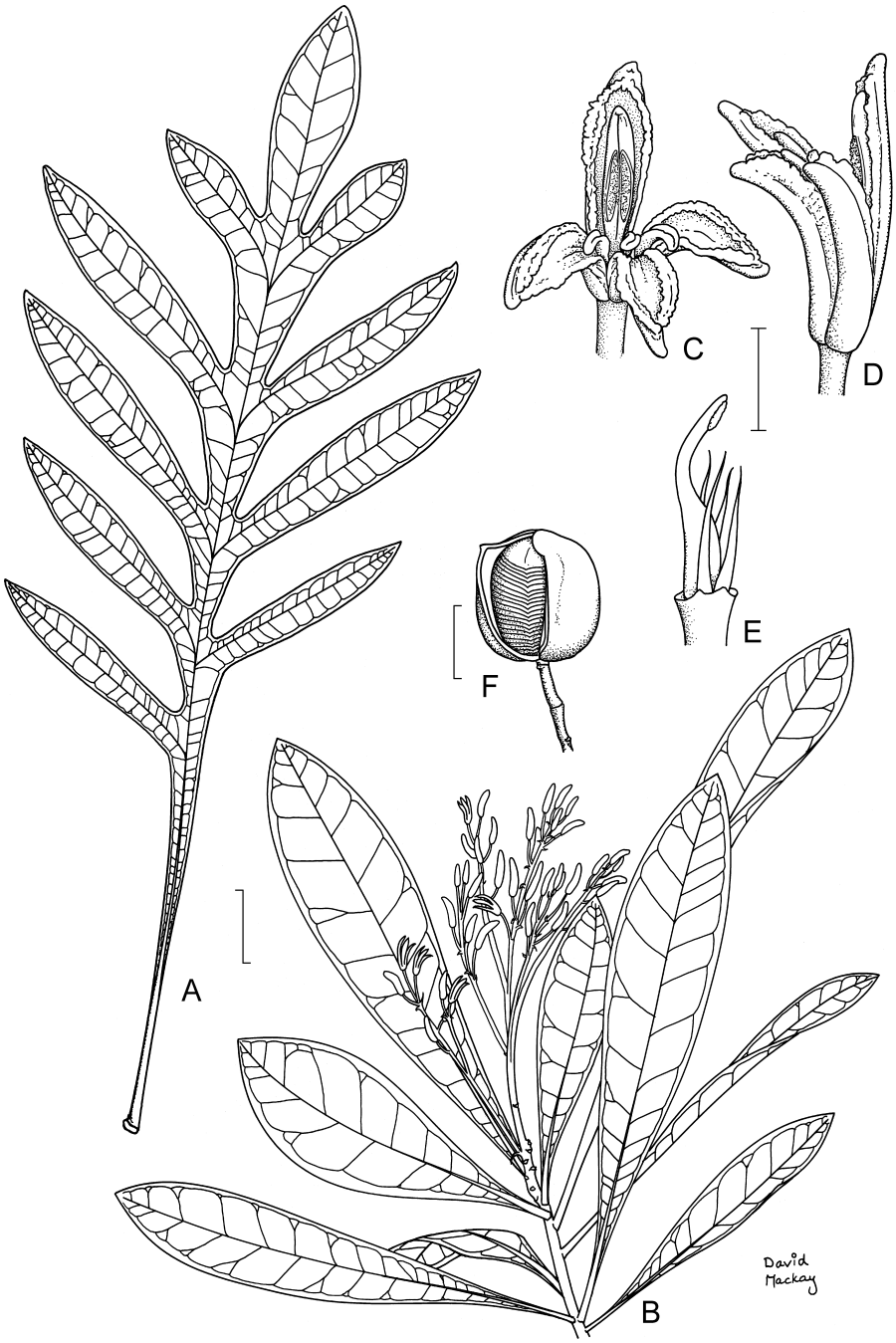



**Figure 36.** *Placospermum coriaceum*. **A**, juvenile leaf (B.Hyland 5346, QRS); **B**, shoot with inflorescence (B.Hyland 10632, NSW); **C**, male flower, front view; **D**, male flower, side view (**C–D**, from photographs of a plant cultivated at Royal Botanic Gardens, Sydney, N.S.W.); **E**, gynoecium with hypogynous glands (**E**, B.Gray 2803, NSW); **F**, follicle (B.Gray 2070, NSW). Scale bars: **A** = 4 cm; **B**, F = 2 cm; **C–E** = 5 mm. Drawn by D.Mackay.

**Placospermum coriaceum** C.T.White & W.D.Francis, *Proc. Roy. Soc. Queensland* 35: 79 (1924)

T: Mt Alexander, near Daintree, Qld, *coll. unknown*; holo: BRI 011421.

Illustration: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 518 (1989).

Tree 7–30 m tall; glabrous except for pubescent scale leaves and immature stems and petioles. Leaves with slightly recurved margins; intermediate leaves shallowly to deeply 2–10-lobed or entire and narrowly spathulate, to 80 cm long, to 24 cm wide; adult leaves narrowly spathulate to oblanceolate, acute to rounded, 8–25 cm long, 1.6–4.3 cm wide. Inflorescence 2.5–11 cm long; ultimate branches 1–18-flowered. Flowers pink, not opening widely. Posterior tepal 18–20 mm long in bisexual flowers, 12–15 mm long in male flowers. Anther loculi 5–7 mm long; appendage 2–3 mm long. Hypogynous glands 3–5 mm long. Gynoecium 8–9 mm long. Follicle 28–40 mm long, 28–38 mm wide, 22–25 mm thick. Cotyledons 13–20 mm long, 23–30 mm wide. Figs 2, 36.

Occurs in rainforest from 180 to 1500 m alt., between the Big Tableland and Mt Bellenden Ker, northern Qld. Flowers Oct.–Nov. Map 3.

Qld: Timber Reserve 165, Alexandra Logging Area, *B.P.M.Hyland 10632* (NSW, QRS); Mt Lewis Rd, 28 km from Rex Hwy, *P.H.Weston 637* (NSW); Kuranda, *L.J.Webb & J.G.Tracey 5713* (BRI); State Forest Reserve 185, Robson Logging Area, *B.Gray 2803* (NSW, QRS); summit of Mt Bellenden Ker, *B.P.M.Hyland 5346* (BRI, QRS).

## Trib. 2. PERSOONIEAE

*Proteaceae* trib. *Persoonieae* Rchb., *Consp.* 81 (1828).

*Proteaceae* subtrib. *Persooniinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 170 (1975). T: *Persoonia* Sm.

All leaves entire. Flowers bisexual. Stamens usually all fertile or, rarely, anterior stamen infertile. Hypogynous glands short, thick. Fruits drupaceous; endocarp woody, developed from the inner epidermis and penetrating between the seeds. Seeds 1–many, longitudinally or obliquely oriented in drupe, ovoid, rarely somewhat compressed, lacking wings. Cotyledons elliptic to linear, sessile, semicircular to triangular in cross-section. $n = 7$, rarely 14.

A tribe of 4 genera and 101 species in Australia, New Zealand and New Caledonia. In Australia, 2 genera and 99 species, all endemic, and comprising shrubs and small trees, mainly from sclerophyllous communities but some extending to alpine or semiarid zones.

This circumscription of *Persoonieae* is identical to an earlier definition of subtribe Persooniinae (P.H.Weston, *Telopea* 6: 51–165, 1994). However, this taxon has had to be elevated to the tribal rank because of the exclusion, here, of *Bellendena* from Persoonioideae.

## 2. ACIDONIA

*Acidonia* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 175 (1975); from the Greek *akis, akidos* (a point), alluding to the connective appendage, and the ending *-onia* to suggest affinity with *Persoonia*.

Type: *A. microcarpa* (R.Br.) L.A.S.Johnson & B.G.Briggs

Shrubs. Leaves alternate, sessile. Inflorescence lateral, abbreviated, anauxotelic. Flowers subtended by scale leaves. Perianth actinomorphic; tepals free. Stamens all fertile; filaments adnate to tepals; anthers slightly incurved, flattened; connective slightly wider than loculi, extending beyond loculi as a rounded, slightly concave appendage. Hypogynous glands 4, equal. Gynoecium longer than stamens; ovary contracted at base, sessile; style recurved at tip but otherwise straight; ovules 2. Pyrene transversely ribbed; seed 1. Cotyledons 2.

A monospecific genus, endemic in south-western Australia. The generic circumscription adopted here is radically different to that of Johnson & Briggs (*ibid.*). Those authors

included *Persoonia* groups *Rufiflora*, *Dillwynioides*, *Graminea*, *Chapmaniana* and *Quinquenervis* in their concept of *Acidonia*. *Acidonia microcarpa* has a taxonomically basal position in the Persoonieae, most probably being the sister group of *Persoonia* or of *Toronia* and *Garnieria*.

P.H.Weston, The Western Australian species of subtribe Persooniinae (Proteaceae: Persoonioideae: Persoonieae), *Telopea* 6: 51–165 (1994).

**Acidonia microcarpa** (R.Br.) L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 175 (1975)

*Persoonia microcarpa* R.Br., *Trans. Linn. Soc. London* 10: 160 (1810); *Linkia microcarpa* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Princess Royal Harbour to King George Sound [W.A.], *R.Brown (Britten 329I)*; lecto: BM; isolecto: BM, K, NSW, *fide* P.H.Weston, *Telopea* 6: 88 (1994).

Erect shrub 0.6–3 m tall. Bark smooth, compact. Hairs of moderate length, appressed to antrorse, greyish to mid-brown. Young branchlets moderately to densely hairy. Leaves not twisted, linear, mostly 6–13 cm long, 0.7–1.7 mm wide, prominently convex when fresh, with revolute margins when dried, with obscure venation, often sinuate, mostly spreading to suberect, not pungent, concolorous, green, sparsely to densely hairy when immature, glabrescent, smooth. Inflorescence 1–4-flowered; rachis to 10 mm long. Pedicels 2–5 mm long. Tepals 8–12 mm long, bright yellow, acute, moderately hairy. Anthers bright yellow; appendage 0.6–1 mm long. Gynoecium 7.5–9.5 mm long. Pyrene compressed-ellipsoidal, 4–4.5 mm long, c. 2.5 mm wide. Figs 3, 37A–D.

Occurs within 50 km of the coast, from Margaret River to Albany, south-western W.A.; grows in peaty, poorly drained sand, surrounding bogs or creeks, usually in thicket or swamp-heath communites dominated by sedges and Myrtaceous shrubs; in small populations. Flowers Oct.–Dec. Map 4.

W.A.: Scott R., *E.Wittwer 2256* (PERTH); 11.1 km S of Northcliffe, on road to Windy Harbour, *P.H.Weston 218* (SYD); 16 km NW of Mt Manypeaks, *K.Newbey 2736* (PERTH).

## 3. PERSOONIA

*Persoonia* Sm., *Trans. Linn. Soc. London* 4: 215 (1798), *nom. cons.*; named in honour of Dutch mycologist and botanist Christiaan Hendrik Persoon (1761/62–1836).

Type: *P. lanceolata* Andrews

*Linkia* Cav., *Icon.* 4: 61 (1797), *nom. rej.* vs. *Persoonia* Sm. T: *L. levis* Cav.

*Pentadactylon* C.F.Gaertn., *Suppl. Carp.* 3: 219 (1807). T: *P. angustifolium* C.F.Gaertn.

*Pycnonia* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 175 (1975). T: *P. teretifolia* (R.Br.) L.A.S.Johnson & B.G.Briggs

Shrubs or small trees. Leaves alternate or rarely opposite or whorled, sessile to shortly petiolate. Inflorescence terminal or lateral, abbreviated to elongate, anauxotelic or auxotelic. Flowers subtended by scale leaves or leaves. Perianth actinomorphic or zygomorphic; tepals free but usually coherant towards base. Stamens usually all fertile or rarely anterior stamen infertile; filaments adnate to tepals, sometimes free at tips; anthers straight or recurved, rarely flattened; connective narrower or wider than loculi. Hypogynous glands 2 or 4; anterior pair equal to posterior pair or much reduced or absent. Gynoecium longer or shorter than stamens; ovary shortly stipitate or not contracted at base; style straight or slightly sinuous or prominently recurved; ovules 1 or 2. Pyrene smooth; seeds 1 or 2. Cotyledons 2–9. $n = 7$ (11 species studied), H.P.Ramsay, *Austral. J. Bot.* 11: 4 (1963).

A genus of 98 species, all endemic in Australia. *Persoonia* extends only marginally into the arid zone, with 16 species occurring in areas that receive less than 25 mm annual rainfall. Of these 15 occur in south-western Australia, only 2 of which, *P. pertinax* and *P. leucopogon*, have wholly arid distributions. *Persoonia* is most diverse in the subtropics, in areas of topographic and edaphic complexity, particularly the sandplains of south-western Australia and the coastal plain and Great Dividing Range of south-eastern Australia. Several species

reach the alpine zone in Tas. and the Australian Alps but few occur above 1500 m altitude.

The circumscription of *Persoonia* adopted here differs substantially from that proposed by Johnson & Briggs (*loc. cit.*). My concept of *Persoonia* subsumes the genus *Pycnonia* L.A.S.Johnson & B.G.Briggs and includes all but one of the species included by Johnson & Briggs in *Acidonia*.

A.E.Orchard, The Tasmanian species of *Persoonia* Smith (Proteaceae), *Brunonia* 6: 217–240 (1983); A.S.George, *Intr. Proteaceae W. Australia* 90–93 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 574–597 (1989); S.L.Krauss & L.A.S.Johnson, A revision of the complex species *Persoonia mollis* (Proteaceae), *Telopea* 4: 185–199 (1991); P.H.Weston & L.A.S.Johnson, Taxonomic changes in *Persoonia* (Proteaceae) in New South Wales, *Telopea* 4: 269–306 (1991); P.H.Weston & L.A.S.Johnson, Three new species of *Persoonia* (Proteaceae) from Queensland, *Telopea* 6: 31–37 (1994); P.H.Weston, The Western Australian species of subtribe Persooniinae (Proteaceae: Persoonioideae: Persoonieae), *Telopea* 6: 51–165 (1994).

**1** Perianth zygomorphic; gynoecium about half length of stamens and hooked so that tip sits in pouch of ventral tepal below ventral anther

**2** Bark lamellose-flaky, deeply fissured; leaves slightly to strongly falcate [tropical W.A., N.T., Qld] **89. P. falcata**

**2:** Bark smooth and compact, sometimes fissured or slightly flaky at base; leaves straight to slightly falcate [south-western W.A.]

**3** Hypogynous glands 2 or 4; dorsal pair much reduced or absent; anthers white

**4** Perianth moderately hairy on outside

**5** Leaves subterete, grooved underneath **90. P. biglandulosa**

**5:** Leaves flat

**6** Leaves with recurved or revolute margins; flowers mostly subtended by leaves; rachis 7–25 cm long **91. P. brachystylis**

**6:** Leaves margins not recurved; flowers mostly subtended by scale leaves and leaves; rachis to 1 cm long **92. P. kararae**

**4:** Perianth glabrous to sparsely hairy on outside

**7** Leaves flat, without prominent parallel veins **93. P. stricta**

**7:** Leaves dorsiventrally flattened, with 2 or 4 grooves on both surfaces, or ±triangular in cross-section with 2 grooves on both surfaces, or ±triangular to ventrally plano-convex in cross-section without grooves, or ±subterete with single groove underneath **94. P. saundersiana**

**3:** Hypogynous glands 4, equal; anthers yellow or yellow with white tips

**8** Leaves terete; ventral tepal shallowly saccate **95. P. teretifolia**

**8:** Leaves subterete and grooved underneath or flat to compressed; ventral tepal deeply saccate

**9** Leaves more than 2.5 mm wide **96. P. comata**

**9:** Leaves less than 2 mm wide

**10** Tepals hairy; anthers yellow with white tips **97. P. saccata**

**10:** Tepals glabrous; anthers yellow **98. P. hakeiformis**

**1:** Perianth actinomorphic; gynoecium exserted, equal to or slightly longer or shorter than stamens

**11** Anther connective extending beyond loculi as an appendage [W.A.]

**12** Broadest leaves more than 2 mm wide

**13** Leaves opposite-decussate, broadly cordate; width equal to or greater than length **69. P. cordifolia**

**13:** Leaves mostly alternate, not cordate, longer than wide

**14** Ovary densely hairy **76. P. trinervis**

**14:** Ovary glabrous

**15** Longest leaves more than 8 cm long

**16** Tepals more than 10 mm long; erect shrub or small tree to 5 m, with lamellose-flaky bark **7. P. longifolia**

**16:** Tepals less than 5 mm long; erect to decumbent herb or weak shrub to 0.6 m, with smooth bark **72. P. graminea**

**15:** Leaves less than 8 cm long

**17** Leaves mostly more than 10 mm wide; inflorescences anauxotelic, terminal or occasionally subterminal; rachis 1–6 cm long; flowers subtended by scale leaves; plants prostrate **73. P. micranthera**

**17:** Leaves less than 10 mm wide; inflorescences auxotelic or sometimes anauxotelic but then usually axillary and rachis less than 1 mm long; flowers subtended by scale leaves or leaves; plants erect to spreading

**18** Inflorescences usually auxotelic, terminal to axillary; flowers subtended by scale leaves or leaves; anthers yellow when fresh; cotyledons more than 2

**19** Leaves without prominent parallel veins, often pungent, often narrow but never linear

**20** Anther appendage 1.2–2 mm long, recurved through 90–180°; anther loculi introrse

**21** Tepals moderately glandular-hairy on outside, 9–13 mm long; pedicels 3.5–9 mm long; young branchlets covered with incurved-patent hairs **81. P. spathulata**

**21:** Tepals glabrous to moderately covered in non-glandular hairs on outside, 6.5–10 mm long; pedicels 1.5–4.5 mm long; young branchlets covered with antrorsely spreading hairs **82. P. scabra**

**20:** Anther appendage 0.3–0.5 mm long, not recurved; anther loculi sublatrorse **71. P. flexifolia**

**19:** Leaves with 3–13 prominent, parallel veins or without prominent parallel veins but then linear, not pungent

**22** Anther appendage 0.4–1 mm long, recurved through less than 90° **83. P. quinquenervis**

**22:** Anther appendage 1.4–2.8 mm long, recurved through 90–180° **84. P. striata**

**18:** Inflorescences anauxotelic, axillary; flowers subtended by scale leaves; anthers white when fresh; cotyledons 2

**23** Pedicels obsolete; leaves with 3 prominent, parallel veins on upper surface **3. P. rufiflora**

**23:** Pedicels 1.5–5 mm long; leaves without prominent, parallel veins **2. P. brevirhachis**

**12:** Leaves less than 2 mm wide

**24** Ovary densely hairy

**25** Tepals glabrous **74. P. chapmaniana**

**25:** Tepals moderately to densely hairy

**26** Leaves concave, with no other grooves or prominent, parallel veins **87. P. rudis**

**26:** Leaves subterete to compressed but not concave, with 6 prominent, parallel veins

**27** Leaves pungent **79. P. bowgada**

**27:** Leaves not pungent

**28** Inflorescences 1–4-flowered; flowers mostly subtended by scale leaves; leaves smooth to slightly scaberulous **77. P. angustiflora**

**28:** Inflorescences 1–20-flowered; flowers subtended by scale leaves and leaves; leaves scabrous **78. P. papillosa**

**24:** Ovary glabrous or, rarely, sparsely hairy

**29** Anther appendage less than 1 mm long, either not recurved or recurved less than 90°

**30** Leaves with recurved to revolute margins (sometimes subterete and grooved underneath); anthers white

**31** Leaves without prominent veins, circular in cross-section but with longitudinal groove on undersurface; pedicels 1–2.5 mm long **1. P. inconspicua**

**31:** Leaves with 3 prominent veins on upper surface or at least somewhat angular in cross-section; pedicels obsolete **3. P. rufiflora**

**30:** Leaves without recurved to revolute margins; anthers yellow

**32** Longest leaves more than 2.5 cm long

**33** Leaves pungent, scabrous, ±terete, with 5 prominent, parallel veins; ovules 2; inflorescences anauxotelic **75. P. pentasticha**

**33:** Leaves not pungent, smooth to scaberulous, if subterete then with 8 prominent, parallel veins; ovule 1; inflorescences mostly auxotelic **83. P. quinquenervis**

**32:** Leaves less than 2.5 cm long

**34** Leaves concave to subterete and involute **70. P. dillwynioides**

**34:** Leaves flat to subterete but not involute

**35** Leaves flat to slightly concave or convex, without prominent, parallel veins, sharp but not pungent, 1.8–3 mm wide; ovules 2 **71. P. flexifolia**

**35:** Leaves compressed to subterete, with 4 or 6 prominent, parallel veins, pungent, 0.6–1 mm wide; ovule 1 **86. P. acicularis**

**29:** Anther appendage more than 1 mm long, recurved through 90–180°

**36** Longest leaves more than 5 cm long; tepals sparsely to moderately hairy **80. P. hexagona**

**36:** Leaves less than 5 cm long; tepals glabrous

**37** Anther appendage filiform **88. P. filiformis**

**37:** Anther appendage obtuse or acute

**38** Leaves pungent **85. P. sulcata**

**38:** Leaves sometimes sharp but never pungent **84. P. striata**

**11:** Anther appendage absent [all states except N.T.]

**39** Widest leaves less than 2 mm wide

**40** Ovary moderately to densely hairy

**41** Prostrate shrubs; leaves smooth to slightly scaberulous **48. P. chamaepitys**

**41:** Erect to spreading shrubs; leaves smooth to scabrous

**42** Leaves 0.5–1.4 cm long, recurved **47. P. hirsuta**

**42:** Leaves mostly 1.5–4.5 cm long, not recurved

**43** Leaves flat to concave; ovary moderately hairy [W.A.] **65. P. cymbifolia**

**43:** Leaves convex with revolute margins to subterete and grooved underneath; ovary densely hairy [eastern Australia]

**44** Hairs mostly patent **50. P. fastigiata**

**44:** Hairs mostly appressed to antrorsely spreading **51. P. subtilis**

**40:** Ovary glabrous

**45** Leaves ±terete, with 5 prominent, parallel veins, scabrous **75. P. pentasticha**

**45:** Leaves flat or compressed or concave or terete, either not grooved or with a single longitudinal groove on upper or lower surface, smooth to scabrous

**46** Leaves twisted, often asymmetrical [W.A.]

**47** Longest leaves more than 2.5 cm long

**48** Leaves twisted through 90° to 6 complete turns **63. P. helix**

**48:** Leaves twisted at base through 90° **64. P. pertinax**

**47:** Longest leaves less than 2.5 cm long

**49** Leaves sharp but not pungent, glaucous; tepals densely hairy **66. P. leucopogon**

**49:** Leaves pungent, not glaucous; tepals glabrous **67. P. pungens**

**46:** Leaves not twisted [south-eastern Australia]

**50** Leaves pungent **14. P. juniperina**

**50:** Leaves sometimes sharp but not pungent

**51** Widest leaves less than 1 mm wide, subterete or terete

**52** Leaves strongly scabrous **52. P. curvifolia**

**52:** Leaves smooth to finely scabrous

**53** Leaves 3–7 cm long; inflorescences anauxotelic; flowers subtended by reduced leaves **60. P. pinifolia**

**53:** Leaves mostly less than 3 cm long; inflorescences auxotelic; flowers mostly subtended by full-sized leaves

**54** Tepals moderately to densely hairy; leaves 0.8 mm wide or more **55. P. mollis**

**54:** Tepals glabrous to sparsely hairy; leaves c. 0.5 mm wide or less

**55** Tepals prominently caudate with dorsal tails **18. P. acerosa**

**55:** Tepals obtuse or apiculate

**56** Leaves subterete and slightly grooved on upper surface when living **17. P. tenuifolia**

**56:** Leaves terete **61. P. isophylla**

**51:** Widest leaves more than 1 mm wide, mostly flat or compressed

**57** Leaves narrowly to linear-spathulate, strongly scabrous **53. P. cuspidifera**

**57:** Leaves linear to narrowly oblong to narrowly elliptic to narrowly lanceolate, smoothly to strongly scabrous

**58** Longest leaves 0.4–1 cm long, narrowly oblong; inflorescences anauxotelic **26. P. terminalis**

**58:** Longest leaves more than 1 cm long, linear-oblong or lanceolate to linear-lanceolate; inflorescences mostly auxotelic

**59** Pedicels and tepals glabrous

**60** Leaves slightly to strongly discolorous, flat or convex with recurved margins

**61** Leaves mostly lanceolate to linear-lanceolate **27. P. bargoensis**

**61:** Leaves linear-oblong

**62** Erect to spreading shrub; leaves 1.5–4.5 cm long, strongly discolorous **28. P. nutans**

**62:** Prostrate or decumbent shrub; leaves 0.8–1.5 cm long, slightly discolorous **29. P. laxa**

**60:** Leaves concolorous, flat to slightly concave

**63** Decumbent or prostrate shrubs; leaves 0.8–2.5 cm long **15. P. chamaepeuce**

**63:** Erect or rarely prostrate shrubs; leaves 2–5 cm long **16. P. virgata**

**59:** Pedicels and tepals hairy, tepals sometimes only sparsely so

**64** Prostrate shrubs **15. P. chamaepeuce**

**64:** Erect to spreading shrubs

**65** Leaves concave **14. P. juniperina**

**65:** Leaves flat to convex

**66** Bark lamellose-flaky; leaves flat, sometimes slightly convex **59. P. linearis**

**66:** Bark smooth; leaves convex to revolute or subterete

**67** Leaves strongly scabrous, usually curved upwards, concolorous **52. P. curvifolia**

**67:** Leaves smooth to scaberulous, not consistently curved upwards, strongly discolorous **55. P. mollis**

**39:** Widest leaves more than 2 mm wide

**68** Ovary glabrous

**69** Tepals with prominent lateral flaps [Tas.]

**70** Prostrate shrubs; leaves 0.6–1.5 cm long **13. P. moscalii**

**70:** Erect shrubs; leaves 1–6 cm long

**71** Tepals 10–13.5 mm long, white to cream **11. P. gunnii**

**71:** Tepals 15–22 mm long, cream to yellow **12. P. muelleri**

**69:** Tepals lacking lateral flaps [mainland Australia]

**72** Longest leaves less than 2.5 cm long

**73** Leaves twisted through 0–360° and/or consistently asymmetrical [W.A.]

**74** Tepals densely hairy **66. P. leucopogon**

**74:** Tepals glabrous

**75** Leaves spathulate to narrowly spathulate, not pungent **68. P. baeckeoides**

**75:** Leaves elliptic, narrowly elliptic or narrowly oblong, pungent **67. P. pungens**

**73:** Leaves not twisted [south-eastern Australia]

**76** Leaves widest above middle

**77** Mature leaves smooth to slightly scaberulous, or softly hairy **55. P. mollis**

**77:** Mature leaves strongly scabrous

**78** Widest leaves less than 5.5 mm wide, concolorous; pedicels 2–5 mm long **53. P. cuspidifera**

**78:** Widest leaves more than 5.5 mm wide, concolorous to slightly discolorous; pedicels 1–3 mm long **54. P. rigida**

**76:** Leaves mostly widest at or below middle

**79** Tepals prominently caudate with dorsal, recurved tails **19. P. myrtilloides**

**79:** Tepals apiculate to shortly caudate with terminal tails

**80** Pedicels erect, moderately to densely hairy **55. P. mollis**

**80:** Pedicels mostly spreading to recurved, glabrous to moderately hairy

**81** Tepal tips shortly caudate **20. P. brevifolia**

**81:** Tepal tips acute to apiculate

**82** Mature leaves scabrous with antrorse to patent hairs; leaves convex with recurved to revolute margins **25. P. microphylla**

**82:** Mature leaves smooth and glabrescent to scaberulous with appressed to antrorse hairs; leaves flat with flat to recurved margins

**83** Pedicels sparsely to moderately hairy; tepals glabrous to moderately hairy; leaves sparsely to moderately hairy when immature, remaining so when mature **24. P. asperula**

**83:** Pedicels and tepals glabrous (or rarely pedicels very sparsely hairy); leaves sparsely, rarely moderately, hairy when immature, glabrescent to sparsely hairy when mature

**84** Longest leaves 1.1 cm long or less **23. P. oxycoccoides**

**84:** Longest leaves more than 1.1 cm long

**85** Leaves usually strongly discolorous, with recurved margins, 2.5–8.5 mm wide **21. P. acuminata**

**85:** Leaves concolorous to slightly discolorous, with flat to slightly recurved margins, 1.2–3.5 mm wide **22. P. recedens**

**72:** Longest leaves more than 2.5 cm long

**86** Bark lamellose-flaky, rough ('paper bark')

**87** Leaves straight, not twisted, 2–9 cm long, 1–7 mm wide **59. P. linearis**

**87:** Leaves slightly to strongly asymmetrical, usually twisted at base so that lamina is held in a vertical plane, 6–20 cm long, 2–80 mm wide

**88** Gynoecial abscission zone at base of stipe; leaves 13–80 mm wide; cotyledons more than 2 [south-eastern Australia] **58. P. levis**

**88:** Gynoecial abscission zone $^{1}/_{3}$–$^{2}/_{3}$ way up stipe; leaves 2–16 mm wide; cotyledons 2 [W.A.] **7. P. longifolia**

**86:** Bark compact, smooth or corky, sometimes fissured or finely flaky on main stems

**89** Pedicels recurved (or rarely spreading if less than 3 mm long)

**90** Tepals prominently caudate; pedicels sparsely to moderately hairy, 2–10 mm long; leaf margins recurved **19. P. myrtilloides**

**90:** Tepals apiculate to shortly caudate; pedicels glabrous, 9–23 mm long; leaf margins flat **30. P. oblongata**

**89:** Pedicels erect

**91** Plants prostrate

**92** Leaves strongly discolorous, with revolute margins **55. P. mollis**

**92:** Leaves concolorous, with slightly recurved margins

**93** Tepals moderately hairy **32. P. daphnoides**

**93:** Tepals sparsely hairy **33. P. procumbens**

**91:** Plants erect to decumbent

**94** Leaves consistently asymmetrical, or occasionally symmetrical but then twisted through more than 90°

**95** Longest leaves more than 6.5 cm long [N.S.W.] **37. P. katerae**

**95:** Longest leaves 6.5 cm long or less [W.A.]

**96** Leaves twisted through 180° to 6 complete turns, 1.5–4 mm wide **63. P. helix**

**96:** Leaves twisted through less than 180° or twisted up to 360° but then more than 4 mm wide

**97** Leaves 1–2.5 mm wide, not glaucous **64. P. pertinax**

**97:** Widest leaves 3–13 mm wide, often glaucous **62. P. coriacea**

**94:** Leaves symmetrical, or a few leaves slightly asymmetrical (sometimes due to galling), not twisted or twisted through 90° or less

**98** Anthers white when fresh

**99** Tepals 16–19 mm long **9. P. arborea**

**99:** Tepals 11–15 mm long

**100** Inflorescences consistently auxotelic, leafy; mature leaves sparsely to moderately hairy; cotyledons 3–5 **10. P. subvelutina**

**100:** Inflorescences anauxotelic or mixed anauxotelic and auxotelic; mature leaves glabrescent to sparsely hairy; cotyledons 2

**101** At least some inflorescences auxotelic and bearing some flowers in axils of leaves; leaves alternate; tepals glabrous to moderately hairy **6. P. silvatica**

**101:** All inflorescences anauxotelic and bearing flowers only in axils of scale leaves; leaves usually opposite; tepals densely hairy

**102** Leaves moderately scabrous **4. P. laurina**

**102:** Leaves smooth **5. P. confertiflora**

**98:** Anthers yellow when fresh

**103** Mature leaves scabrous, with recurved margins, 1.5–5 cm long, concolorous to slightly discolorous, widest above middle **54. P. rigida**

**103:** Mature leaves smooth, or if scabrous, then with flat margins or more than 5 cm long or strongly discolorous or widest at or below middle

**104** Gynoecial abscission zone ¼–½ way up stipe; cotyledons 2 [W.A.] **8. P. elliptica**

**104:** Gynoecial abscission zone at base of stipe; cotyledons more than 2 [eastern Australia]

**105** Leaves twisted at base through 90° so that the laminae are held in a vertical plane, concolorous

**106** Leaves strongly glaucous, especially when young; ovule 1 **57. P. glaucescens**

**106:** Leaves not glaucous; ovules 2, rarely 1 **56. P. lanceolata**

**105:** Leaves not twisted or twisted through 0–90°; laminae not consistently held in a vertical plane, concolorous to strongly discolorous

**107** Ovules 2

**108** Pedicels glabrous; leaves less than 6 mm wide, flat to concave **16. P. virgata**

**108:** Pedicels hairy; leaves 2–50 mm wide, flat with slightly recurved to revolute margins

**109** Inflorescences anauxotelic; flowers subtended by scale leaves or reduced leaves; rachis 0.3–1 cm long **44. P. tropica**

**109:** Inflorescences auxotelic; flowers subtended by scale leaves and leaves; rachis often more than 1 cm long

**110** Leaves markedly discolorous **55. P. mollis**

**110:** Leaves concolorous

**111** Basal bark deeply fissured; leaves 3–8 cm long; inflorescences 1–11-flowered; rachis 0–4 cm long [Qld] **45. P. amaliae**

**111:** Basal bark finely fissured; leaves 6–17 cm long; inflorescences mostly 6–22-flowered; rachis 3–16 cm long [N.S.W.] **37. P. katerae**

**107:** Ovule 1 (occasionally 2)

**112** Tepals and young branchlets glabrous to sparsely covered in appressed hairs **42. P. media**

**112:** Tepals and young branchlets moderately to densely hairy

**113** Inflorescences mostly anauxotelic; tepals acute to apiculate, moderately to densely hairy **36. P. cornifolia**

**113:** Inflorescences mostly auxotelic or if mostly anauxotelic then tepals moderately hairy; tepals apiculate to caudate

**114** Multi-stemmed shrubs, 0.2–1 m tall **34. P. oleoides**

**114:** Single-stemmed shrubs to small trees 1–9 m tall

**115** Leaves usually 3–10 mm wide, 5–15 times longer than wide; bark smooth to base **46. P. volcanica**

**115:** Leaves (6–) 10–45 mm wide, 1.5–7 times longer than wide; bark finely fissured at base, smooth on branches

**116** Tepals apiculate to shortly caudate; leaves mostly 2–4 times as long as wide **39. P. stradbrokensis**

**116:** Tepals prominently caudate; leaves mostly 3–7 times as long as wide **38. P. adenantha**

**68:** Ovary sparsely to densely hairy

**117** Leaves 0.5–1.4 cm long, recurved **47. P. hirsuta**

**117:** Leaves more than 1.5 cm long, either incurved or not consistently curved

**118** Leaves 1–3 mm wide; pedicels erect to suberect; ovary moderately hairy [W.A.] **65. P. cymbifolia**

**118:** Leaves more than 3 mm wide or if less than 3 mm wide then pedicels recurved and/or ovary densely hairy [eastern Australia]

**119** Pedicels recurved

**120** Pedicels glabrous, 9–23 mm long; tepals glabrous to sparsely hairy **30. P. oblongata**

**120:** Pedicels moderately to densely hairy, 2–12 mm long; tepals moderately to densely hairy **49. P. sericea**

**119:** Pedicels erect to spreading

**121** Leaves mostly opposite and decussate, strongly discolorous; tepals densely ferruginous-hairy **4. P. laurina**

**121:** Leaves alternate, concolorous to discolorous; tepals glabrous to densely hairy

**122** Prostrate to decumbent shrubs

**123** Tepals caudate with dorsal tails, sparsely hairy [N.S.W.] **31. P. marginata**

**123:** Tepals apiculate, moderately to densely hairy [Qld] **40. P. prostrata**

**122:** Spreading to erect shrubs or trees

**124** Ovary hairs ferruginous; mature leaves smooth **43. P. iogyna**

**124:** Ovary hairs greyish to tawny, or rarely ferruginous but then mature leaves scabrous

**125** Mature leaves sparsely to densely hairy, widest above middle, 2–6 cm long **49. P. sericea**

**125:** Mature leaves glabrescent or rarely sparsely to moderately hairy, but then widest at or below middle, 2–14 cm long

**126** Young branchlets and tepals glabrous to sparsely hairy; hairs mostly appressed **42. P. media**

**126:** Young branchlets moderately to densely hairy; hairs appressed to patent

**127** Young branchlets, young leaves, pedicels and tepals ferruginous-hairy; mature leaves scabrous, glabrescent to moderately hairy; ovary densely hairy **35. P. rufa**

**127:** Young branchlets, young leaves, pedicels and tepals greyish- to tawny-hairy or, if rusty-hairy, ovary sparsely hairy; mature leaves smooth to slightly scabrous, glabrescent to sparsely hairy

**128** Inflorescences mostly anauxotelic; tepals acute to apiculate, moderately to densely hairy; bark smooth to base **36. P. cornifolia**

**128:** Inflorescences mostly auxotelic, or, if mostly anauxotelic, tepals moderately hairy and apiculate to caudate; bark finely flakey at base

**129** Tepals sparsely to moderately covered in appressed to antrorse hairs; leaves mostly 4–10 times longer than wide **41. P. conjuncta**

**129:** Tepals moderately to densely covered in appressed to patent hairs; leaves mostly 2–4 times longer than wide **39. P. stradbrokensis**

## *Rufiflora* Group

Bark smooth. Leaves alternate, concolorous (sometimes glaucous underneath in *P. rufiflora*). Inflorescence axillary, anauxotelic. Flowers actinomorphic, subtended by scale leaves; tepals greenish yellow; lateral wings absent. Anthers sublatrorse, held close together and close to gynoecium at their bases but recurved outwards towards tips, white; appendage obtuse either not recurved or recurved less than 90°. Hypogynous glands 4, equal. Gynoecium exserted, shorter than, equal to, or slightly longer than stamens; abscission zone basal. Ovary glabrous; ovules 2. Cotyledons 2.

### 1. Persoonia inconspicua P.H.Weston, *Telopea* 6: 90 (1994)

T: 6 km N of Hicky Ricken Soak, c. 60 km N of Bullfinch, W.A., *P.G.Wilson 8766*; holo: PERTH; iso: SYD.

Erect to spreading shrubs 0.5–2.5 m tall. Hairs greyish to tawny, appressed to antrorsely spreading. Young branchlets densely hairy. Leaves linear, 2–6.5 cm long, 0.7–1.3 mm wide, subterete and grooved underneath, without prominent veins, often slightly incurved, suberect to erect, straight, innocuous, concolorous, not glaucous, moderately to densely hairy when immature, glabrescent, smooth to slightly scabrous. Inflorescence 1–3-flowered. Pedicels 1–2.5 mm long, erect to spreading, moderately to densely hairy. Tepals 8–10.5 mm long, acute, glabrous to moderately hairy on outside. Anther appendage 0.3–0.6 mm long.

Occurs in an area roughly bounded by Cowcowing Lakes, Mt Jackson, Queen Victoria Rock and the Johnston Lakes in south-western W.A.; grows in heath and mallee heath, in sand. Flowers June–Sept. Map 5.

W.A.: Bencubbin, *R.D.Royce 6653* (PERTH); Noongar, *M.D.Crisp 6571* (CBG); 20 km NE of Bungalbin Hill, *K.Newbey 8988* (PERTH); SW of Queen Victoria Rock, *A.S.George 8048* (PERTH); 39.5 km E of Southern Cross–L. King road, on Hyden–Norseman road, *P.H.Weston 343* (SYD).

### 2. Persoonia brevirhachis P.H.Weston, *Telopea* 6: 92 (1994)

T: 31 km S of Lake Grace on road to Pingrup, W.A., 33°23'S, 118°30'E, 17 Sept. 1984, *D.B.Foreman 757*; holo: PERTH; iso: CANB, MEL, NSW.

Erect to spreading shrubs 0.3–2 m tall. Hairs greyish to tawny, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves mostly oblanceolate to narrowly spathulate, occasionally linear-oblanceolate to linear-spathulate, 2–5 cm long, 2.5–5.5 mm wide, flat, with recurved to revolute margins, without prominent veins, often slightly incurved, suberect to erect, straight, innocuous, concolorous, not glaucous, moderately to densely hairy when immature, glabrescent, scabrous. Inflorescence 1–2-flowered. Pedicels 1.5–5 mm long, erect to spreading, moderately to densely hairy. Tepals 6.5–9 mm long, acute, moderately to densely hairy on outside. Anther appendage 0.4–0.6 mm long.

Occurs between Lake Grace, Newdegate and Ravensthorpe in south-western W.A.; grows in heath and mallee heath, in sand. Flowers Aug.–Oct. Map 6.

W.A.: near L. Grace, *W.E.Blackall 3188* (PERTH); 25 km E of L. Grace, *K.Newbey 9536* (PERTH); 2 km W of Newdegate, *P.H.Weston 253* (SYD); 20 miles [32 km] NW of Ravensthorpe, *C.A.Gardner 1765* (PERTH).


**Figure 37**. **A–D**, *Acidonia microcarpa*. **A**, flowering branchlet; **B–C**, tepals with anthers; **D**, gynoecium and hypogynous glands (**A–D**, A.Strid 21468, NSW). **E–F**, *Persoonia*. **E**, *P. laurina* subsp. *laurina*, flowering branchlet (Hurstville, N.S.W., J.Camfield, NSW). **F**, *P. rufiflora*, flowering branchlet (B.Smith 377, NSW). Scale bars: **A**, **E**, **F** = 1 cm; **B–D** = 5 mm. Drawn by D.Mackay.

### 3. **Persoonia rufiflora** Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 72 (1855)

*Linkia rufiflora* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: interior north of Swan R., W.A., 1850–51, *J.Drummond 6: 176*; lecto: NY; isolecto: BM, CGE, K, MEL, NSW., *fide* P.H.Weston, *Telopea* 6: 93 (1994).

*Persoonia scabrella* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 72 (1855); *Linkia scabrella* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: south-western W.A., *J.Drummond 6: 177*; lecto: NY; isolecto: BM, CGE, K, MEL, NSW, PERTH, *fide* P.H.Weston, *Telopea* 6: 93 (1994).

Erect to spreading shrubs 0.5–2.5 m tall. Hairs greyish to ferruginous, appressed to patent. Young branchlets moderately to densely hairy. Leaves oblanceolate to linear, 2–4.5 cm long, 0.7–8 mm wide, flat to convex or subterete, with recurved to revolute margins, with 3 prominent, parallel veins on upper surface, often slightly incurved, suberect to erect, straight, innocuous or sharp but not pungent, concolorous, sometimes glaucous underneath, moderately to densely hairy when immature, glabrescent, smooth to moderately scabrous. Inflorescence 1–2-flowered. Pedicels obsolete. Tepals 6.5–10 mm long, acute, densely hairy on outside. Anther appendage 0.2–0.4 mm long. Fig. 37F.

Occurs from Kalbarri Natl Park south-west to the Mogumber–Minnivale area, south-western W.A.; grows in heath, mallee heath and mallee woodland, in sand or laterite. Flowers June–Sept. Map 7.

W.A.: 27 miles [43.7 km] SE of Kalbarri, *R.Filson 8664* (PERTH); 15 miles [24 km] N of Badgingarra, *A.S.George 6746* (NSW, PERTH); 3 miles [4.9 km] S of Maya, *H.Demarz 1436* (KPBG, PERTH); Mogumber, 1 Feb. 1935, *H.Steedman* (PERTH); Manmanning rubbish tip, *P.H.Weston 316* (SYD).

*Persoonia rufiflora* shows clinal variation in leaf morphology from broad-leaved populations in the Maya area to narrow-leaved populations in the Badgingarra–Mogumber area. Two collections have also been made much further north, in Kalbarri Natl Park, and these are intermediate in leaf form.

## ***Laurina* Group**

Bark smooth. Leaves alternate or opposite-decussate, strongly discolorous. Inflorescence axillary to terminal, anauxotelic or auxotelic. Flowers actinomorphic, subtended by scale leaves and/or leaves; tepals yellow; lateral wings absent. Anthers sublatrorse, held close together and close to gynoecium at their bases but recurved outwards towards tips, white; appendage absent. Hypogynous glands 4, equal. Gynoecium exserted, shorter than, equal to, or slightly longer than stamens; abscission zone basal. Ovary glabrous to densely hairy; ovule 1. Cotyledons 2.

### 4. **Persoonia laurina** Pers., *Syn. Pl.* 1: 118 (1805)

T: Port Jackson [N.S.W.], 1793 & 1794, *J.White*; syn: LINN.

Erect to decumbent shrubs 0.2–2 m tall. Hairs greyish to ferruginous, appressed to patent. Young branchlets densely hairy. Leaves opposite-decussate, elliptic to ovate to oblong to narrowly oblong, 3.5–11 cm long, 10–60 mm wide, flat, with recurved margins, sometimes slightly incurved, spreading to suberect, straight, innocuous, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth or moderately scabrous. Inflorescence anauxotelic. Flowers subtended by scale leaves; pedicels 0–2 mm long, erect, densely hairy; tepals 12–15 mm long, obtuse to acute, densely hairy. Ovary glabrous or densely hairy on outside.

Occurs east of the Great Dividing Range, from Port Stephens south to the southern Budawang Range, central-eastern N.S.W.; grows in dry sclerophyll woodland and forest, usually in sandy to stony soils derived from sandstone, or occasionally in sandy alluvium or granite or metasediments, from sea level to 1200 m alt. Flowers Nov.–Jan.

*Persoonia laurina* grows together with a number of other *Persoonia* species but is not known to hybridise with any of them. Three subspecies are recognised.

**1** Ovary densely hairy; style strongly reflexed on mature drupe

**2** Mature leaves smooth **4a.** subsp. **laurina**

**2:** Mature leaves scabrous **4b.** subsp. **intermedia**

**1:** Ovary glabrous; style reflexed on mature drupe **4c.** subsp. **leiogyna**

## 4a. Persoonia laurina Pers. subsp. laurina

*Persoonia ferruginea* Sm., *Exot. Bot.* 2: 47 (1806); *Linkia ferruginea* (Sm.) Kuntze, *Revis. Gen Pl.* 2: 579 (1891). T: Nova Hollandia, prope Port Jackson, N.S.W., 1793 & 1794, *J.White*; syn: LINN.

*Persoonia maidenii* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: Port Jackson district, N.S.W., Jan. 1893, *J.H.Maiden*; holo: LY.

*Persoonia monticola* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: Mount Victoria, N.S.W., Dec. 1886, *C.Walter*; holo: LY.

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 8 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 154–155 (1992).

Mature leaves smooth. Ovary densely hairy; style strongly reflexed on mature drupe. Fig. 37E.

Occurs from the Bulahdelah district and Capertee River south to Georges River and Coxs River–Lake Burragorang, in central-eastern N.S.W. Map 8.

N.S.W.: 2 miles [3 km] W of Karuah, 12 Oct. 1953, *L.A.S.Johnson* (NSW); Agnes Banks, *D.H.Benson 1034* (NSW); Hurstville, Dec. 1896, *J.H.Camfield* (NSW); Excelsior, Jan. 1914, *J.L.Boorman* (NSW); Evans Lookout, *P.H.Weston 1274 & D.Catling* (NSW).

## 4b. Persoonia laurina subsp. intermedia L.A.S.Johnson & P.H.Weston, *Telopea* 4: 294 (1991)

T: Banksia St, Hill Top, N.S.W., 19 Dec. 1989, *P.H.Weston 1419 & S.L.Krauss*; holo: NSW; iso: AD, BRI, CBG, HO, K, MEL, MO, PERTH, RB.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 9; pl. 1 (1991).

Mature leaves moderately scabrous. Ovary densely hairy; style strongly reflexed on mature drupe.

Occurs from the upper Georges River to Bowral and the Wombeyan district, N.S.W. Map 9.

N.S.W.: 3 miles [5 km] E of Leumeah, 6 Nov. 1948, *L.A.S.Johnson* (NSW); Yerrinbool, 15 Apr. 1951, *L.A.S.Johnson* (NSW); The Gibb [Mt Gibraltar], Bowral, 20 Nov. 1945, *H.M.R.Rupp* (NSW); Richlands to Wombeyan Caves, *C.W.E.Moore 2642* (NSW).

## 4c. Persoonia laurina subsp. leiogyna L.A.S.Johnson & P.H.Weston, *Telopea* 4: 295 (1991)

T: Wingello, N.S.W., Dec. 1917, *J.L.Boorman*; holo: NSW.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 9 (1991).

Mature leaves moderately scabrous. Ovary glabrous; style reflexed on mature drupe.

Occurs from the Jenolan Caves district to the southern Budawang Range and Conjola, N.S.W. Map 10.

N.S.W.: Conjola, Nov. 1898, *W.Heron* (NSW); Ruby Creek Falls, Mt Werong State Forest, *R.G.Coveny 12159, W.Bishop & R.O.Makinson* (NSW); Jamberoo Mtn Rd, Carrington Falls, *P.H.Weston 1391 & A.Bishop* (NSW); 8 km E of Nerriga along Nerriga–Nowra road, *R.Pullen 10.212* (NSW); 16 km NNE of Mongarlowe, *L.A.S.Johnson 7247* (NSW).

**5. Persoonia confertiflora** Benth., *Fl. Austral.* 3: 396 (1870)

T: Stringy Bark Ranges, Vic., *F.Mueller*; syn: K; Mitta Mitta R., Vic., *F.Mueller*; syn: K, MEL; Genoa R., Vic., *F.Mueller*; syn: MEL, NY.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 9 (1991).

Erect to decumbent shrubs 0.5–2 m tall. Hairs tawny to ferruginous, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves opposite-decussate or sometimes alternate, ovate to elliptic to narrowly elliptic, 3–9 cm long, 13–30 mm wide, flat, with recurved margins, sometimes slightly incurved, spreading, straight, innocuous, not glaucous, sparsely to moderately hairy when immature, glabrescent to sparsely hairy when mature, smooth. Inflorescence anauxotelic. Flowers subtended by scale leaves; pedicels 1–2 mm long, erect, densely hairy; tepals 12–14 mm long, apiculate, densely hairy on outside. Ovary glabrous.

Occurs in coastal districts between Eden and the La Trobe River and in ranges between the Kosciusko area and the Snowy Range, south-eastern N.S.W. and eastern Vic.; grows in dry sclerophyll woodland to wet sclerophyll forest in a variety of well-drained soils, from sea level to 1500 m alt. Flowers Nov.–Feb. Map 11.

N.S.W.: Green Cape Rd, 9 Oct. 1954, *E.F.Constable* (NSW); 8.7 km SW of Geehi Reservoir substation, *P.N.Martensz 591* (NSW). Vic.: Brumby Point, Nunniong Plateau, *N.G.Walsh 850* (NSW); Briagolong, *R.A.Kilgour 142* (NSW).

*Persoonia confertiflora* intergrades to a limited extent with *P. silvatica* where their distributions overlap in far-eastern Vic. It produces rare hybrids with *P. chamaepeuce* where they grow together.

**6. Persoonia silvatica** L.A.S.Johnson, *Victorian Naturalist* 73: 160 (1957)

T: Brown Mountain, near Littleton, N.S.W., Feb. 1893, *E.Betche*; holo: NSW; iso: K, L.

Illustrations: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 483 (1989); P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 9 (1991).

Erect to spreading shrubs or trees 1.5–9 m tall. Hairs greyish to tawny, appressed to antrorsely spreading. Young branchlets sparsely to moderately hairy. Leaves mostly alternate, narrowly elliptic to lanceolate to narrowly spathulate to oblanceolate, 3–12 cm long, 6–25 mm wide, flat, with recurved margins, sometimes slightly incurved, spreading to suberect, straight, innocuous, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth. Inflorescence anauxotelic or auxotelic. Flowers subtended by scale leaves or leaves; pedicels 1–3 mm long, erect, glabrous to moderately hairy; tepals 12–14 mm long, acute to caudate, glabrous to moderately hairy on outside. Ovary glabrous.

Occurs on the eastern side of the Great Dividing Range, especially along the escarpment between Mt Currockbilly in south-eastern N.S.W. and the Errinundra Plateau in eastern Vic.; grows in dry sclerophyll woodland to wet sclerophyll forest on a variety of substrata but most commonly on granite, from 500 to 1360 m alt. Flowers Nov.–Mar. Map 12.

N.S.W.: 5 km N of Monga, *L.G.Adams 2386* (K, NSW); c. 2 km SE of Tinderry Peak, *A.M.Lyne 743 & S.Donaldson* (NSW); 2 km S of Pikes Saddle, *P.H.Weston 1761 & P.Bernhardt* (MO, NSW); White Rock Mtn, Nalbaugh Natl Park, *P.Beesley 313 & D.Binns* (NSW). Vic.: Goonmirk Rocks, Errinundra Flora Reserve, *G.A.Savage 12* (NSW).

*Persoonia silvatica* intergrades to a limited extent with *P. confertiflora* where their distributions overlap in far-eastern Vic.

## *Longifolia* Group

Bark corky or lamellose-flaky. Leaves alternate, spreading to suberect, innocuous, concolorous to slightly discolorous, not glaucous, smooth. Inflorescence axillary to terminal, anauxotelic or auxotelic. Flowers actinomorphic, subtended by scale leaves and leaves; pedicels erect to spreading, moderately to densely hairy; tepals yellow; lateral wings absent. Anthers sublatrorse, held close together and close to gynoecium at their bases but recurved outwards towards tips, yellow; appendage absent or rarely present. Gynoecium exserted, shorter than, equal to, or slightly longer than stamens; abscission zone $^1/_3$–$^1/_2$ way up stipe. Ovary glabrous; ovules 2. Cotyledons 2.

### 7. **Persoonia longifolia** R.Br., *Trans. Linn. Soc. London* 10: 164 (1810)

*Linkia longifolia* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: King George Sound [W.A.], *R.Brown s.n.*; lecto: BM; isolecto: K, *fide* P.H.Weston, *Telopea* 6: 95 (1994).

*Persoonia articulata* R.Br., *Trans. Linn. Soc. London* 10: 164 (1810); *Linkia articulata* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: King George Sound [W.A.], Dec. 1801, *R.Brown s.n.*; lecto: BM; isolecto: NSW, *fide* P.H.Weston, *Telopea* 6: 95 (1994).

*Persoonia drummondii* Lindl., *Sketch Veg. Swan R.* xxxv (1839). T: Swan R. district, W.A., 1839, *J.Drummond s.n.*; lecto: CGE; isolecto?: FI, K, *fide* P.H.Weston, *Telopea* 6: 95 (1994).

Illustration: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 482 (1989).

Erect shrubs to trees 1–5 m tall. Bark lamellose-flaky. Hairs tawny to ferruginous, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves linear to narrowly elliptic to oblanceolate, 8–20 cm long, 2–16 mm wide, flat or sometimes convex, sometimes with slightly recurved margins, falcate, twisted at base through 0–90°, glabrous to sparsely hairy when immature, glabrescent. Pedicels 4–12 mm long. Tepals 10–16 mm long, acute to acuminate, moderately hairy on outside. Anther appendage absent or acute, to 1 mm long, not recurved. Fig. 38D.

Occurs within 70 km of the coast, from Perth to Albany, south-western W.A.; grows in sclerophyll woodland and forest, in sandy soils or laterite. Flowers Nov.–Feb. Map 13.

W.A.: Bunbury–Busselton road, 6.7 km N of Stratham, *P.H.Weston 191* (SYD); Yallingup Nature Reserve, *R.Pullen 9856* (CANB); 1 mile [1.6 km] S of Mt Barker, *K.F.Kenneally 60* (PERTH); summit of Mt Clarence, *C.A.Gardner 1268* (PERTH); Bow R., Dec. 1912, *S.W.Jackson* (NSW (2 sheets), PERTH).

*Persoonia longifolia* is a distinctive species, readily distinguished by its combination of lamellose-flaky bark, regular flowers and compressed-reniform drupes, each containing a single, crescentic seed with 2 cotyledons.

### 8. **Persoonia elliptica** R.Br., *Trans. Linn. Soc. London* 10: 164 (1810)

*Linkia elliptica* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Observatory Hill, south coast [W.A.], 19 Dec. 1801, *R.Brown s.n.*; lecto: BM; isolecto: K, NSW, *fide* P.H.Weston, *Telopea* 6: 98 (1994).

*Persoonia laureola* Lindl., *Sketch Veg. Swan R.* xxxv (1839). T: Swan R. district, W.A., 1839, *J.Drummond s.n.*; lecto: CGE; isolecto?: E, FI, K, *fide* P.H.Weston, *Telopea* 6: 98 (1994).

Erect shrubs to trees 2–8 m tall. Bark corky. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves obovate to spathulate to narrowly so, 5–11 cm long, 9–50 mm wide, flat, sometimes with slightly recurved margins, straight or sometimes slightly falcate, twisted at base through 90°, concolorous, glabrous. Pedicels 2.5–7 mm long. Tepals 8–12.5 mm long, obtuse to acute to apiculate, glabrous to sparsely hairy on outside. Anther appendage absent.

Occurs within 50 km of the coast, from Perth to Albany, south-western W.A.; grows in sclerophyll woodland and forest, in sandy soil or laterite. Flowers Oct.–Feb. Map 14.

W.A.: Bushmead, *F.Lullfitz 1820* (KPBG, PERTH); Great Eastern Hwy, 5.1 km W of Great Southern Hwy, *P.H.Weston 328* (SYD); Smiths Mill, Darling Ra., Dec. 1900, *A.Morrison* (AD, CANB, NSW, PERTH); Bunker Bay, *N.Kniep 63* (PERTH); Wheatleys Mill, Jan. 1918, *C.E.Lane-Poole* (PERTH).


**Figure 38**. *Persoonia*. **A**, *P. arborea*, flowering branchlet (from photographs and specimen: P.Weston 1054, NSW). **B**, *P. juniperina*, flowering branchlet (P.Weston 387, NSW). **C**, *P. muelleri* subsp. *muelleri*, flowering branchlet (M.Phillips, NSW 118752). **D**, *P. longifolia*, flowering branchlet (A.Strid 21775, NSW). Scale bar = 1 cm. Drawn by D.Mackay.

## Arborea Group

Bark smooth. Leaves alternate, spreading, straight, innocuous, strongly discolorous, not glaucous. Inflorescence axillary to terminal, auxotelic. Flowers actinomorphic, subtended by leaves and/or scale leaves; tepals yellow; lateral wings absent. Anthers sublatrorse, held close together and close to gynoecium at their bases but recurved outwards towards tips, or not held close to each other nor to gynoecium, white; appendage absent. Gynoecium exserted, shorter than, equal to, or slightly longer than stamens; abscission zone basal. Ovary glabrous; ovule 1. Cotyledons 3–5.

### 9. Persoonia arborea F.Muell., *Fragm.* 5: 37 (1865)

*Linkia arborea* (F.Muell.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Vallies towards the sources of the Tyers, Tangil and Tarwan Rivers, Vic., Jan. 1861, *F.Mueller*; syn: MEL, NSW; upper Tarwin R., *F.Mueller*; syn: MEL; sources of the Tyers R., *F.Mueller*; syn: MEL; Tyers R., *F.Mueller*; syn: L.

Illustration: G.R.Cochrane *et al.*, *Fl. & Pl. Victoria* 127, pl. 385 (1968).

Erect shrubs or trees 3–14 m tall. Hairs of short to moderate length, greyish to ferruginous, appressed to patent. Young branchlets densely hairy. Leaves oblanceolate to narrowly spathulate, 4–10 cm long, 6–21 mm wide, flat, with recurved margins, moderately hairy when immature, glabrous to moderately hairy when mature, smooth. Flowers subtended by scale leaves and leaves; pedicels 2–5 mm long, erect, moderately hairy; tepals 16–19 mm long, acute to apiculate, moderately hairy on outside. Fig. 38A.

Restricted to the ranges at the headwaters of the La Trobe and Yarra Rivers, Vic.; grows in wet sclerophyll forest to cool-temperate rainforest on granite, acid volcanics and in metamorphic substrata, from 450 to 1200 m alt. Flowers Dec.–Mar. Map 15.

Vic.: plateau above Cumberland Falls, 23 Jan. 1967, *L.A.S.Johnson* (NSW); Matlock, Apr. 1911, *J.Staer* (NSW); Mt Baw Baw, *P.H.Weston 385, 386* (MEL, NSW, SYD); Mt Donna Buang, Feb. 1916, *P.R.H.StJohn* (MEL).

### 10. Persoonia subvelutina L.A.S.Johnson, *Victorian Naturalist* 73: 161 (1957)

T: Island Bend, Upper Snowy R., N.S.W., Feb. 1954, *G.W.Althofer*; holo: NSW; iso: K.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 9 (1991).

Spreading shrubs or trees 0.5–5 m tall. Hairs greyish to tawny, appressed to patent. Young branchlets moderately to densely hairy. Leaves elliptic to obovate to spathulate to narrowly so, 3–7 cm long, 6–15 mm wide, flat, with recurved to revolute margins, sometimes slightly incurved, moderately to densely hairy when immature, sparsely to moderately so when mature, scaberulous. Flowers mostly subtended by leaves; pedicels 1–4 mm long, erect, moderately to densely hairy; tepals 11–15 mm long, apiculate to caudate, moderately to densely hairy on outside.

Occurs on the Great Dividing Range and nearby ranges between Brindabella in south-eastern N.S.W. and the Bogong High Plains in eastern Vic.; grows in dry sclerophyll woodland to wet sclerophyll forest at altitudes between 900 and 1800 m. Flowers Jan.–Mar. Map 16.

N.S.W.: Buddong Ck, Bago State Forest, 10 Mar. 1963, *K.Giles* (NSW); Island Bend–Guthega road, 5.4 km from Island Bend, *P.H.Weston 381* (NSW, SYD). A.C.T.: Mt Ginini, 1 km NE of summit, Brindabella Ra., *M.D.Crisp 8187 & I.R.Telford* (NSW). Vic.: 3 km S of Bogong P.O., 6 Feb. 1987, *A.Opie & J.Westaway* (NSW).

## *Gunnii* Group

Bark flaky. Leaves alternate, straight, innocuous, not glaucous, concolorous to slightly discolorous. Inflorescence axillary to terminal, auxotelic. Flowers actinomorphic, subtended by scale leaves and/or leaves; tepals white to yellow; lateral flaps present. Anthers sublatrorse, not held close to each other or to gynoecium, yellow or white; appendage absent.

Gynoecium exserted, shorter than, equal to, or slightly longer than stamens; abscission zone basal. Ovary glabrous; ovules 2. Cotyledons 3–4.

### 11. Persoonia gunnii Hook.f., *London J. Bot.* 6: 283 (1847)

*Linkia gunnii* (Hook.f.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891); *Persoonia gunnii* var. *dilatata* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 340 (1856), *nom. illeg.* T: May-day Plains, Tas., 1837, *R.C.Gunn 870*; syn: K.

*Persoonia gunnii* var. *oblanceolata* Orchard, *Brunonia* 6: 236 (1984). T: The Thumbs, Tas., 23 Mar. 1940, *A.M.Olsen*; holo: HO *n.v.*

Illustrations: M.Cameron (ed.), *Guide to Fl & Pl. Tasmania* 43, pl. 76 (1981); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 482 (1989).

Erect shrubs 0.6–3 m tall. Hairs whitish or greyish, patent. Young branchlets moderately to densely hairy. Leaves obovate to spathulate or rarely narrowly so, 1–5 cm long, 3–10 mm wide, flat or convex, with slightly recurved margins, slightly to strongly incurved, erect at tips, glabrous to sparsely hairy when immature, glabrescent, smooth. Flowers subtended by scale leaves and leaves; pedicels 2.5–5 mm long, erect, moderately to densely hairy; tepals 10–13.5 mm long, white to cream, apiculate, sparsely to moderately hairy on outside at base but glabrous at tip.

Occurs south-west from Black Bluff Range–Lake St Clair and Derwent River, Tas.; grows in alpine heath to subalpine wet sclerophyll forest to rainforest, on a variety of substrata including dolerite, quartzite and limestone, from 500 to 1300 m alt. Flowers Dec.–May. Map 17.

Tas.: Mt Murchison, on ridge 2 km S of L. Sandra, *A.Moscal 914* (HO); Rasselas Valley, 27 Feb. 1947, *K.Helms* (HO); L. Dobson, *J.M.Powell 2138* (NSW); southern shore of L. Judd, 25 Apr. 1979, *J.Closs* (HO); c. 1 km S of Waratah Lookout, Hartz Mountains Natl Park, *A.E.Orchard 5750* (NSW).

I have not recognised Orchard's var. *oblanceolata* for several reasons. Firstly, his concept refers to a heterogeneous group of populations. Specimens from the mountains between Adamsons Peak and South Cape are morphologically intermediate between *P. gunnii* and *P. muelleri* subsp. *angustifolia* (see below), and only superficially resemble the two remaining specimens cited by Orchard (one of which is the type). Secondly, at least one of these two remaining specimens (*J.Closs*, cited above) was collected in rainforest and a phenotypic response to reduced light seems as reasonable an explanation for their unusually long leaves as genotypic differentiation. Thirdly, although these specimens were collected only 35 km apart, one specimen of typical *P. gunnii* (*J.H.Hemsley 6547*, HO) has been collected from a locality about halfway between them, and other specimens of typical *P. gunnii* have been collected from surrounding areas. Geographic isolation seems an inadequate explanation for their morphological divergence, although ecotypic differentiation cannot be excluded.

Specimens from Adamsons Peak, the South Cape Range and the Recherche Bay area in southern Tas. (e.g. *S.J.Jarman 78*, HO; *A.M.Buchanan 3528*, HO) are morphologically intermediate between *P. gunnii* and *P. muelleri* subsp. *angustifolia*. These specimens have oblanceolate leaves that are moderately hairy when immature, remaining sparsely to moderately hairy when mature, as in *P. muelleri* subsp. *angustifolia*. Pedicels are c. 4 mm long, consistent with *P. muelleri*. The tepals are c. 13 mm long, consistent with *P. gunnii*, but moderately hairy from base to tip (cf. *P. muelleri*), although slightly more densely so at the base. More collections from the area between Hartz Mtns and South Cape would help to clarify the relationships of these populations.

*Persoonia gunnii* and *P. muelleri* apparently intergrade in the Lake Dove–Cradle Mtn area. One specimen (*R.F.Thorne 26005 & R.C.Carolin*, NSW) is consistent with *P. gunnii* but others (e.g. *R.Filson 10808*, HO; *J.R.Busby 78*, HO) are morphologically intermediate between *P. gunnii* and *P. muelleri*. Among the intermediates, leaves vary in shape from obovate to spathulate (as is usual in *P. gunnii*), to oblanceolate or narrowly spathulate (as in *P. muelleri* subsp. *muelleri*). The immature leaves are moderately to densely hairy and remain moderately hairy when mature (as in *P. muelleri* subsp. *angustifolia*). Tepals are 10–13 mm long and creamy white (as in *P. gunnii*) but uniformly moderately hairy (as in *P. muelleri*). Populations in this area need detailed study in the field.

## 12. **Persoonia muelleri** (P.Parm.) Orchard, *Brunonia* 6: 226 (1984)

*Drimys muelleri* P.Parm., *Bull. Sci. France Belgique* 27: 300 (1896). T: Mt Victoria, Tas., 1883, *C.Glover 5*; syn: MEL *n.v.*, P *n.v.*; photo NSW.

*Persoonia gunnii* var. *alpina* Hook.f., *London J. Bot.* 6: 283 (1847). T: Lake St Clair, Tas., 7 Jan. 1841, *R.C.Gunn*; lecto: (*Gunn 1237/1842*) K; isolecto: NSW; syn: K, *fide* A.E.Orchard, *Brunonia* 6: 226 (1984).

Erect shrubs or trees 1–5 m tall. Hairs greyish to tawny, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves oblanceolate to linear-oblanceolate to spathulate to narrowly spathulate, 1.3–6 cm long, 3–10 mm wide, flat to convex, usually with recurved margins, sometimes slightly incurved, spreading to suberect, sparsely to densely hairy when immature, glabrescent to moderately hairy when mature, smooth. Flowers mostly subtended by scale leaves; pedicels 3–5.5 mm long, erect to spreading, densely hairy; tepals 15–22 mm long, yellow to cream, apiculate, sparsely to moderately hairy on outside.

Widespread in Tas., at high altitudes in the north-west and centre, and at sea level on the south coast.

*Persoonia muelleri* apparently intergrades with *P. gunnii* in the Lake Dove–Cradle Mtn and Adamsons Peak–South Cape areas (see above). Three subspecies are recognised.

**1** Mature leaves glabrescent

**2** Leaves lax, oblanceolate — **12a.** subsp. **muelleri**

**2:** Leaves crowded, narrowly spathulate — subsp. **muelleri–angustifolia** intermediates

**1:** Mature leaves sparsely to moderately covered in appressed hairs

**3** Leaves linear- to narrowly oblanceolate — **12b.** subsp. **angustifolia**

**3:** Leaves obovate to spathulate or narrowly so

**4** Tepals 15–21 mm long — **12c.** subsp. **densifolia**

**4:** Tepals c. 10 mm long — subsp. **muelleri–gunnii** intermediates

### 12a. **Persoonia muelleri** (P.Parm.) Orchard subsp. **muelleri**

Illustration: M.Stones & W.Curtis, *Endemic Fl. Tasmania* 1: pl. 35 (1967), as *P. gunnii*.

Shrubs 1.2–4 m tall. Hairs greyish. Young branchlets densely hairy. Leaves not crowded, oblanceolate to narrowly spathulate, 2–5 cm long, 4–8 mm wide, with slightly recurved margins, spreading to suberect, glabrous to sparsely hairy when immature, glabrescent. Pedicels erect. Tepals 15–22 mm long, sparsely to moderately hairy. Fig. 38C.

Occurs chiefly north-east of Lake St Clair–Derwent River, Tas., with a single collection known from Mt Field; grows in sclerophyll forest to alpine heath, on dolerite, from 700 to 1200 m alt. Flowers Dec.–May. Map 18.

Tas.: S slope, Mt Victoria, *A.Moscal 10647* (HO, NSW); N of Snow Hill, July 1984, *P.Bennett* (HO); E of Great L., *A.Moscal 674* (HO); shores of L. St Clair, *K.Hill 1500*, *L.A.S.Johnson & D.Blaxell* (NSW); Mt Field, Dec. 1920, *L.Rodway* (HO).

*Persoonia muelleri* subsp. *muelleri* intergrades with subsp. *angustifolia* in the area between Lake St Clair and Macquarie Harbour. Specimens from this area (e.g. *A.Moscal 1861*, *1862*, *1775*, HO) have immature leaves with a dense indumentum (as in subsp. *angustifolia*), glabrescent to moderately hairy, mature leaves and a leaf shape closer to that of subsp. *muelleri*.

### 12b. **Persoonia muelleri** subsp. **angustifolia** (Benth.) L.A.S.Johnson & P.H.Weston, *Fl. Australia* 16: 472 (1995)

*Persoonia gunnii* var. *angustifolia* Benth., *Fl. Austral.* 5: 399 (1870); *P. muelleri* var. *angustifolia* (Benth.) Orchard, *Brunonia* 6: 232 (1984). T: Macquarie Harbour, Tas., *Milligan 738*; syn: K, NSW.

Illustration: A.E.Orchard, *Brunonia* 6: 233, fig. 9 (1984), as var. *angustifolia*.

Shrubs to 4 m tall. Hairs greyish to tawny. Young branchlets moderately to densely hairy.

Leaves not crowded, linear-oblanceolate to oblanceolate, 3–6 cm long, 3–7 mm wide, flat to convex, with recurved margins, sometimes slightly incurved, suberect, moderately to densely hairy when immature, moderately so when mature. Pedicels erect to spreading. Tepals 15–19 mm long, moderately hairy on outside.

Occurs in western Tas., within 50 km of the coast, from the Pieman River catchment at least as far south as Bathurst Range; grows in rainforest to dense scrub and, perhaps, subalpine heath, in a variety of sedimentary and metamorphic substrata, from 60 to 700 m alt. Flowers Jan.–Mar. Map 19.

Tas.: Long Plains, Corinna, *W.D.Jackson J426* (HO); Commonwealth Hill, near Renison Bell, *A.M.Gray 611* (HO, NSW); Sassy Ck, *A.M.Buchanan 6129* (HO); Bathurst Ra., 20 Jan. 1976, *A.M.Gray* (HO).

The distributions of *P. muelleri* subsp. *angustifolia* and subsp. *densifolia* overlap in the area between Elliott Point and Cox Bight. However, they grow in different habitats at different altitudes and no intermediate specimens have been collected from this area. Both subspecies occur in close proximity in the Bathurst Range–Cox Bight area; more collections from a range of habitats and altitudes from that area as well as the area north of Port Davey would be useful in clarifying the relationship between these subspecies.

### 12c. **Persoonia muelleri** subsp. **densifolia** (Orchard) L.A.S.Johnson & P.H.Weston, *Fl. Australia* 16: 472 (1995)

*Persoonia muelleri* var. *densifolia* Orchard, *Brunonia* 6: 230 (1984). T: Coxs [Cox] Bight, W of Point Eric, Tas., 16 Mar. 1980, *A.Moscal 119*; holo: HO *n.v.*; iso: NSW.

Illustration: A.E.Orchard, *Brunonia* 6: 231, fig. 8 (1984), as var. *densifolia*.

Shrubs or trees, 1–3.5 m tall. Leaves crowded, narrowly spathulate to spathulate, 2–5 cm long, 6–10 mm wide, with recurved margins, suberect, moderately to densely hairy when immature, sparsely to moderately so when mature. Tepals 15–19 mm long, moderately hairy on outside.

Restricted to the coast of southern Tas. and offshore islands, from Surprise Bay to Elliott Point; grows in coastal heath and scrub, on quartzite, coastal dunes and a variety of sedimentary substrata including mudstone and limestone, from sea level to 40 m alt. Flowers Jan.–Apr. Map 20.

Tas.: Roaring Beach, 9 Feb. 1937, *C.Davis* (NSW); Cox Bight, *D.I.Morris 8297* (HO); W end of Prion Beach, *A.M.Buchanan 3463* (HO); Flat Witch Is., 28 Dec. 1978–8 Jan. 1979, *G.White* (HO); Surprise Bay, *A.Moscal 908* (HO, NSW).

Specimens from mountains in south-western Tas. (e.g. summit area of Mt Propsting, *M.J.Brown 1370*, HO; Mt Counsel, *A.Moscal 122*, HO, NSW) resemble subsp. *densifolia* in leaf shape and crowding but have glabrescent leaves (as in subsp. *muelleri*). Presumably these were collected from populations that are intermediate between these subspecies, but few collections have been made in the area between the south coast and Mt Field, the most southerly collection locality for subsp. *muelleri*.

### 13. **Persoonia moscalii** Orchard, *Brunonia* 6: 238 (1984)

T: Mt Counsel, Tas., 16 Mar. 1980, *A.Moscal 126*; holo: HO *n.v.*; iso: NSW.

Illustration: A.E.Orchard, *Brunonia* 6: 239, fig. 12 (1984).

Prostrate shrubs to 10 cm tall. Hairs whitish, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves obovate to spathulate to narrowly so, 6–15 mm long, 2–4 mm wide, flat or concave, usually incurved, spreading to suberect, sparsely hairy when immature, glabrescent, smooth. Flowers mostly subtended by leaves; pedicels 1.5–2 mm long, erect, moderately hairy; tepals 9–11 mm long, yellow, apiculate, sparsely hairy on outside.

Restricted to the Melaleuca, Bathurst and Frankland Ranges, south-western Tas.; grows in alpine heath, on quartzite, from 640 to 760 m alt. Flowers Feb.–Mar. Map 21.

Tas.: Double Peak, 20 Jan. 1977, *S.J.Jarman* (HO); Mt Rallinga, Feb. 1976, *A.Moscal* (HO); Mt Counsel,

*A.Moscal 124, 125* (HO).

*Persoonia moscalii* grows together with *P. muelleri* on Mt Counsel, and one specimen from that location (*A.Moscal 127*) is morphologically intermediate between these species. A.E.Orchard (*Brunonia* 6: 232, 1984) considered this to be a wind-prostrated specimen of *P. muelleri* but, since it is intermediate in leaf size and shape, indumentum density and flower size, it seems more likely to be a *P. moscalii* × *P. muelleri* hybrid. Similarly, *P. moscalii* grows together with *P. gunnii* on the Frankland Range and one specimen (N of Frankland Peak, 30 Dec. 1979, *A.Moscal*, NSW) is morphologically intermediate between them. This also seems likely to be a hybrid.

## *Lanceolata* Group

Bark smooth throughout or smooth above and fissured at base, or lamellose-flaky. Leaves alternate to 3-whorled, straight to falcate, innocuous to pungent, sometimes glaucous, concolorous to strongly discolorous. Inflorescence axillary to terminal, anauxotelic or auxotelic. Flowers actinomorphic, subtended by scale leaves and/or leaves; tepals yellow, rarely with red markings; lateral wings absent. Anthers sublatrorse, held close together and close to gynoecium at their bases but recurved outwards towards tips, yellow; appendage absent. Gynoecium exserted, shorter than, equal to, or slightly longer than stamens; abscission zone basal. Ovary glabrous to densely hairy; ovules 1 or 2. Cotyledons 3–8.

### **14. Persoonia juniperina** Labill., *Nov. Holl. Pl.* 1: 33 (1805)

*Linkia juniperina* (Labill.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: precise locality unknown [Tas.], *J.J.H. de Labillardière*; syn: FI, NSW; precise locality unknown [Tas.], *J.J.H. de Labillardière*; syn: B, BM, FI, TCD.

*Persoonia juniperina* var. *ulicina* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 336 (1856). T: Circular Head, Tas., *R.C.Gunn 537 ex parte, 869*; lecto: K, *fide* A.E.Orchard, *Brunonia* 6: 224 (1984); syn: K, NY.

*Persoonia juniperina* var. *brevifolia* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 336 (1856). T: Hobart, Tas., *R.C.Gunn 537 ex parte*; lecto: K, *fide* A.E.Orchard, *Brunonia* 6: 225 (1984); syn: K, NY.

*Persoonia tasmanica* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: Goulds Country, Tas., Oct. 1875, *A.Simson 330*; holo: LY.

*Persoonia latiuscula* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: precise locality unknown, Vic., 1902, *C.Walter*; holo: LY.

*Persoonia adjacens* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: Harrietville, Vic., 1 June 1910, *J.W.Audas*; holo: LY.

*Persoonia porrigens* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: Oukleigh [Oakleigh] district, Vic., Dec. 1897, *C.Walter*; holo: LY.

*Persoonia juniperina* var. *sericea* Ewart & B.Rees, *Proc. Roy. Soc. Victoria* 2: 26: 8 (1913). T: Grampians, Vic., 10 Oct. 1911 & 17 Jan. 1912, *A.G.Campbell*; *n.v.*

*Persoonia juniperina* var. *mollis* Orchard, *Brunonia* 6: 225 (1984). T: ridge at N end of Moulting Bay, c. 6 km NE of St Helens, Tas., 10 May 1981, *A.Moscal 768*; holo: HO *n.v.*; iso: NSW.

Illustrations: G.R.Cochrane *et al.*, *Fl. & Pl. Victoria* 29, pl. 45 (1968); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 482 (1989); P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 9 (1991).

Erect to decumbent shrubs 0.3–2 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets sparsely to densely hairy. Leaves spreading to suberect, straight, linear, 8–35 mm long, 0.7–1.5 mm wide, concave, occasionally incurved, usually pungent, concolorous, not glaucous, glabrous to densely hairy when immature, glabrescent, smooth. Inflorescence auxotelic, 1–40-flowered; rachis 0–15 cm long. Flowers mostly subtended by leaves; pedicels 0.8–3 mm long, erect to spreading, moderately to densely hairy; tepals 6–11 mm long, apiculate to caudate, sparsely to moderately hairy on outside. Ovary glabrous; ovules 2. Fig. 38B.

Occurs in south-eastern Australia from Adelaide, S.A., through southern Vic. to Green Cape in south-eastern N.S.W., and widespread in Tas.; grows in heath to dry sclerophyll forest in siliceous soils, from sea level to 700 m alt. Flowers chiefly Dec.–May. Map 22.

S.A.: Mt Lofty Ra., *A.C.Beauglehole 7789* (NSW). N.S.W.: Green Cape lighthouse, *R.G.Coveny 5810 & J.Armstrong* (NSW). Vic.: 2 km ESE of Fernbank, *F.E.Davies 621, M.J.Winsbury & S.Donaldson* (NSW); Grampians Natl Park, *P.G.Abell 502, C.Herscovitch, N.Marriott & W.Funk* (NSW). Tas.: 2 km E of Apsley Marshes, *A.Moscal 6256* (NSW).

*Persoonia juniperina* is a widespread and morphologically variable species. Orchard (*Brunonia* 6: 217–240, 1984) produced a revised infraspecific classification of this species in Tas., in which he recognised four varieties. I have not adopted this classification for two reasons. Firstly, all of the varieties that Orchard recognised in Tas. are broadly sympatric and intergrade extensively. Consequently, they are not infraspecific taxa comparable to the subspecies recognised elsewhere in this treatment and may represent ecotypes or phenotypic variants. Secondly, since Orchard's treatment only covered part of the species distribution it is incomplete and probably inapplicable to mainland populations. A study of ecogeographic variation in *P. juniperina* across its whole distributional range would be a worthwhile project.

### **15. Persoonia chamaepeuce** Lhotsky ex Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 336 (1856)

*Linkia chamaepeuce* (Lhotsky ex Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Australian Alps, N.S.W.?, *J.Lhotsky*; syn: NY; Ballarat, Vic., *F.Mueller*; syn: NSW.

*Persoonia effusa* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: Sunny Corner, N.S.W., Nov. 1899, *J.L.Boorman* (cited as 'Maiden'); syn: LY, NSW.

*Persoonia myrioclada* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: Monga, N.S.W., Dec. 1898, *W.Bäuerlen* (cited as 'Baker'); holo: LY.

*Persoonia viridula* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: precise locality unknown, Vic., 1902, *C.Walter*; lecto: LY, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 350 (1973); syn: LY; near Harrietville, Vic., 3 June 1910, *J.W.Audas*; syn: LY.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 10 (1991).

Decumbent to prostrate shrubs to 20 cm tall. Bark poorly developed. Hairs greyish, appressed to antrorsely spreading. Young branchlets glabrous to sparsely hairy. Leaves linear, 8–25 mm long, 1–2 mm wide, flat to concave, spreading to suberect, straight, innocuous, concolorous, not glaucous, glabrous, smooth. Inflorescence usually auxotelic, 1–20-flowered; rachis 0–3.5 cm long. Flowers mostly subtended by leaves; pedicels 3–6 mm long, erect to recurved, glabrous to sparsely hairy; tepals 9–13 mm long, caudate, glabrous or rarely sparsely hairy on outside. Ovary glabrous; ovule 1.

Occurs along the Great Dividing Range from the Tenterfield district in north-eastern N.S.W. to the Grampians in western Vic.; grows in dry sclerophyll woodland to wet sclerophyll forest, mostly on granite and metamorphic substrata, from 300 to 1600 m alt. Flowers Dec.–Mar. Map 23.

N.S.W.: 12 km NNE of Torrington, *R.G.Coveny 5715 & N.Lander* (NSW); near Kangaroo Flats, Paddys R. district, *R.D.Hoogland 10062* (B, K, L, NSW). A.C.T.: Ginini Flat, Brindabella Ra., *T.G.Hartley 13652* (NSW). Vic.: Sugarloaf Track, 5.6 km NW of Buchan R., *S.J.Forbes 290* (NSW); between Jamieson and Walhalla, *M.E.Phillips 114* (NSW).

*Persoonia chamaepeuce* hybridises sporadically with *P. asperula*, *P. confertiflora* and *P. linearis* where they grow together.

### **16. Persoonia virgata** R.Br., *Trans. Linn. Soc. London* 10: 164 (1810)

*Linkia virgata* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Sandy Cape [Qld], 31 July 1802, *R.Brown s.n.*; syn: BM; Sandy Cape [Qld], 1 Aug. 1802, *R.Brown s.n.*; syn: K, NY.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 9 (1991).

Erect or rarely prostrate shrubs 0.5–4 m tall. Bark smooth. Hairs whitish or greyish, appressed to patent. Young branchlets moderately hairy. Leaves linear to narrowly spathulate, 2–5 cm long, 1–2 (–5.5) mm wide, flat or concave, sometimes slightly incurved, straight, innocuous, concolorous, not glaucous, glabrous to sparsely hairy when immature, glabrescent, smooth. Inflorescence auxotelic, 1–75-flowered; rachis 0–23 cm long. Flowers

mostly subtended by leaves; pedicels 4–9 mm long, erect to spreading, glabrous; tepals 9–11 mm long, obtuse to acute, glabrous on outside. Ovary glabrous; ovules 2. Fig. 39A.

Occurs between Shoalwater Bay, Qld, and Forster in north-eastern N.S.W.; grows in heath to dry sclerophyll forest, almost exclusively on stabilised coastal sand dunes, below 100 m alt. Flowers Nov.–July, but chiefly Dec.–Mar. Map 24.

Qld: track to Five Rocks from Byfield, *J.M.Powell 869 & J.A.Armstrong* (BRI, NSW); mouth of Bool Ck, Fraser Is., *P.H.Weston 1505 & P.G.Richards* (BRI, NSW); Stradbroke Is., Apr. 1915, *E.W.Bick* (BRI, NSW). N.S.W.: Broadwater to Evans Head, *P.H.Weston 1372 & P.G.Richards* (NSW); c. 1 mile [1.6 km] N of Tuncurry, *D.J.McGillivray 1266* (BRI, K, NSW).

*Persoonia virgata* hybridises sporadically with *P. lanceolata* and *P. stradbrokensis* where it grows with them. The type of *P. attenuata* R.Br. [*Suppl. Prodr. Fl. Nov. Holl.* 16 (1830); T: 'Orâ Orient. Moreton Bay' [Qld], 1827, *C.Fraser*; holo: BM] appears to be a *P. stradbrokensis* × *P. virgata* hybrid.

Leaf width is more variable north of Moreton Bay, particularly in some populations from Fraser Is., Qld, with a range of 1–5.5 mm. The type material is from a plant at the extreme, broad-leaved end of this range of variation. Populations south of Moreton Bay show a range of leaf width of 1–2 mm. A population from Mooloolah Natl Park consists of mixed erect and prostrate plants, which are morphologically indistinguishable in the absence of habit information.

### 17. **Persoonia tenuifolia** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 13 (1830)

*Linkia tenuifolia* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Moreton Bay [Qld], 1827, *C.Fraser*; holo: BM.

Illustrations: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 483 (1989); P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 10 (1991).

Erect to decumbent shrubs 20–50 cm tall. Bark poorly developed. Hairs greyish, antrorsely spreading to patent. Young branchlets sparsely to moderately hairy. Leaves linear, 10–25 mm long, 0.3–0.5 mm wide, subterete and grooved on upper surface, usually strongly incurved, spreading to erect, straight, innocuous, concolorous, not glaucous, glabrous, smooth. Inflorescence usually auxotelic, 1–8-flowered; rachis 0–2.3 cm long. Flowers mostly subtended by leaves; pedicels 1–3 mm long, erect to spreading, glabrous; tepals 8–10 mm long, obtuse to apiculate, glabrous on outside. Ovary glabrous; ovules 2.

Occurs in the coastal lowlands between Bundaberg, Qld, and Grafton, N.S.W., on the Great Dividing Range and surrounding tablelands between Dalveen in Qld and Torrington in N.S.W. and in the Yetman district in N.S.W.; grows in heath to dry sclerophyll forest, in siliceous soils derived from coastal sand, granite, sandstone and sandy alluvium, from sea level to 1050 m alt. Flowers Nov.–Feb. Map 25.

Qld: State Forest 840, S of Bundaberg, *P.I.Forster 9316 & P.Machim* (BRI, NSW); Beerburrum, *V.K.Moriarty 590* (BRI). N.S.W: Grant Rd, Bebo State Forest, *R.G.Coveny 11718 & P.G.Wilson* (BRI, NSW); Thunderbolts Hiding Place, road to Boonoo Boonoo Falls, *L.Murray 71, R.G.Coveny & W.Bishop* (BRI, NSW); N slope of Mt Neville, *P.H.Weston 1087, K.Hill & L.A.S.Johnson* (NSW).

*Persoonia tenuifolia* hybridises sporadically with *P. cornifolia*, *P. sericea* and *P. stradbrokensis* where they grow together. These hybrids, which are morphologically intermediate between the parental species, are so distinctive that they have frequently been mistakenly identified as unnamed species.

### 18. **Persoonia acerosa** Sieber ex Schult. & Schult.f., *Mant.* 3: 269 (1827)

*Linkia acerosa* (Sieber ex Schult. & Schult.f.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: locality unknown, N.S.W., 1823, *F.W.Sieber 59*; syn: B, BM, FI, K, L, M, NSW.

*Persoonia pallida* Graham, *Edinburgh New Philos. J.* 6: 177 (1829). T: from a plant cultivated at Edinburgh Botanic Garden, Scotland, Sept.–Oct. 1828, *R.Graham*; holo: K.

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 10 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 156–157 (1992).

Erect to spreading shrubs 0.5–2 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets glabrous to sparsely hairy. Leaves linear, 10–23 mm long, 0.5 mm wide, subterete and grooved on upper surface, strongly incurved, suberect to erect, straight, innocuous, concolorous, not glaucous, sparsely hairy when immature, glabrescent, smooth. Inflorescence usually auxotelic, 1–80-flowered; rachis 0–11 cm long. Flowers mostly subtended by leaves; pedicels 1–2 mm long, erect to spreading, glabrous to sparsely hairy; tepals 8–10 mm long, prominently caudate with dorsal tails, glabrous on outside. Ovary glabrous; ovule 1.

Restricted to the Blue Mountains and Hill Top district in central-eastern N.S.W.; grows in heath to dry sclerophyll forest on sandstone, from 550 m to 1000 m alt. Flowers Dec.–May. Map 26.

N.S.W.: Waratah Ridge Rd, Newnes Plateau, *P.Hind 4455* (NSW); 0.8 km along Tableland Rd from Great Western Hwy, Wentworth Falls, *P.H.Weston 363* (K, NSW, PERTH); Woodford, Sept. 1913, *E.Cheel* (K, NSW); Wattle Ridge Rd, 2 km N of Hill Top, *P.H.Weston 1043*, *M.D.Crisp & P.Kater* (MEL, NSW).

*Persoonia acerosa* hybridises sporadically with *P. levis* and *P. myrtilloides* where they grow together. The type of *P. angulata* R.Br. [*Suppl. Prodr. Fl. Nov. Holl.* 14 (1830). T: 'Ora Orient., prope Port Jackson' [N.S.W.], 4 Oct. 1822, *A.Cunningham 39*; syn: BM, K] is one of these hybrids, most probably *P. acerosa* × *P. levis*.

### **19. Persoonia myrtilloides** Sieber ex Schult. & Schult.f., *Mant.* 3: 272 (1827)

*Linkia myrtilloides* (Sieber ex Schult. & Schult.f.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: locality unknown, N.S.W., 1823, *F.W.Sieber 52*; lecto: M; isolecto: FI, K, L, M, MEL, NSW, NY, *fide* P.H.Weston & L.A.S.Johnson, *Telopea* 4: 273 (1991).

Erect to spreading shrubs 0.5–2.5 m tall. Bark smooth. Hairs greyish, appressed to patent. Young branchlets moderately hairy. Leaves narrowly to broadly elliptic to ovate, 1.2–5 cm long, 4–30 mm wide, flat, with slightly recurved margins, sometimes slightly incurved, spreading, straight, innocuous, concolorous to strongly discolorous, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth to moderately scabrous. Inflorescence auxotelic, 1–40-flowered; rachis 0–17 cm long. Flowers subtended by scale leaves and leaves; pedicels 2–10 mm long, spreading to recurved, sparsely to moderately hairy; tepals 9–12 mm long, prominently caudate with dorsal tails, sparsely to moderately hairy on outside. Ovary glabrous; ovules 2.

Occurs from the upper Goulburn River through the Wollemi district to Wentworth Falls, N.S.W., in the upper Blue Mountains, eastern N.S.W. Flowers Dec.–Apr.

*Persoonia myrtilloides* often occurs sympatrically, and occasionally hybridises, with *P. recedens*, *P. acerosa* and *P. levis*. It also sometimes grows with *P. chamaepitys*, *P. linearis* and *P. laurina*.

Morphological variation in *P. myrtilloides* is geographically correlated, ranging from populations with small, broadly elliptic leaves and with long, reflexed tepal tips in the north to those with larger, narrowly elliptic leaves and with shorter, slightly recurved tepal tips in the south. Geographical variation in leaf morphology seems to be clinal, but with regard to the morphology of tepal tips it seems to involve an abrupt transition in the Capertee area. Two subspecies are recognised.

Tepal tips recurved, 1–2 mm long; leaves narrowly elliptic to narrowly ovate, 2–5 cm long, 4–12 mm wide — **19a.** subsp. **myrtilloides**

Tepal tips prominently reflexed, 2.5–4.5 mm long; leaves mostly broadly elliptic to ovate to narrowly ovate, 1.2–3.8 cm long, 6–30 mm wide — **19b.** subsp. **cunninghamii**

### **19a. Persoonia myrtilloides** Sieber ex Schult. & Schult.f. subsp. **myrtilloides**

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 10 (1991).

Leaves narrowly elliptic to lanceolate to ovate, 2–5 cm long, 4–12 mm wide, smooth to moderately scabrous. Tepal tips recurved, 1–2 mm long. Fig. 39B.

Distributed in the higher Blue Mountains from Capertee south to Wentworth Falls; grows in dry sclerophyll eucalypt forest or occasionally in woodland or heath, in sandy, stony or clayey soils derived from sandstone, from 900 to 1200 m alt. Map 27.

N.S.W.: Excelsior, Jan. 1914, *J.L.Boorman* (NSW); Wolgan Gap, 17 May 1970, *L.A.S.Johnson* (NSW); 0.7 km from Bell–Lithgow road on Clarence sawmill road, *P.H.Weston 377*, (NSW, SYD); Mount Boyce, *R.G.Coveny 4754 & J.A.Armstrong* (NSW); Wentworth Falls, Nov. 1913, *A.A.Hamilton* (NSW).

*Persoonia myrtilloides* subsp. *myrtilloides* hybridises sporadically with *P. acerosa*, *P. levis* and, more extensively, with *P. recedens*, producing hybrid swarms of limited extent.

### 19b. **Persoonia myrtilloides** subsp. **cunninghamii** (R.Br.) L.A.S.Johnson & P.H.Weston, *Telopea* 4: 274 (1991)

*Persoonia cunninghamii* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 13 (1830); *Linkia cunninghamii* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: N of Cugeegong [Cudgegong] R., N.S.W., 1823, *A.Cunningham*; lecto: BM; isolecto: K, MEL, NY, *fide* P.H.Weston & L.A.S.Johnson, *Telopea* 4: 274 (1991).

Illustrations: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 482 (1989), as *P. myrtilloides* P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 11 (1991).

Leaves broadly elliptic to ovate to narrowly ovate, 1.2–3.8 cm long, 6–30 mm wide, often slightly incurved, smooth to slightly scaberulous. Tepal tips prominently reflexed, 2.5–4.5 mm long.

Occurs from the upper Goulburn River through the Wollemi district to the Capertee River, in dry sclerophyll eucalypt or *Callitris* woodland to forest in sandy to stony soils derived from sandstone, from 470 to 1000 m alt. Map 28.

N.S.W.: 'The Drips', Goulburn R., *R.G.Coveny 9572* (NSW); near Munghorn Gap, 15 Jan. 1968, *C.O.Boyd* (NSW); 2 miles [c. 3 km] N of Mt Coricudgy, 31 Aug. 1951, *L.A.S.Johnson* (NSW); Great Dividing Ra., 22 km SE of Rylstone, *H.Streimann 835* (NSW); 17.1 km NE of Rylstone on road to Growee Gulph, *R.G.Coveny 10502 & P.Hind* (NSW).

*Persoonia myrtilloides* subsp. *cunninghamii* hybridises sporadically with *P. linearis* where they grow together.

### 20. **Persoonia brevifolia** (Benth.) L.A.S.Johnson & P.H.Weston, *Telopea* 4: 275 (1991)

*Persoonia myrtilloides* var. *brevifolia* Benth., *Fl. Austral.* 5: 401 (1870). T: upper Genoa R., N.S.W., Sept. 1860, *F.Mueller*; syn: BM, K, L, MEL, NSW, NY; Nangatta [Nungatta] Mountains, N.S.W., *F.Mueller*; syn: MEL, NSW, NY.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 10 (1991).

Erect shrubs 0.8–1.5 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves elliptic to broadly elliptic to ovate to obovate, 10–25 mm long, 3–12 mm wide, flat, with slightly recurved margins, spreading, straight, innocuous, usually strongly discolorous, not glaucous, sparsely hairy when immature, glabrescent, smooth. Inflorescence auxotelic, 1–10-flowered; rachis 0–5 cm long. Flowers mostly subtended by leaves; pedicels 2–5 mm long, erect to recurved, glabrous to sparsely hairy; tepals 5–12 mm long, apiculate to caudate, glabrous to sparsely hairy on outside. Ovary glabrous; ovule 1 or 2.

Restricted to White Rock, Wog Wog Mountain, Nungatta Peak, and Mt Imlay in far-south-eastern N.S.W., also the upper Genoa River in far-eastern Vic.; grows in dry to wet sclerophyll eucalypt forest in stony, well-drained soils derived from granitic rocks or sandstone, at 200–1100 m alt. Flowers Dec.–Mar. Map 29.

N.S.W.: White Rock, *P.Beesley 315 & D.Binns* (NSW); Wog Wog Mtn, *J.D.Briggs 1795 & P.H.Weston* (NSW); summit of Mt Imlay, *D.Albrecht 196 & B.Conn* (NSW). Vic.: slopes above S bank of Yambulla Ck, *D.Albrecht 3696* (NSW).


**Figure 39**. *Persoonia*. **A**, *P. virgata*, flowering branchlet (I.Telford, NSW 118722). **B**, *P. myrtilloides* subsp. *myrtilloides*, flowering branchlet (H.Deane, NSW 21187). **C**, *P. acuminata*, flowering branchlet (R.Pullen 3777, NSW). **D**, *P. stradbrokensis*, flowering branchlet (T. & J.Whaite 3079, NSW). Scale bar = 1 cm. Drawn by D.Mackay.

## **21. Persoonia acuminata** L.A.S.Johnson & P.H.Weston, *Telopea* 4: 276 (1991)

T: Racecourse Track, 0.4 km NE of junction with Werrikimbe Trail, N.S.W., 31°08'S, 152°18'E, 30 Jan. 1988, *P.H.Weston 1169 & P.G.Richards*; holo: NSW.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 12 (1991).

Spreading to prostrate shrubs to 1.7 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves narrowly to broadly elliptic to ovate to obovate or narrowly oblong, 8–22 mm long, 2.5–8.5 mm wide, flat, with recurved margins, usually spreading but sometimes with a prominently recurved tip, straight, innocuous, slightly to strongly discolorous, not glaucous, sparsely hairy when immature, glabrescent to very sparsely hairy when mature, smooth but sometimes with longitudinal wrinkles abaxially when dried. Inflorescence auxotelic, 1–16-flowered; rachis 0–7.5 cm long. Flowers mostly subtended by reduced leaves or leaves; pedicels 3–6 mm long, erect to spreading, glabrous; tepals 7–10 mm long, apiculate, glabrous on outside. Ovary glabrous; ovule 1. Fig. 39C.

Disjunctly distributed from the Ebor district to the Barrington Tops of the Northern Tablelands and the Hampton area on the Central Tablelands, N.S.W.; grows in heath to wet sclerophyll eucalypt forest, in well-drained soils, usually derived from granite or metasediments, or on basic volcanic substrata in high-rainfall areas, at 1000–1500 m alt. Flowers Dec.–Apr. Map 30.

N.S.W.: Point Lookout, 2 Feb. 1951, *L.A.S.Johnson* (NSW); Thumb Rd, off Hastings Forest Hwy, *T.M.Whaite 3758* (NSW); Dilgry Circle, c. 1 km N of Dilgry R., *A.Rodd 4706 & R.Parsons* (NSW); Mt Bindo, 1.3 km NW of Tower, *D.H.Benson 2302 & D.Keith* (NSW).

*Persoonia acuminata* intergrades with *P. oxycoccoides* in a limited area between Jenolan Caves and Kanangra Walls at the southern end of its distribution. These specimens have ovate to broadly ovate or orbicular leaves that, on average, are shorter than those of *P. acuminata*.

## **22. Persoonia recedens** Gand., *Bull. Soc. Bot. France* 66: 227 (1919)

T: Blackheath, N.S.W., Dec. 1882, *C.Walter*; holo: LY.

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 12 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 162–163 (1992).

Spreading to prostrate shrubs 0.3–1.5 m tall. Bark smooth. Hairs greyish, appressed. Young branchlets sparsely to moderately hairy. Leaves narrowly oblong to narrowly elliptic, 10–20 mm long, 1.2–3.5 mm wide, flat, with flat to recurved margins, usually suberect, straight, innocuous, concolorous to slightly discolorous, not glaucous, sparsely hairy when immature, glabrescent, smooth but with prominent, longitudinal wrinkles abaxially when dried. Inflorescence auxotelic, 1–12-flowered; rachis 0–7.5 cm long. Flowers subtended by reduced leaves or leaves; pedicels 2–3.5 mm long, spreading, glabrous; tepals 9–10 mm long, apiculate, glabrous on outside. Ovary glabrous; ovule 1.

Restricted from Newnes Plateau to Blackheath, in central-eastern N.S.W., with a dubious, disjunct record from Abercrombie Caves; grows in dry sclerophyll eucalypt forest, in sandy, siliceous soils, usually derived from Narrabeen Sandstone, at 600–1200 m alt. Flowers Dec.–Jan. Map 31.

N.S.W.: near Bungleboori, Newnes State Forest, *L.A.S.Johnson 8459* (NSW); 0.7 km from Bell–Lithgow road on Clarence sawmill road, *P.H.Weston 372* (NSW, SYD); Blackheath, Dec. 1882, *E.Betche* (NSW); Abercrombie Caves, 22 Oct. 1958, *E.F.Constable* (NSW).

The supposed Abercrombie Caves locality is open to doubt, since that area differs geologically from the rest of the range of *P. recedens*, and the collector is known to have made occasional errors in locality recording. *Persoonia recedens* hybridises with *P. myrtilloides* subsp. *myrtilloides* where they grow together, producing hybrid swarms of limited extent.

**23. Persoonia oxycoccoides** Sieber ex Spreng., *Syst. Veg.* 4(2): 45 (1827)

*Linkia oxycoccoides* (Sieber ex Spreng.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: locality unknown, N.S.W., 1823, *F.W.Sieber 49*; lecto: B; isolecto: BM, FI, K, L, M, MEL, NY, *fide* P.H.Weston & L.A.S.Johnson, *Telopea* 4: 279 (1991).

*Persoonia thymifolia* A.Cunn. ex R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 15 (1830). T: Argyle, N.S.W., Apr. 1824, *A.Cunningham*, syn: BM, K, NY.

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 12 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 160–161 (1992).

Spreading to prostrate shrubs to 90 cm tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets sparsely to moderately hairy. Leaves narrowly to broadly elliptic to ovate, 4–11 mm long, 1.5–6 mm wide, flat, with recurved margins, spreading, straight, innocuous, slightly to strongly discolorous, not glaucous, sparsely to moderately hairy when immature, glabrescent to sparsely hairy when mature, smooth to slightly scaberulous. Inflorescence auxotelic, 1–13-flowered; rachis 0–3.5 cm long. Flowers subtended by reduced leaves or leaves; pedicels 2–5 mm long, erect to spreading, glabrous or rarely very sparsely hairy; tepals 8–11 mm long, acute to apiculate, glabrous on outside. Ovary glabrous; ovule usually 1.

Occurs in an area bounded by Mittagong, Jamberoo Pass and Tallong on the Central Tablelands of N.S.W.; grows in heath to dry sclerophyll eucalypt forest, in acid, sandy soils derived from sandstone, at 600–700 m alt. Flowers Dec.–Apr. Map 32.

N.S.W.: Mittagong, *W.A.Dixon* (NSW); c. 2 km N of Dhruwalga trig. on Jamberoo–Robertson road, *P.H.Weston 106* (SYD); near Fitzroy Falls, *E.Gauba* (NSW); Bundanoon, *C.W.E.Moore 3593* (NSW); Penrose, Apr. 1936, *A.D.Lindsay* (NSW).

There is ±clinal variation in leaf shape between the eastern and western parts of the species range. Longer, narrower leaved plants (typical) occur in the west, and shorter, broader leaved plants in the east. *Persoonia oxycoccoides* occasionally hybridises with *P. levis* where they grow together.

**24. Persoonia asperula** L.A.S.Johnson & P.H.Weston, *Telopea* 4: 279 (1991)

T: Wadbilliga Fire Trail, c. 25 km SE of Numeralla, N.S.W., 36°20'S, 149°32'E, 11 Jan. 1973, *L.G.Adams & M.P.Austin 2911*; holo: NSW.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 11 (1991).

Erect to prostrate shrubs to 2 m tall. Bark smooth. Hairs whitish or greyish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves narrowly oblong to oblong to elliptic or, less frequently, ovate, 3–22 mm long, 1–6 mm wide, flat, with recurved margins, spreading, straight, innocuous, concolorous to strongly discolorous, not glaucous, sparsely to moderately hairy, scaberulous. Inflorescence auxotelic, 1–9-flowered; rachis 0–4.5 cm long. Flowers mostly subtended by reduced leaves or leaves; pedicels 1–5 mm long, erect to spreading, sparsely to moderately hairy; tepals 9–11 mm long, acute to apiculate, glabrous to moderately hairy on outside. Ovary glabrous; ovule 1. Fig. 9.

Occurs from Sandhills Range through the Tinderry and Kybean Ranges to Mt Kydra in N.S.W. and in the Moroka River catchment, Vic.; grows in heath dominated by *Allocasuarina nana* to wet sclerophyll eucalypt forest, in shallow, stony soils derived from granite or metasediments, at 900–1350 m alt. Flowers Jan.–Feb., with sporadic inflorescences as late as June. Map 33.

N.S.W.: Sandhills Ra., Hoskinstown–Braidwood area, 19 Nov. 1952, *C.W.E.Moore* (NSW); Badja Fire Trail, c. 0.3 km from Pikes Saddle, *P.H.Weston 69 & D.T.Tomlinson* (SYD); Wadbilliga Fire Trail, 3 km from Wadbilliga, *M.D.Tindale 4034 & D.Wimbush* (BRI, CANB, K, MEL, NSW). Vic.: Nielsons Crag, *N.G.Walsh 1693* (MEL, NSW).

The single specimen from eastern Vic., sampled from a population of two plants, differs from the N.S.W. specimens in having smaller (3–8 mm long, 1–2 mm wide), narrowly elliptic leaves. It has no flowers, so there may be other differences too. This may belong to a different taxon, but further samples of better material are required before we can confidently

classify these plants. The large disjunction between N.S.W. and Vic. populations is surprising given the existence of apparently suitable habitats in the intervening area.

*Persoonia asperula* sometimes hybridises with *P. chamaepeuce* where they grow together.

### 25. Persoonia microphylla R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 15 (1830)

*Persoonia oxycoccoides* var. *microphylla* (R.Br.) Domin, *Biblioth. Bot.* 89: 584 (1921). T: Argyle, N.S.W., Apr. 1824, *A.Cunningham*; syn: BM, K, NY.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 11 (1991).

Erect to prostrate shrubs to 2 m tall. Bark smooth. Hairs whitish or greyish, mostly antrorsely spreading to patent. Young branchlets moderately hairy. Leaves broadly elliptic to ovate to broadly ovate, 3–9 mm long, 2–5 mm wide, convex, with recurved to revolute margins, usually recurved towards tip, spreading at base, straight, innocuous, slightly discolorous, not glaucous, sparsely to moderately hairy when immature, sparsely so when mature, scabrous. Inflorescence auxotelic, 1–14-flowered; rachis 0–3 cm long. Flowers mostly subtended by leaves; pedicels 1–3 mm long, erect to spreading, glabrous to moderately hairy; tepals 8–10 mm long, acute to apiculate, glabrous to sparsely hairy on outside. Ovary glabrous; ovule 1.

Disjunctly distributed in eastern N.S.W. from the Murruin Range towards Taralga on the Great Dividing Range and in the Corang and Endrick River catchments of the Budawang Range; grows in heath to dry sclerophyll eucalypt forest, in sandy to stony soils derived from sandstone or other siliceous rocks, from 600 to 1200 m alt. Flowers Dec.–Feb., occasionally with a few sporadic inflorescences throughout the year. Map 34.

N.S.W.: Mt Werong–South Head, Murruin Ra., 24 Oct. 1957, *L.A.S.Johnson & E.F.Constable* (NSW); Richlands to Wombeyan Caves, *C.W.E.Moore 2641* (NSW); Bungonia road, 0.7 km ESE of junction with Braidwood–Nerriga road, *P.H.Weston 1423 & S.L.Krauss* (AD, B, BRI, CBG, HO, K, MEL, NBG, NSW, PERTH, RSA); Charleys Forest, Sept. 1898, *W.Bäuerlen* (CBG, MEL, NSW).

*Persoonia microphylla* grows together with *P. mollis* subsp. *livens* in the Nerriga area and occasionally hybridises with it.

### 26. Persoonia terminalis L.A.S.Johnson & P.H.Weston, *Telopea* 4: 281 (1991)

T: Emmaville–Torrington road, 3.4 km S of Torrington pub, N.S.W., 29°20'S, 151°41'E, 3 Jan. 1990, *P.H.Weston 1439 & P.G.Richards*; holo: NSW; iso: AD, BRI, CBG, HO, K, MEL, MO, PERTH, RB.

Erect to spreading shrubs 0.7–1.5 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets sparsely hairy. Leaves narrowly oblong, 3.5–10 mm long, 1.2–2 mm wide, convex, with recurved margins, usually slightly to strongly recurved towards tip, spreading at base, straight, innocuous, concolorous to slightly discolorous, not glaucous, glabrous to sparsely hairy when immature, glabrescent, smooth to slightly scaberulous. Inflorescence anauxotelic, 1–5-flowered; rachis 0–7 mm long. Flowers mostly subtended by scale leaves; pedicels 1–2 mm long, erect to spreading, sparsely to moderately hairy; tepals 9–13 mm long, obtuse to apiculate, sparsely hairy on outside. Ovary glabrous; ovules 2.

Occurs in the Cecil Plains–Inglewood area in south-eastern Qld, and in the Warialda area and the Torrington–Binghi area, N.S.W. Flowers Dec.–Jan., sometimes with a few sporadic inflorescences as late as July. Two subspecies are recognised.

| | |
|---|---|
| Leaves slightly recurved towards the tip; longest leaves 6–10 mm long | **26a.** subsp. **terminalis** |
| Leaves strongly recurved towards the tip; longest leaves 3.5–7.5 mm long | **26b.** subsp. **recurva** |

### 26a. Persoonia terminalis L.A.S.Johnson & P.H.Weston subsp. **terminalis**

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 11 (1991).

Shrubs 0.9–1.5 m tall. Leaves 6–10 mm long, slightly recurved towards tip. Tepals 10–13 mm long.

Restricted to the Torrington–Binghi area in north-eastern N.S.W.; grows in dry sclerophyll forest in sandy, stony soils derived from acid granite, from 900 to 1100 m alt. Map 35.

N.S.W.: Bismuth, Jan. 1916, *J.L.Boorman* (NSW); 4 km from Torrington along road to Emmaville, *M.D.Crisp 7523* (NSW); near Emmaville, July 1954, *G.F.Schumacher* (NSW).

*Persoonia terminalis* subsp. *terminalis* grows together with *P. cornifolia* and occasionally hybridises with it.

### 26b. **Persoonia terminalis** subsp. **recurva** L.A.S.Johnson & P.H.Weston, *Telopea* 4: 282 (1991)

T: Warialda, N.S.W., Jan. 1907, *H.M.R.Rupp*; holo: NSW.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 11 (1991).

Shrubs 0.5–1 m tall. Leaves 3.5–7.5 mm long, strongly recurved towards tip. Tepals 9–10 mm long.

Occurs in the Cecil Plains–Inglewood area in south-eastern Qld, and in the Warialda area, N.S.W.; grows in dry sclerophyll forest in sandy soils derived from sandstone, from 350 to 450 m alt. Map 36.

Qld: SW of Cecil Plains, Sept. 1961, *F.D.Hockings & L.Cockburn* (BRI); Inglewood State Forest, *A.R.Bean 1662* (NSW). N.S.W.: c. 4 miles [c. 6.5 km] SE of Coolatai, *B.Lane 10* (NSW); Apex Park on Gwydir Hwy, 1.6 km ESE of Warialda, *R.G.Coveny 12352 & J.Dalby* (B, BRI, K, NSW, PERTH, RSA).

*Persoonia terminalis* subsp. *recurva* hybridises occasionally with *P. sericea* where they grow together.

### 27. **Persoonia bargoensis** P.H.Weston & L.A.S.Johnson, *Telopea* 4: 284 (1991)

T: Douglas Park Rd, 0.5 km SE of bridge over South Western Freeway, N.S.W., 34°12'S, 150°42'E, 18 Dec. 1989, *P.H.Weston 1414 & S.L.Krauss*; holo: NSW; iso: AD, BRI, CBG, HO, K, MEL, MO, PERTH, RB.

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 12 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 164–165 (1992).

Erect shrubs 0.6–2.5 m tall. Bark smooth. Hairs greyish, appressed. Young branchlets sparsely to moderately hairy. Leaves linear-lanceolate to lanceolate, 8–24 mm long, 1–2.3 mm wide, flat or convex, with recurved margins, sometimes recurved towards tip, mostly spreading at base, straight to slightly falcate, innocuous, slightly to strongly discolorous, not glaucous, glabrous to sparsely hairy when immature, glabrescent, smooth. Inflorescence usually auxotelic, 1–20-flowered; rachis 0–25 cm long. Flowers mostly subtended by leaves; pedicels 3–7 mm long, spreading to recurved, glabrous; tepals 7–10 mm long, shortly caudate, glabrous on outside. Ovary glabrous; ovule 1. Fig. 12.

Restricted to the catchments of the Cataract, Cordeaux and Bargo Rivers, N.S.W.; grows in dry sclerophyll eucalypt woodland to forest, on Hawkesbury Sandstone and Wianamatta Shale, between 100 and 300 m alt. Flowers Dec.–Jan. Map 37.

N.S.W.: Ripponden [Douglas Park], Dec. 1802, *G.Caley* (BM, NSW); Appin–Wilton road, above Cataract R., *C.Dunn 11 & T.James* (CBG, MEL, NSW); The Pheasants Nest, Nepean R., *E.F.Constable 6186* (BRI, NSW); Tahmoor to Bargo, 15 Nov. 1949, *L.A.S.Johnson* (NSW).

### 28. **Persoonia nutans** R.Br., *Trans. Linn. Soc. London* 10: 162 (1810)

*Linkia nutans* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: near Richmond and Nepean R., N.S.W., *R.Brown s.n.*; lecto: BM, *fide* P.H.Weston & L.A.S.Johnson, *Telopea* 4: 284 (1991); syn: K, NSW, NY.

*Persoonia apiculata* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 73 (1855); *P. nutans* var. *apiculata* (Meisn.) Benth., *Fl. Austral.* 5: 402 (1870). T: Port Jackson, N.S.W., *A.Cunningham*; holo: NY.

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 12 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 166–167 (1992).

Erect to spreading shrubs 0.5–1.5 m tall. Bark smooth. Hairs greyish, mostly appressed. Young branchlets sparsely to moderately hairy. Leaves linear-oblong, 1–4.5 cm long, 1–2.5 mm wide, usually flat, with recurved margins, sometimes recurved towards tip, mostly spreading, sometimes slightly falcate, innocuous, strongly discolorous, not glaucous, sparsely hairy when immature, glabrescent, smooth. Inflorescence auxotelic, 1–40-flowered; rachis

0–25 cm long. Flowers subtended by leaves; pedicels 7–12 mm long, recurved, glabrous; tepals 8.5–11 mm long, shortly caudate, glabrous on outside. Ovary glabrous; ovules 2.

Restricted to the Cumberland Plain in central-eastern N.S.W., between Richmond, Macquarie Fields, and East Hills, particularly near the Nepean and Georges Rivers; grows in dry sclerophyll eucalypt forest, in laterite, on Hawkesbury Sandstone or in alluvial sand below 60 m alt. Flowers Nov.–Apr., with a few flowers as late as July. Map 38.

N.S.W.: Londonderry, *P.H.Weston 1256 & D.Catling* (K, NSW); Kemps Ck, *R.G.Coveny 11179* (NSW); Georges R., opposite East Hills, *T.M.Whaite 1123* (NSW); Macquarie Fields, Aug. 1914, *J.L.Boorman* (NSW).

This species is restricted to part of the Sydney metropolitan area and most remaining populations are threatened by development for housing and sand mining.

### **29. Persoonia laxa** L.A.S.Johnson & P.H.Weston, *Telopea* 4: 285 (1991)

T: Manly, N.S.W., June 1908, *A.A.Hamilton*; holo: NSW.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 13 (1991).

Decumbent or prostrate shrubs. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets sparsely hairy. Leaves linear, 8–15 mm long, 1–1.8 mm wide, flat, with recurved margins, straight, innocuous, slightly discolorous, not glaucous, sparsely hairy when immature, glabrescent, smooth. Inflorescence auxotelic, 1–3-flowered; rachis 0–0.5 mm long. Flowers mostly subtended by leaves; pedicels 6–8 mm long, spreading to recurved, glabrous; tepals 8–9 mm long, apiculate, glabrous on outside. Ovary glabrous; ovules 2.

Occurs in Newport and Manly, in central-eastern N.S.W.; presumably grows in heath or dry sclerophyll eucalypt woodland or forest on sandstone or in coastal sand. Flowers Nov.–Jan.? Map 39.

N.S.W.: Newport, 9 Nov. 1907, *Chapman* (NSW, SYD).

This species may be extinct, being represented only by two old specimens collected from what is now a suburban area of Sydney. A specimen from Dee Why, collected in 1922 and held at NSW, is morphologically intermediate between *P. laxa* and *P. levis* and could be a hybrid of these species.

### **30. Persoonia oblongata** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 14 (1830)

*Linkia oblongata* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Port Jackson, N.S.W., *coll. unknown*; syn: BM.

Illustrations: A.Fairley & P.Moore, *Native Pl. Sydney Distr.* 158, pl. 514 (1989); P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 11 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 168–169 (1992).

Erect to spreading shrubs 1–3 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets sparsely to moderately hairy. Leaves narrowly to broadly ovate to elliptic, 1.5–6 cm long, 4–25 mm wide, flat, suberect, straight, twisted at base through 90°, innocuous, concolorous, not glaucous, glabrous to sparsely hairy when immature, glabrescent, smooth. Inflorescence usually auxotelic, 1–16-flowered; rachis 0–18 cm long. Flowers subtended by scale leaves and leaves; pedicels 9–23 mm long, recurved, glabrous; tepals 10–12 mm long, apiculate to caudate, glabrous to sparsely hairy on outside. Ovary glabrous to moderately hairy; hairs greyish; ovules 2.

Restricted to an area bounded by Howes Valley, Rylstone, the lower Blue Mountains, and the Judge Dowling Range in central-eastern N.S.W.; grows in dry sclerophyll woodland to forest, on sandstone, between 50 m and 800 m alt. Flowers Oct.–Apr. Map 40.

N.S.W.: Staircase Hill, *R.G.Coveny 15433 & A.Leishman* (B, CHR, HO, K, NBG, NSW, PERTH, PRE, RSA); old Newnes railway line, c. 8 km S of Newnes, *L.A.S.Johnson 8461* (NSW); near Winmalee on Springwood–Agnes Banks road, *R.G.Coveny 12121, J.Dalby & J.Seur* (B, K, NSW, PERTH); c. 1 mile [c. 1.6 km] N of Sampsons Pass, Judge Dowling Ra., 17 Oct. 1965, *L.A.S.Johnson* (NSW); near Sackville Reach,

Sept. 1927, *W.F.Blakely* (K, NSW).

*Persoonia oblongata* is readily distinguished by its long, recurved pedicels.

### **31. Persoonia marginata** A.Cunn. ex R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 16 (1830)

*Linkia marginata* (A.Cunn. ex R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891); *P. marginata* var. *ovalifolia* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 341 (1856). T: N of Bathurst, N.S.W., Dec. 1822, *A.Cunningham*; syn: BM, K, NY.

*Persoonia marginata* var. *obcordata* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 341 (1856). T: Cugeegong [Cudgegong] R., N.S.W., 1825, *A.Cunningham*; syn: K.

Illustrations: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 482 (1989); P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 13 (1991).

Decumbent shrubs 20–60 cm tall. Bark poorly developed. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves elliptic to broadly elliptic to obovate, 2–4 cm long, 6–23 mm wide, flat, spreading to suberect, straight, twisted through 0–90°, innocuous, concolorous, not glaucous, sparsely hairy when immature, glabrescent, smooth to slightly scaberulous. Inflorescence anauxotelic or auxotelic, 2–4-flowered; rachis 0–6 mm long. Flowers mostly subtended by leaves; pedicels 2–7 mm long, erect to spreading, moderately hairy; tepals 8–12 mm long, caudate with dorsal tails, sparsely hairy on outside. Ovary densely hairy; hairs greyish; ovules 2.

Restricted to the area between Kandos and Portland in central-eastern N.S.W.; grows in dry sclerophyll forest on sandstone, at c. 700 m alt. Flowers Jan.–Feb. Map 41.

N.S.W.: Clandulla State Forest, *R.G.Coveny 9564* (K, NSW); Capertee, Dec. 1915, *J.L.Boorman* (K, NSW); 3 miles [c. 5 km] NE of Dark Corner P.O., *J.Pickard 441* (NSW).

*Persoonia marginata* is readily distinguished by the combination of a densely hairy ovary and the caudate, dorsal-subterminal tepal tails.

### **32. Persoonia daphnoides** A.Cunn. ex R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 15 (1830)

T: near Hunter's [Hunter] R., N.S.W., Aug. 1827, *A.Cunningham 56*; lecto: BM; isolecto: K, NSW, NY, *fide* P.H.Weston & L.A.S.Johnson, *Telopea* 4: 301 (1991).

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 13 (1991).

Prostrate shrubs to 10 cm tall. Bark poorly developed. Hairs tawny, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves mostly obovate to spathulate, 1.5–5 cm long, 4–20 mm wide, flat, with slightly recurved margins, suberect, straight, twisted through 0–90°, innocuous, concolorous, not glaucous, sparsely hairy when immature, glabrescent, smooth. Inflorescence usually auxotelic, 1–8-flowered; rachis 0–35 mm long. Flowers subtended by scale leaves and leaves; pedicels 1.5–3 mm long, erect, moderately to densely hairy; tepals 9–10 mm long, apiculate, moderately hairy on outside. Ovary glabrous; ovule 1.

Restricted to the Stanthorpe–Tenterfield area of south-eastern Qld and north-eastern N.S.W.; grows in dry sclerophyll forest, on Permian adamellite, between 950 and 1200 m alt. Flowers Dec.–Jan. Map 42.

Qld: Wyberba, Jan. 1983, *E.A.Goebel* (BRI). N.S.W.: Mt Lindesay Hwy, 0.7 km S of Bookookoora [Bookookoorara] Ck, *P.H.Weston 1447 & P.G.Richards* (AD, BRI, CBG, MEL, NSW, PERTH); Colongan Fire Trail, 6.2 km S of Imbergers Rd, Forestland State Forest, *P.H.Weston 1330 & P.G.Richards* (NSW).

The type locality cited by Brown, and recorded on Allan Cunningham's labels, is undoubtedly erroneous, as discussed by P.H.Weston & L.A.S.Johnson, *Telopea* 4: 301–302 (1991).

### **33. Persoonia procumbens** L.A.S.Johnson & P.H.Weston, *Telopea* 4: 297 (1991)

T: Point Lookout road, 0.7 km E of Armidale–Ebor road, N.S.W., 30°29'S, 152°18'E, 1 Feb. 1988, *P.G.Richards 92 & P.H.Weston*; holo: NSW; iso: AD, BRI, CBG, K, MEL, MO, PERTH, RB.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 13 (1991).

Prostrate shrubs to 10 cm tall. Bark poorly developed. Hairs ferruginous, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves mostly obovate to spathulate, 15–36 mm long, 4–17 mm wide, flat, with slightly recurved margins, suberect, straight, twisted through 0–90°, innocuous, concolorous, not glaucous, sparsely hairy when immature, glabrescent, smooth. Inflorescence usually auxotelic, 1–6-flowered; rachis 0–10 mm long. Flowers subtended by scale leaves and leaves; pedicels 1.5–3 mm long, erect, moderately to densely hairy; tepals 7–9 mm long, apiculate, sparsely hairy on outside. Ovary glabrous; ovule 1.

Restricted to the Backwater and Round Mountain areas of north-eastern N.S.W.; grows in dry sclerophyll eucalypt woodland to forest in sandy to clayey soil derived from granite (adamellite or leucoadamellite), at 1200–1500 m alt. Flowers Dec.–Feb. Map 43.

N.S.W.: Pheasant Mtn, c. 2 km NE of Backwater, *I.R.Telford 8984 & G.Butler* (CBG, NSW); 1 km SE of Cathedral Rock, Cathedral Rock Natl Park, Snowy Ra., *I.R.Telford 10777* (CBG, NSW); 9.5 km SW of Ebor, on Armidale–Grafton road, *R.G.Coveny 2278* (NSW).

*Persoonia procumbens* resembles *P. daphnoides* very closely, differing only in the darker pigmentation of the hairs, its less densely hairy tepals, smaller flowers and slightly fleshier leaves. Thus they are probably sister species, united by a synapomorphy of prostrate habit.

### **34. Persoonia oleoides** L.A.S.Johnson & P.H.Weston, *Telopea* 4: 296 (1991)

T: Styx R. Forest Way, 1.9 km NE of Armidale–Kempsey road, N.S.W., 30°36'30"S, 152°11'45"E, 31 Jan. 1988, *P.G.Richards 84 & P.H.Weston*; holo: NSW; iso: AD, BRI, CBG, K, MEL, MO, PERTH, RB.

*Persoonia oxycoccoides* var. *longifolia* Benth., *Fl. Austral.* 5: 401 (1870). T: New England [N.S.W.], *C.Stuart*; holo: K.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 13 (1991).

Erect to spreading shrubs 0.2–1 m tall. Bark smooth. Hairs greyish to ferruginous, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves narrowly oblong to narrowly elliptic to elliptic to lanceolate to oblanceolate to narrowly spathulate to spathulate, mostly 2–6 cm long, mostly 4–15 mm wide, flat, with slightly recurved to recurved margins, sometimes incurved, spreading to suberect, straight, innocuous, concolorous to slightly discolorous, not glaucous, sparsely hairy when immature (but denser on margins), glabrescent to sparsely hairy when mature (on abaxial surface), smooth to slightly scaberulous. Inflorescence auxotelic or anauxotelic, 1–25-flowered; rachis 0–13 cm long. Flowers subtended by scale leaves and leaves; pedicels mostly 1–3 mm long, erect, moderately to densely hairy; tepals 10–15 mm long, apiculate to shortly caudate, moderately hairy outside. Ovary glabrous; ovule 1. Fig. 4.

Occurs between the upper Clarence River and the Barrington Tops, north-eastern N.S.W.; grows in dry to wet sclerophyll eucalypt forest, in various metamorphic and igneous substrata, common on the eastern side of the tablelands but also occurring occasionally down to the foot of the eastern escarpment, from 190 m to 1300 m alt. Flowers Jan.–Feb. Map 44.

N.S.W.: Bruxner Hwy at Crooked Ck, *P.H.Weston 1335–1337 & P.G.Richards* (NSW); Spirabo Fire Trail, 1.8 km N of junction with Upper Rocky R. Trail, Spirabo State Forest, *P.H.Weston 1327–1328 & P.G.Richards* (NSW); Gwydir Hwy, 2.1 km SSW of Bark Hut Forest Rd, *P.H.Weston 1433–1434 & P.G.Richards* (NSW); c. 1 mile [c. 1.6 km] W of Point Lookout, 12 Feb. 1966, *J.B.Williams* (NSW); Barrington Tops State Forest, *D.Binns 2363* (NSW).

This species shows remarkable variability in the shape and size of its leaves, and in inflorescence behaviour, but is relatively stable in other characters such as habit. Leaf length seems to be negatively correlated with altitude, and populations from low altitudes tend to be more variable in leaf morphology than those from the tablelands.

*Persoonia oleoides* forms narrow hybrid zones with *P. cornifolia*, which only occurs to the west of *P. oleoides*. *Persoonia oleoides* also grows together with *P. media* and *P. linearis* but rarely seems to hybridise with those species.

**35. Persoonia rufa** L.A.S.Johnson & P.H.Weston, *Telopea* 4: 298 (1991)

T: Gwydir Hwy, 4.3 km NE of turn-off to Raspberry Lookout, Gibraltar Range, N.S.W., 29°32'S, 152°17'E, 2 Jan. 1990, *P.H.Weston 1428 & P.G.Richards*; holo: NSW; iso: AD, BRI, CBG, K, MEL, MO, PERTH, RB.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 14 (1991).

Erect to spreading shrubs 1–2.5 m tall. Bark smooth. Hairs tawny to ferruginous, appressed to patent. Young branchlets moderately to densely hairy. Leaves elliptic to broadly elliptic, 3–6 cm long, 10–25 mm wide, flat, with recurved margins, sometimes slightly incurved, suberect, straight, twisted through 0–90°, innocuous, slightly discolorous, not glaucous, moderately hairy when immature, glabrescent to moderately hairy when mature, scabrous. Inflorescence anauxotelic or auxotelic, 1–12-flowered; rachis 0–11 cm long. Flowers subtended by scale leaves and leaves; pedicels 1–3 mm long, erect, moderately to densely hairy; tepals 10–14 mm long, caudate, moderately to densely hairy on outside. Ovary densely hairy; hairs greyish to ferruginous; ovule 1. Fig. 14.

Restricted to Gibraltar Range, north-eastern N.S.W.; grows in heath to dry sclerophyll eucalypt forest, in stony or sandy to loamy soils derived from granite, from 900 to 1100 m alt. Flowers Dec.–Feb. Map 45.

N.S.W.: southern end of Washpool State Forest, *L.A.S.Johnson & D.J.McGillivray 2426* (NSW); Mulligans Hut, Gibraltar Range Natl Park, *R.G.Coveny 2232* (NSW); Gibraltar Range Natl Park, *R.G.Coveny 5685 & N.S.Lander* (B, K, NSW).

*Persoonia rufa* most closely resembles *P. cornifolia* and *P. oleoides*. It differs from the former in the ferruginous colour of the hairs of the young branchlets and flowers, and its more strongly hairy-scabrous, more markedly discolorous leaves. It differs from *P. oleoides* in being a larger shrub, in its usually longer, more ferruginous hairs, its usually more scabrous leaves and its densely hairy ovary.

**36. Persoonia cornifolia** A.Cunn. ex R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 15 (1830)

*Linkia cornifolia* (A.Cunn. ex R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: [Yetman district, 29°S, 150°30'E], N.S.W., June–July 1827, *A.Cunningham 97*; lecto: BM, *fide* P.H.Weston, *Fl. Australia* 16: 471 (1995); ora orient., Moreton Bay [Qld], 1827, *C.Fraser*; syn: *n.v.*

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 14, pl. 1 (1991).

Erect to spreading shrubs 0.9–6 m tall. Bark smooth. Hairs greyish to tawny, appressed to patent. Leaves elliptic to broadly elliptic to ovate, 2–8 cm long, 10–45 mm wide, flat, with recurved margins (sometimes only slightly so), spreading to suberect, straight, twisted through 0–90°, innocuous, concolorous to slightly discolorous, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth to slightly scaberulous. Inflorescence mostly anauxotelic, mostly 1–4-flowered; rachis mostly 0–5 mm long. Flowers mostly subtended by scale leaves; pedicels 1–2 mm long, erect, densely hairy; tepals 10–13 mm long, acute to apiculate, moderately to densely hairy on outside. Ovary moderately to densely hairy or rarely glabrous; hairs greyish; ovule 1.

Occurs in an area bounded by Stanthorpe and Inglewood in south-eastern Qld and Warialda, Moonbi Range and Werrikimbe Natl Park in north-eastern N.S.W.; grows in dry sclerophyll woodland to forest, in a variety of well-drained substrata, most commonly on granite or sandstone, from 300 m to 1200 m alt. Flowers Nov.–Feb. Map 46.

Qld: Inglewood, *C.J.Smith 6* (BRI); Girraween Natl Park, *D.Halford Q1586 & P.I.Forster* (NSW). N.S.W.: 6.7 km E of Yetman, *R.G.Coveny 11672 & P.G.Wilson* (BRI, CBG, MEL, NSW); 3.2 km N of Tungsten, *P.H.Weston 1446 & P.G.Richards* (AD, BRI, CBG, HO, K, L, MEL, MO, NA, NSW, PE, PRE); Werrikimbe Natl Park, *J.R.Hosking 392* (NSW).

*Persoonia cornifolia* possibly intergrades with *P. stradbrokensis* in the upper Clarence River catchment. It differs from *P. stradbrokensis* in having smooth (rather than basally flaky) bark, in its predominantly anauxotelic inflorescence with short (0–5 mm) rachises, and its acute to apiculate (never caudate) tepals. Although some specimens of *P. stradbrokensis* from the Noosa–Cooloola area of Qld have a high percentage of anauxotelic inflorescences, the rachises in these are mostly 5–20 mm long.

*Persoonia cornifolia* hybridises with *P. fastigiata*, *P. oleoides*, *P. tenuifolia*, *P. sericea* and *P. terminalis* where they grow together. It forms geographically restricted hybrid swarms with the first two species, but only sporadic hybrids with the other three.

### 37. **Persoonia katerae** P.H.Weston & L.A.S.Johnson, *Telopea* 4: 291 (1991)

T: Boomerang Drive, 1.2 km N of Headland Rd, 0.2 km W of Boomerang Beach, N.S.W., 32°20'15"S, 152°32'30"E, 28 Jan. 1988, *P.H.Weston 1124 & P.G.Richards*; holo: NSW; iso: BRI, CBG, K, MEL, MO.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 14 (1991).

Erect shrubs or trees 3–9 m tall. Bark smooth on upper branches, finely fissured at base. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves narrowly elliptic to oblanceolate, 6–17 cm long, 8–22 mm wide, flat, with slightly recurved margins, spreading to suberect, straight or often falcate, twisted through 0–90°, innocuous, concolorous, not glaucous, glabrous to sparsely hairy when immature (but much denser on margins), glabrescent, smooth. Inflorescence auxotelic, mostly 6–22-flowered; rachis 3–16 cm long. Flowers mostly subtended by leaves; pedicels 3–5 mm long, erect, moderately hairy; tepals 9–12 mm long, acute to acuminate, moderately hairy on outside. Ovary glabrous; ovules 2.

Occurs between Lake Cathie and Smiths Lake, N.S.W.; grows in heath to dry sclerophyll forest, usually in association with *Banksia integrifolia* or *Eucalyptus pilularis*, exclusively on stabilised coastal sand dunes, below 20 m alt. Flowers Jan.–Feb. Map 47.

N.S.W.: 0.3 km N of Cathie Ck, on Cathie Rd, *P.H.Weston 1145–1147 & P.G.Richards* (NSW); Crowdy Head–Diamond Head track, 7 km N of Crowdy Head, *P.H.Weston 1142–1144 & P.G.Richards* (NSW); The Lakes Way, Tiona, *P.H.Weston 1117* (BRI, CBG, NSW).

*Persoonia katerae* most closely resembles *P. media*, *P. conjuncta* and *P. stradbrokensis*, from which it is distinguished by consistently having 2 ovules per carpel, leaves that turn black on natural drying (check fallen leaves in the field), and in having appressed to antrorsely spreading, short, greyish hairs that are moderately dense on the branchlets. It hybridises sporadically with *P. lanceolata* where they grow together.

### 38. **Persoonia adenantha** Domin, *Biblioth. Bot.* 89: 582 (1921)

T: Logan R., Qld, Mar. 1910, *K.Domin*; syn: PR.

*Persoonia adenantha* var. *salicifolia* Domin, *Biblioth. Bot.* 89: 582 (1921). T: Tambourine Mtns [Tamborine Mtn], Qld, Mar. 1910, *K.Domin*; syn: PR.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 14 (1991).

Erect shrubs or trees 2.5–9 m tall. Bark smooth on upper branches, finely fissured at base. Hairs greyish to tawny, appressed to patent. Leaves narrowly elliptic to lanceolate, 3–14 cm long, 6–30 mm wide, flat, with recurved margins, suberect, straight, twisted through 0–90°, innocuous, slightly to strongly discolorous, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth. Inflorescence auxotelic, mostly 5–40-flowered; rachis mostly 3–26 cm long. Flowers subtended by scale leaves and leaves; pedicels 1–4 mm long, erect, moderately to densely hairy; tepals 10–13 mm long, prominently caudate, moderately to densely hairy on outside. Ovary glabrous to sparsely hairy; ovule 1. Fig. 5.

Occurs on the coastal lowlands and ranges between Pimpama and Mt Tamborine in south-eastern Qld and Broadwater in north-eastern N.S.W.; grows in heath to wet sclerophyll forest and littoral rainforest, in a variety of well-drained substrata including stabilised coastal dunes and metasediments, from sea level to 500 m alt. Flowers chiefly Nov.–Apr. Map 48.

Qld: Yawalpah Rd, Pimpama, *P.R.Sharpe 2032 & B.Lebler* (BRI, NSW); Contour Rd, Mt Tamborine, *P.R.Sharpe 1998 & S.T.Reynolds* (BRI, NSW); Tallebudgera, *C.T.White 1881* (BRI, NSW). N.S.W.: Byron Bay, Nov. 1903, *J.H.Maiden & J.L.Boorman* (NSW).

*Persoonia adenantha* intergrades with *P. stradbrokensis* in the area between Evans Head and Nimbin in N.S.W, and possibly also with *P. media* in the Nightcap Range in north-eastern N.S.W. and on Tamborine Mountain in south-eastern Qld.

**39. Persoonia stradbrokensis** Domin, *Biblioth. Bot.* 89: 580 (1921)

T: Stradbroke Is., Qld, Mar. 1910, *K.Domin*; syn: PR.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 14 (1991).

Erect shrubs or trees 1–6 m tall. Bark smooth on upper branches, finely fissured at base. Hairs greyish to tawny, appressed to patent or curly. Leaves narrowly to broadly elliptic to ovate to obovate, 3–11 cm long, 10–40 mm wide, flat to convex, with slightly recurved margins, suberect, straight, twisted through 0–90°, innocuous, concolorous to slightly discolorous, not glaucous, moderately to densely hairy when immature, glabrescent, smooth. Inflorescence usually auxotelic, 1–20-flowered; rachis 0–10 cm long. Flowers subtended by scale leaves and leaves; pedicels 1–4 mm long, erect, moderately to densely hairy; tepals 10–13 mm long, apiculate to shortly caudate, moderately to densely hairy on outside. Ovary moderately to densely hairy or rarely glabrous; hairs greyish to tawny; ovule 1. Fig. 39D.

Occurs in near-coastal eastern Australia between the Tin Can Bay area in south-eastern Qld and Hastings River in north-eastern N.S.W.; grows in heath to dry sclerophyll forest in coastal sand, sandstone and metasediments, from sea level to 500 m alt. Flowers chiefly Dec.–May. Map 49.

Qld: Maryborough–Tin Can Bay road, *P.H.Weston 1520 & P.G.Richards* (BRI, CANB, NSW); Griffith University site, Mt Gravatt, *P.Sharpe 753* (BRI). N.S.W.: Bostock Rd, Tucabia, *F.M.Isaac 1198* (NSW); Coffs Harbour, 8 June 1911, *J.L.Boorman* (L, NSW); Port Macquarie–Point Plomer road, 5.5 km S of Point Plomer, *P.H.Weston 1148–1149 & P.G.Richards* (NSW).

*Persoonia stradbrokensis* intergrades with *P. adenantha* (see above) and *P. conjuncta* (see below). It hybridises sporadically with *P. lanceolata*, *P. levis*, *P. tenuifolia* and *P. virgata* where it grows with them. The type of *P. attenuata* R.Br. [*Suppl. Prodr. Fl. Nov. Holl.* 16 (1830); T: 'Orâ Orient. Moreton Bay' [Qld], 1827, *C.Fraser*; holo: BM] appears to be a *P. stradbrokensis* × *P. virgata* hybrid.

**40. Persoonia prostrata** R.Br., *Trans. Linn. Soc. London* 10: 163 (1810)

*Linkia prostrata* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: near Sandy Cape, Qld, 31 July 1802, *R.Brown s.n.*; lecto: BM; isolecto: NSW, *fide* P.H.Weston & L.A.S.Johnson, *Telopea* 4: 302 (1991).

Similar to *P. stradbrokensis* but differs as follows: Prostrate shrubs. Leaves elliptic to spathulate, 2.3–5 cm long, 12–24 mm wide. Inflorescence anauxotelic, 1–5-flowered; rachis to 6 mm long. Flowers subtended by scale leaves; tepals c. 10 mm long, apiculate, moderately to densely hairy. Ovary hairs greyish.

Restricted to the northern tip of Fraser Is., Qld, where it must be rare or extinct; presumably grows on stabilised coastal sand dunes, in heath or dry sclerophyll woodland or forest, below 50 m alt. Map 50.

Qld: Fraser Is., *Lovell* (BRI, NSW).

*Persoonia prostrata* is very similar to specimens of *P. stradbrokensis* collected from the mainland south of Fraser Is., but differs in its prostrate habit, usually smaller leaves and smaller flowers. These differences are based on only two collections for *P. prostrata*, neither of which is an adequate specimen. It may be that *P. prostrata* and *P. stradbrokensis* are conspecific, and that *P. prostrata* is just a prostrate, maritime form. However, the distributions of these species are separated by over 100 km.

**41. Persoonia conjuncta** P.H.Weston & L.A.S.Johnson, *Telopea* 4: 286 (1991)

T: Mt Yarrahapinni, N.S.W., 30°50'S, 152°56'E, 23 Jan. 1980, *L.A.S.Johnson 8516*; holo: NSW; iso: CBG.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 15 (1991).

Erect shrubs or trees 2–7 m tall. Bark smooth on upper branches, finely fissured at base. Hairs greyish to tawny, antrorsely spreading. Leaves narrowly elliptic to lanceolate, 6–14 cm long, 10–26 mm wide, flat, with recurved margins (often only slightly so), spreading to suberect, straight or rarely slightly falcate, twisted through 0–90°, innocuous, concolorous to slightly discolorous, not glaucous, glabrous to sparsely hairy when immature (but much

denser on margins), glabrescent, smooth. Inflorescence usually auxotelic, 1–16-flowered; rachis 0–14 cm long. Flowers subtended by scale leaves; pedicels 2–6 mm long, erect, sparsely to densely hairy; tepals 12–13 mm long, acuminate to caudate, sparsely to moderately hairy on outside. Ovary moderately hairy; hairs greyish; ovule 1.

Occurs on coastal ranges and valleys of north-eastern N.S.W., between Bellinger River and Manning River; grows in dry to wet sclerophyll eucalypt forest on a variety of sedimentary and metamorphic substrata, from near sea level to at least 350 m alt. Flowers Jan.–Feb. Map 51.

N.S.W.: Martells Rd, 4.4 km W of Pacific Hwy, *P.H.Weston 1073, K.D.Hill & L.A.S.Johnson* (NSW); Range Rd, Ingalba State Forest, *L.A.S.Johnson 8705* (NSW); Pacific Hwy, 4.2 km N of Cooperabung Ck, *P.H.Weston 1376–1377 & P.G.Richards* (NSW); Pacific Hwy, between turn-off to Rossglen and Charlies Yard Rd, *P.H.Weston 1378–1379 & P.G.Richards* (NSW).

This taxon encompasses populations that are intermediate between *Persoonia media* and *P. stradbrokensis*, occurring commonly in a quite large geographic area between the distributions of those species.

*Persoonia conjuncta* apparently hybridises sporadically with *P. linearis* where they occur together.

### 42. **Persoonia media** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 16 (1830)

*Linkia media* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: ora orientalis, mont. prope Port Jackson, N.S.W., 1818, *C.Fraser 47*; holo: BM.

[*Persoonia attenuata auct. non* R.Br.: L.A.S.Johnson *in* S.W.L.Jacobs & J.Pickard, *Pl. New South Wales* 181 (1981)]

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 15 (1991).

Erect to spreading shrubs to trees 0.3–25 m tall. Bark uniformly smooth or smooth on upper branches and finely fissured at base. Hairs tawny to ferruginous, mostly appressed. Young branchlets glabrous to sparsely hairy. Leaves linear-elliptic to broadly elliptic to ovate, 3–14 cm long, 4–35 mm wide, flat, with recurved margins, spreading to suberect, straight, innocuous, concolorous, not glaucous, glabrous to sparsely hairy when immature, glabrescent, smooth. Inflorescence anauxotelic or auxotelic, 1–16-flowered; rachis 0–15 cm long. Flowers subtended by scale leaves and/or leaves; pedicels 3–10 mm long, erect, glabrous to moderately hairy; tepals 10–14 mm long, apiculate to caudate, glabrous to sparsely hairy on outside. Ovary glabrous or occasionally sparsely to moderately hairy; hairs greyish to tawny; ovule 1.

Occurs on the Lamington and Springbrook Plateaus in south-eastern Qld and in the Nightcap Range, and the eastern escarpment of the tablelands from Chaelundi Mtn to the upper Manning River, north-eastern N.S.W.; grows in dry sclerophyll forest to rainforest, in a variety of metamorphic, granitic and acid volcanic substrata from 50 to 1300 m alt. Flowers Dec.–Apr. Map 52.

Qld: Daves Ck, Binna Burra, 7 Dec. 1961, *R.Jones* (BRI, NSW). N.S.W.: 3 miles [5 km] NW of Peach Mtn, Nightcap Ra., 10 June 1957, *L.A.S.Johnson & H.C.Hayes* (NSW); Chaelundi Rd, *P.G.Richards 94 & P.H.Weston* (NSW); Dorrigo, Sept. 1909, *J.L.Boorman* (NSW); Fenwicks Rd, 5.7 km from Oxley Hwy, *P.H.Weston 1157–1159 & P.G.Richards* (NSW).

Populations of *P. media* show considerable geographical and ecotypic variation. In populations south of the Macleay River in N.S.W. variation is clinal and ecologically correlated: plants in the driest sites (dry sclerophyll forest) are usually multistemmed, lignotuberous, 0.3–2 m tall, having short, anauxotelic inflorescences as well as, or instead of, auxotelic inflorescences; plants in the wettest sites (rainforest margins) are (0.7–) 2–8 m tall, single-stemmed, produce only auxotelic inflorescences and usually have narrower leaves than the multi-stemmed plants. Between the Macleay River and Chaelundi Mountain in N.S.W. and on the Lamington and Springbrook Plateaus in Qld, plants resemble the rainforest form. Plants from the Nightcap Range more closely resemble the dry sclerophyll form.

*Persoonia media* hybridises with *P. oleoides* and *P. linearis* where they grow together. It

intergrades with *P. conjuncta* in the coastal ranges between the Hastings River and Bellinger River, N.S.W., and possibly also with *P. adenantha* in the Nightcap Range in north-eastern N.S.W. and on Tamborine Mountain in south-eastern Qld.

### **43. Persoonia iogyna** P.H.Weston & L.A.S.Johnson, *Telopea* 6: 33 (1994)

T: Mt Glorious Road, 8.1 km NNW of Mt Nebo, 1 km S of Samford–Mt Glorious road, Qld, 27°21'30"S, 152°45'40"E, 5 Jan. 1990, *P.H.Weston 1457 & P.G.Richards*; holo: NSW; iso: AD, BRI, CANB, DNA, HO, K, MEL, MO, NSW, QRS.

Illustration: P.H.Weston & L.A.S.Johnson, *Telopea* 6: 34, fig. 3 (1994).

Erect shrubs to trees 1.6–4 m tall. Bark smooth. Hairs ferruginous, mostly antrorsely spreading. Young branchlets moderately hairy. Leaves narrowly elliptic to ovate to obovate, 2.5–11 cm long, 6–19 mm wide, flat, with recurved margins, spreading, straight, innocuous, slightly to strongly discolorous, not glaucous, sparsely hairy when immature, mostly glabrescent, smooth. Inflorescence anauxotelic or auxotelic, 1–11-flowered; rachis 0–5.5 cm long. Flowers subtended by scale leaves and leaves; pedicels 2–5 mm long, erect, sparsely to moderately hairy; tepals 10–13 mm long, shortly caudate, sparsely to moderately hairy on outside. Ovary moderately to densely covered in ferruginous hairs; ovule 1. Figs 6, 15.

Occurs on the Conondale and D'Aguilar Ranges in south-eastern Qld; grows in dry to wet sclerophyll eucalypt forest, in soils derived from metasediments, from 400 to 600 m alt. Flowers Dec.–Feb. Map 53.

Qld: 0.3 km N of Bellthorpe forestry office, *P.H.Weston 1465–1466 & P.G.Richards* (BRI, NSW); 6.3 km beyond Mt Glorious, along Wivenhoe Dam road, *A.Bean 1012* (NSW); Mt Glorious, *M.S.Clemens s.n.* (BM, BRI, L).

This species most closely resembles *P. media*, *P. conjuncta* and *P. oleoides*. It is distinguished from all of those species by its consistently ferruginous-hairy ovary (*P. media* and *P. oleoides* usually have glabrous ovaries but a few specimens of both those species and all specimens of *P. conjuncta* have greyish-hairy ovaries).

### **44. Persoonia tropica** P.H.Weston & L.A.S.Johnson, *Telopea* 6: 31 (1994)

T: 6 km from Koombooloomba Dam on road to Tully Falls, Qld, 17°49'30"S, 145°33'40"E, 18 Sept. 1991, *P.Hind 6421 & C.Herscovitch*; holo: NSW; iso: BRI, CANB, K, MO.

Illustration: P.H.Weston & L.A.S.Johnson, *Telopea* 6: 32, fig. 1 (1994).

Erect shrubs or small trees 2–3.5 m tall. Bark smooth, grey. Hairs greyish to mid-brown, appressed. Young branchlets moderately hairy. Leaves narrowly elliptic to oblanceolate, 4.5–11 cm long, 7–21 mm wide, flat, with recurved margins, spreading to suberect, straight, innocuous, slightly discolorous, not glaucous, sparsely to moderately hairy when immature, retaining hairs towards base but otherwise usually glabrescent, smooth. Inflorescence anauxotelic, 3–10-flowered; rachis 0.3–1 cm long. Flowers subtended by scale leaves or reduced leaves; pedicels 0.5–2 mm long, erect, moderately to densely hairy; tepals 9–11 mm long, acute, sparsely hairy on outside. Ovary glabrous; ovules 2.

Occurs in the Herberton Range, the Ravenshoe area and the catchment of the upper Tully River, Qld; grows in dry to wet sclerophyll forest, in soils derived from granite, metasediments or rhyolite, from 700 to 1200 m alt. Flowers all months but chiefly Sept.–Jan. Map 54.

Qld: 1.3 km SW of Wallum trig., Herberton Ra., *P.H.Weston 1791, 1792 & E.A.Brown* (BRI, NSW); 3.2 km W of Ravenshoe, near Corduroy Ck, *M.Lockyer* (BRI); State Forest Reserve 756, Ismailia, Muggera Logging Area, 3 km S of Tully Falls turn-off, *B.P.M.Hyland 14097, 14098* (BRI, NSW, QRS).

This species most closely resembles *P. media* and *P. amaliae*. However, it is distinguished by its inflorescences which are consistently anauxotelic, its shorter pedicels, and its ovary containing 2 ovules.

**45. Persoonia amaliae** Domin, *Biblioth. Bot.* 89: 582 (1921)

T: Lake Elphinstone, Qld, *A.Dietrich 1707*; syn: MEL, NSW, PR.

Erect shrubs to trees 2–8 m tall. Bark smooth on upper branches, deeply fissured at base. Hairs greyish to tawny, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves spathulate to narrowly elliptic to oblanceolate to lanceolate, 3–8 cm long, 6–18 mm wide, with recurved margins, sometimes slightly incurved, spreading to suberect, straight, innocuous, concolorous, not glaucous, sparsely to moderately hairy when immature (but denser on margins), glabrescent, smooth. Inflorescence auxotelic, 1–11-flowered; rachis 0–4 cm long. Flowers subtended by scale leaves and leaves; pedicels 3–9 mm long, erect, moderately to densely hairy; tepals 10–13 mm long, acuminate to apiculate, sparsely to moderately hairy on outside. Ovary glabrous; ovules 2. Fig. 7.

Occurs in eastern Qld, on near-coastal ranges between Eungella and Coast Range, south of Biggenden, and on Ropers Peak, Denham Range; grows in dry sclerophyll forest and vine-forest, on granite and other well-drained substrata, from 150 m to 700 m alt. Flowers Jan.–July. Map 55.

Qld: Dicks Tableland, *A.R.Bean 3677* (NSW); Ropers Peak, *A.R.Bean 568* (NSW); Shoalwater Bay Military Reserve, *J.R.Clarkson 700 & T.D.Stanley* (NSW); upper slopes of Mt Stanley, *A.R.Bean 748* (BRI, NSW); 1 km NE of Coongara Rock, *P.H.Weston 1489 & P.G.Richards* (NSW).

*Persoonia amaliae* exhibits geographic variation in density of tepal indumentum and the sharpness of the tips of seedling leaves. Specimens from Lake Elphinstone, near the northern limit of distribution, have moderately hairy tepals and seedling leaves with innocuous tips, while specimens from Coongara Rock, at the southern limit, have sparsely hairy tepals and seedling leaves with pungent tips. Specimens from south of Broad Sound resemble those from Coongara Rock in tepal indumentum, but seedling specimens are not known from most localities.

The statement that the ovary of *P. amaliae* contains only 1 ovule (P.H.Weston & L.A.S.Johnson, *Telopea* 6: 32, 1994) is an error. It consistently contains 2 ovules.

**46. Persoonia volcanica** P.H.Weston & L.A.S.Johnson, *Telopea* 4: 299 (1991)

T: Mt Lindesay Hwy, 12 km NE of Woodenbong, N.S.W., 28°20'S, 152°40'E, 27 Jan. 1989, *P.H.Weston 1353 & P.G.Richards*; holo: NSW; iso: AD, BRI, CBG, K, MEL, MO, NSW, PERTH, RB.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 15 (1991).

Erect shrubs 1.8–6 m tall. Bark smooth. Hairs greyish to ferruginous, appressed to patent. Young branchlets moderately [to densely?] hairy. Leaves linear-ovate to narrowly ovate to elliptic to oblong, 2–9 cm long, usually 3–10 mm wide, flat, with recurved margins, spreading to suberect, straight or occasionally slightly falcate, innocuous, concolorous to strongly discolorous, not glaucous, sparsely to moderately hairy when immature, glabrescent to moderately hairy when mature, smooth to slightly scaberulous. Inflorescence usually auxotelic, 1–20-flowered; rachis 0–18 cm long. Flowers mostly subtended by leaves; pedicels mostly 1.5–10 mm long, erect, moderately hairy; tepals 9–13 mm long, shortly caudate, moderately hairy on outside. Ovary glabrous; ovule 1.

Disjunctly distributed on the Kroombit Tops in Qld, and the McPherson Range on the N.S.W.–Qld border and nearby mountains between Wilsons Peak and Levers Plateau; grows in dry sclerophyll forest to rainforest margins in wet sclerophyll forest, on volcanic or sedimentary substrata, from 500 to 1000 m alt. Flowers chiefly Dec.–Feb. Map 56.

Qld: main road, Kroombit Tops, *P.H.Weston 1524 & P.G.Richards* (AD, B, BRI, CANB, DNA, HO, K, L, MEL, MO, NSW, QRS); foothills of Mt Ballow, downstream from Grace Hut, *A.R.Bean 1289* (BRI, NSW); Mt Barney (lower slopes, track up S ridge), 17 May 1969, *I.R.Telford* (CBG, NSW). N.S.W.: Mahoneys Spur, Levers Plateau, *A.G.Floyd 500* (NSW).

Specimens from Kroombit Tops differ from those from McPherson Range in their generally shorter leaves.

In the past, this species has been treated as a form of *P. media*. It differs from that species in

its mostly antrorsely spreading to patent hairs which are generally denser, its leaves which are, on average, smaller, and its bark which is smooth to the base.

### 47. Persoonia hirsuta Pers., *Syn. Pl.* 1: 118 (1805)

*Linkia hirsuta* (Pers.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Port Jackson, N.S.W., 1794, *J.White*; syn: LINN.

*Persoonia arida* Sieber ex Spreng., *Syst. Veg.* 4(2): 45 (1827); *P. hirsuta* β [var.] *subovalis* Endl., *Gen. Pl.* 81 (1848). T: precise locality unknown, N.S.W., 1823, *F.W.Sieber 55*; syn: B, BM, FI, K, L, M, NY. *Sieber 55* is a mixed collection of at least two distinct elements, one of which is *P. hirsuta* subsp. *hirsuta*, while another is *P. hirsuta* subsp. *evoluta*.

Spreading to decumbent shrubs 0.3–1.5 m tall. Bark smooth. Hairs greyish to tawny, patent. Young branchlets moderately to densely hairy. Leaves linear to narrowly oblong to narrowly elliptic to lanceolate to narrowly spathulate to spathulate, 5–14 mm long, 0.7–5 mm wide, convex, with recurved to revolute margins, slightly to strongly recurved, spreading to suberect, straight, innocuous, slightly discolorous, not glaucous, moderately to densely hairy when immature, glabrescent to moderately hairy when mature, scabrous. Inflorescence usually auxotelic, 1–10-flowered; rachis 0–2 cm long. Flowers subtended by scale leaves and leaves; pedicels 1–3 mm long, erect to spreading, moderately to densely hairy; tepals 10 mm long, acute, moderately to densely hairy on outside. Ovary densely hairy; hairs greyish to tawny; ovule 1.

Patchily distributed in N.S.W. in an area bounded by Putty, Glen Davis and Gosford, south to Royal Natl Park and Hill Top; grows in dry sclerophyll eucalypt woodland to forest, in sandy to stony soils derived from sandstone, from near sea level to 600 m alt. Flowers chiefly Nov.–Jan.

Geographic variation in *P. hirsuta* is clinal, from narrow-leaved populations in the east to broad-leaved populations in the west. Subsp. *evoluta* is arbitrarily distinguished from subsp. *hirsuta* by its broader, obtuse leaves with less prominently recurved margins. Specimens from the lower Blue Mountains and western suburbs of Sydney (and even some specimens from further east) are intermediate between the extreme eastern and western forms.

Leaves linear to narrowly oblong, acute, 0.75–1.5 mm wide, with revolute margins — **47a.** subsp. **hirsuta**

Leaves spathulate to elliptic or narrowly so, mostly obtuse, 1.5–5 mm wide, with mostly recurved margins — **47b.** subsp. **evoluta**

### 47a. Persoonia hirsuta Pers. subsp. hirsuta

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 15 (1991).

Leaves linear to narrowly oblong, acute, 0.75–1.5 mm wide, with revolute margins.

Occurs from Gosford to Royal Natl Park, N.S.W., within 20 km of the coast and below 300 m alt. Map 57.

N.S.W.: Gosford, Jan. 1903, *J.L.Boorman* (NSW); Roseville East, 14 Dec. 1952, *L.A.S.Johnson* (NSW); North Head, 26 Aug. 1967, *R.G.Coveny* (NSW); [Royal] Natl Park, 9 Nov. 1898, *A.A.Hamilton* (NSW).

### 47b. Persoonia hirsuta subsp. evoluta L.A.S.Johnson & P.H.Weston, *Telopea* 4: 290 (1991)

T: corner of Banksia and Wattle Streets, Hill Top, N.S.W., 34°21'S, 150°29'E, 15 Jan. 1985, *P.H.Weston 432 & J.Dalby*; holo: NSW; iso: AD, B, BRI, CANB, HO, K, L, MEL, MO, NBG, PERTH, RSA.

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 16, pl. 1 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 173 (1992).

Leaves narrowly elliptic to lanceolate to narrowly spathulate to spathulate, mostly obtuse, 1.5–5 mm wide, with mostly recurved margins.

Sporadically distributed in the Putty, Glen Davis and Hill Top districts, N.S.W., at 350–600 m alt. Map 58.

N.S.W.: E of Putty, 20 Sept. 1951, *L.A.S.Johnson* (NSW); Green Gully, 1.7 km S of Glen Davis, *M.D.Crisp 2201 & I.R.Telford* (CBG, NSW); Balmoral [near Hill Top], Nov. 1896, *Bingham* (NSW); Hill Top, Jan. 1896, *J.H.Maiden* (AD, BRI, CBG, MEL, NSW, PERTH).

## 48. Persoonia chamaepitys A.Cunn. *in* B.Field, *Geographical Mem. New South Wales* 329 (1825)

*Linkia chamaepitys* (A.Cunn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: precise locality unknown, N.S.W., Nov.–Dec. 1822, *A.Cunningham*; holo: BM.

*Persoonia gnidioides* Sieber ex Spreng., *Syst. Veg.* 4(2): 45 (1827). T: precise locality unknown, N.S.W., 1823, *F.W.Sieber 53*; syn: B, BM, FI, K, L, M, MEL, NY.

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 16 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 174–175 (1992).

Prostrate shrubs to 20 cm tall. Bark poorly developed. Hairs greyish to tawny, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves linear, 7–19 mm long, 0.5–1 mm wide, terete, and grooved underneath (when dry), spreading, straight, innocuous, concolorous, not glaucous, sparsely hairy when immature, glabrescent to sparsely hairy when mature, smooth or slightly scaberulous. Inflorescence auxotelic. Flowers mostly subtended by leaves; pedicels 2–3 mm long, erect to spreading, moderately to densely hairy; tepals 9–18 mm long, caudate, sparsely hairy on outside. Ovary densely hairy; hairs greyish to tawny; ovule 1. Fig. 40A.

Occurs from Upper Goulburn Valley through the Mellong Range and Blue Mountains to the Budawang Range in central-eastern N.S.W.; grows in heath to dry sclerophyll forest on sandstone, from 360 m to 1100 m alt. Flowers Oct.–Jan. Map 59.

N.S.W.: 2 km SE of Olinda, *B.G.Briggs 6958 & L.A.S.Johnson* (NSW); Angorawa Ck Fire Trail, *R.Johnstone 188 & R.Makinson* (NSW); Kings Tableland, *P.H.Weston 1266 & D.Catling* (NSW); Wingello, *J.L.Boorman* (NSW 20854); 2 km E of Round Hill, Budawang Ra., *J.Armstrong 126* (NSW).

*Persoonia chamaepitys* is readily distinguished by the combination of prostrate habit and linear-terete leaves.

## 49. Persoonia sericea A.Cunn. ex R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 14 (1830)

*Linkia sericea* (A.Cunn. ex R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: near Lachlan River, N.S.W., 1817, *A.Cunningham*; syn: BM.

*Persoonia mitchellii* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 73 (1855); *Linkia mitchellii* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: precise locality unknown, N.S.W., 1836, *T.L.Mitchell*; syn: CGE, NY.

*Persoonia velutina* A.Cunn. ex Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 534 (1845); *P. sericea* var. *velutina* (A.Cunn. ex Meisn.) Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 342 (1856). T: northern skirts of Liverpool Plains, N.S.W., May 1825, *A.Cunningham*; syn: NY.

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 16, pl. 1 (1991).

Erect to spreading shrubs 0.3–4 m tall. Bark smooth or poorly developed. Hairs silvery or greyish to ferruginous, appressed to patent. Young branchlets moderately to densely hairy. Leaves obovate to linear-oblanceolate to oblanceolate to narrowly oblong to narrowly elliptic to narrowly spathulate to spathulate, 2–6 cm long, 2–21 mm wide, flat or flat with recurved margins, sometimes incurved, spreading to suberect, straight to falcate, twisted at base through 0–90°, innocuous, concolorous to strongly discolorous, not glaucous, moderately to densely hairy when immature, sparsely to densely so when mature, smooth to strongly scaberulous. Inflorescence usually auxotelic, 1–23-flowered; rachis 0–25 cm long. Flowers subtended by scale leaves and leaves; pedicels 2–12 mm long, erect to recurved, moderately to densely hairy; tepals 9–11 mm long, acute to apiculate to caudate, moderately to densely hairy on outside. Ovary densely hairy; hairs greyish to tawny; ovules 2. Figs 13, 40C.

Occurs in an area bounded by Salvator Rosa Natl Park and Moreton Bay in south-eastern Qld and Grenfell and Port Macquarie in N.S.W.; grows in woodland to dry sclerophyll forest, in well-drained soils derived from a variety of parent materials including granite, sandstone, metasediments and acid volcanics, from near sea level to 1200 m alt. Flowers Oct.–June. Map 60.


**Figure 40**. *Persoonia*. **A**, P. chamaepitys, flowering branchlet (B.Briggs 6958 & L.Johnson, NSW). **B**, *P. levis*, flowering branchlet (M.Breading, NSW 21719). **C**, *P. sericea*, flowering branchlet (T.Bancroft, NSW 21375). **D**, *P. rigida*, flowering branchlet (Dora Dora State Forest, N.S.W., J.Johnston s.n., NSW). Scale bar = 1 cm. Drawn by D.Mackay.

Qld: Salvator Rosa Natl Park, *D.F.Blaxell 1488 & J.Armstrong* (NSW); 3.5 km NE of Helidon, *P.H.Weston 1452 & P.G.Richards* (BRI, NSW). N.S.W.: Bruxner Hwy, 4.9 km E of Yetman, *R.G.Coveny 11654 & P.Wilson* (K, NSW, PERTH); Kempsey–Crescent Head road, *P.H.Weston 1068, K.Hill & L.A.S.Johnson* (NSW); Warrumba Ra., *D.J.McGillivray 3158 & R.G.Coveny* (NSW).

*Persoonia sericea* is geographically variable, with a number of morphologically distinctive local forms, some of which may prove, on closer analysis, to be distinct species. The entire *P. sericea–P. fastigiata–P. subtilis* complex warrants a taxonomic revision in its own right.

Persoonia sericea hybridises sporadically with P. cornifolia, P. curvifolia, P. cuspidifera, P. linearis, P. rigida, P. tenuifolia and P. terminalis subsp. recurva where they grow together.

### 50. Persoonia fastigiata R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 13 (1830)

*Linkia fastigiata* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: orâ orient., mont. prope Port Jackson, N.S.W., 1818, *C.Fraser*; syn: BM.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 16 (1991).

Erect to spreading shrubs 0.5–1.5 m tall. Bark smooth. Hairs greyish to tawny, mostly patent. Young branchlets moderately hairy. Leaves linear or rarely linear-spathulate, 1.5–4 cm long, mostly 0.7–1 mm wide, subterete or convex, with revolute margins or grooved underneath, slightly to strongly incurved, spreading to erect, straight, innocuous, concolorous, not glaucous, moderately to densely hairy when immature, sparsely to moderately hairy when mature, moderately to strongly scabrous. Inflorescence anauxotelic or auxotelic, 1–5-flowered; rachis 1–10 mm long. Flowers subtended by scale leaves and leaves; pedicels 5–8 mm long, suberect to recurved, moderately hairy; tepals 9–10 mm long, acute to apiculate to caudate, moderately hairy on outside. Ovary densely hairy; hairs greyish to tawny; ovules 2.

Occurs in the New England Tableland and adjacent areas to the west, from the Glen Innes district to the Moonbi Range, N.S.W.; grows in dry sclerophyll woodland and forest on granite, from 800 to 1200 m alt. Flowers chiefly Dec.–Jan. Map 61.

N.S.W.: Howell, *J.L.Boorman* (NSW 21858); Backwater, *W.F.Blakely, E.N.McKie & T.Bouman* (NSW 21857); Parlour Mtn, *P.H.Weston 1287 & P.G.Richards* (NSW).

*Persoonia fastigiata* hybridises extensively with *P. cornifolia* where they grow together, forming hybrid swarms.

### 51. Persoonia subtilis P.H.Weston & L.A.S.Johnson, *Telopea* 6: 35 (1994)

T: falls on Mimosa Creek, next to camping area, Blackdown Tableland, Qld, 23°48'00"S, 149°04'30"E, 12 Jan. 1990, *P.H.Weston 1539 & P.G.Richards*; holo: NSW; iso: AD, BRI, CANB, DNA, HO, K, MEL, MO, QRS.

Illustration: K.A.W.Williams, *Native Pl. Queensland* 3: 243 (1987), as *P. fastigiata*.

Spreading to decumbent, multistemmed shrubs 15–100 cm tall. Bark not well-developed. Hairs greyish to tawny, mostly appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves linear, 1.5–5 cm long, 0.4–0.8 mm wide, subterete, grooved underneath, slightly recurved to strongly incurved, spreading to erect, straight, innocuous, concolorous, not glaucous, moderately hairy when immature, glabrescent to moderately hairy when mature, slightly to moderately scaberulous. Inflorescence mostly auxotelic, 1–18-flowered; rachis 0–5 cm long. Flowers subtended by scale leaves and leaves; pedicels 2–8 mm long, spreading to recurved, moderately hairy; tepals 7–10 mm long, acute to apiculate, moderately hairy on outside. Ovary densely covered in appressed hairs; ovules 2. Fig. 11.

Disjunctly distributed in an area bounded by the Blackdown Tableland, Carnarvon Range and Barakula, south-eastern Qld; grows in dry sclerophyll forest and woodland on sandstone at altitudes of 350–900 m. Flowers chiefly Nov.–Jan. Map 62.

Qld: near Bedourie HS, *Story & Yapp 282* (CANB, NSW); 3rd crossing of Dawson R., 61 km N of Injune, *K.D.Hill 1210, L.A.S.Johnson & A.Bean* (BRI, NSW, PERTH); Waaje area, Barakula State Forest, *A.Bean 546* (BRI, NSW).

This species closely resembles *P. fastigiata* but is distinguished by its indumentum of

appressed to antrorsely spreading hairs and its narrower leaves. Specimens of *P. subtilis* are somewhat variable in leaf length but variation within populations seems as great as that between them.

The locality cited on the label of *L.A.Nielsen 25* (BRI), Bollon State Forest, is spurious. This specimen was probably collected near Ballon State Forest, near Chinchilla (A.Bean, pers. comm.).

### 52. Persoonia curvifolia R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 13 (1830)

*Linkia curvifolia* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: orâ orient., mont. prope Port Jackson [N.S.W.], 1817, *A.Cunningham*; syn: BM, K, NY.

*Persoonia abietina* Meisn. *in* A.L.P.P. de Candolle., *Prodr.* 14: 336 (1856). T: Harvey's Range [Herveys Ra.], distr. Wellington, Nov.-Holl. orientalis [N.S.W.], 1825, *A.Cunningham*; syn: K, NY.

Illustrations: G.M.Cunningham *et al.*, *Pl. W. New South Wales* 218 (1981); P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 16 (1991).

Erect to spreading shrubs 0.3–1.5 m tall. Bark smooth. Hairs greyish to tawny, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves linear, 1–5 cm long, 0.5–1.3 mm wide, terete or subterete and grooved underneath, usually strongly incurved, spreading to erect, straight, innocuous, concolorous, not glaucous, sparsely hairy when immature, glabrescent or sparsely hairy when mature, strongly scabrous. Inflorescence anauxotelic, 1–18-flowered; rachis 0–5.5 cm long. Flowers mostly subtended by leaves; pedicels 2–3 mm long, erect, moderately to densely hairy; tepals 10–12 mm long, caudate, sparsely hairy on outside. Ovary glabrous; ovule(s) 1 or 2.

Occurs from the Warrumbungle Range south to the Goulburn River valley and Tullamore, and disjunctly in the Cocoparra Range, N.S.W.; grows in dry sclerophyll forest and woodland on sandstone, from 180 to 500 m alt. Flowers Nov.–Jan. Map 63.

N.S.W.: Pilliga State Forest, *R.G.Coveny 12746, P.Cuneo & B.Wiecek* (B, K, NBG, NSW, PERTH, RSA); 'Kybeyan', Merrygoen, *P.G.Wilson 2* (K, NSW); Lees Pinch, *P.H.Weston 1571 & P.G.Richards* (NSW); Cocoparra Ra., *N.G.Walsh 2221* (NSW).

*Persoonia curvifolia* hybridises with *P. linearis* and *P. sericea* where they grow together. It appears to intergrade or hybridise with *P. cuspidifera* in the Warrumbungle Range and Pilliga Scrub.

### 53. Persoonia cuspidifera L.A.S.Johnson & P.H.Weston, *Telopea* 4: 288 (1991)

T: Newell Hwy, 4.1 km NNE of junction with Oxley Hwy, N.S.W., 31°13'S, 149°20'E, 15 Jan. 1990, *P.H.Weston 1566 & P.G.Richards*; holo: NSW; iso: AD, BRI, CBG, K, MEL, MO, PERTH, RB.

*Persoonia rigida* var. *microphylla* Benth., *Fl. Austral.* 400 (1870) *p.p.* T: Blue Mountains, *G.Caley*; syn: *n.v.*; Castlereagh R., near Belair, *C.Moore*; syn: NSW.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 16 (1991).

Erect shrubs 0.3–2 m tall. Bark smooth. Hairs greyish to tawny, appressed to patent. Young branchlets moderately to densely hairy. Leaves narrowly to broadly spathulate, 10–20 mm long, 1.5–5 mm wide, convex, slightly to strongly incurved, spreading to suberect, straight, innocuous, concolorous, not glaucous, sparsely to moderately hairy when immature, glabrescent, strongly scabrous. Inflorescence usually auxotelic, 1–25-flowered; rachis 0–7 cm long. Flowers mostly subtended by leaves; pedicels 2–5 mm long, erect, moderately hairy; tepals 8–12 mm long, apiculate, moderately hairy on outside. Ovary glabrous; ovule 1. Fig. 10.

Occurs in the southern Pilliga Scrub and foothills of the Warrumbungle Range, N.S.W.; grows in heathy and scrubby understorey of dry sclerophyll communities on sandstone, from 300 to 650 m alt. Flowers Nov.–Mar. Map 64.

N.S.W.: Tummallallee [Timmallallie] Ck, c. 30 miles [c. 48 km] NNE of Coonabarabran on Narrabri road, 7 Nov. 1951, *L.A.S.Johnson* (NSW); 2 miles [c. 3 km] N of Long Ridge, c. 22 miles [c. 35 km] E of Coonabarabran, 29 Sept. 1968, *L.A.S.Johnson* (NSW); Warrumbungle Ra., 23 May 1948, *E.F.Constable* (K, NSW).

*Persoonia cuspidifera* most closely resembles its sister species, *P. curvifolia*, from which it is distinguished by its much broader, spathulate-cuspidate leaves. The flowers of both species are greenish yellow, heavily marked with maroon on the outside. *Persoonia cuspidifera* hybridises sporadically with *P. sericea* where their distributions overlap in the Pilliga area. It intergrades or hybridises with *P. curvifolia* in the Warrumbungle Range and Pilliga Scrub.

### 54. Persoonia rigida R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 14 (1830)

*Linkia rigida* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: orâ orient., mont. prope Port Jackson, N.S.W., 1804, *G.Caley*; syn: *n.v.*; orâ orient., mont. prope Port Jackson, N.S.W., 1817, *A.Cunningham 38*; syn: BM, K.

*Persoonia rigida* var. *planifolia* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 337 (1856). T: precise locality unknown, N.S.W., 1823, *F.W.Sieber 51*; syn: FI, K, L, NY.

*Persoonia rigida* var. *revoluta* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 338 (1856). T: precise locality unknown, N.S.W., 1822, *A.Cunningham*; syn: NY; precise locality unknown, N.S.W., 1825, *A.Cunningham*; syn: NY.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 17 (1991).

Erect to decumbent shrubs 0.15–2 m tall. Bark smooth. Hairs greyish to tawny, appressed to patent. Young branchlets moderately to densely hairy. Leaves oblanceolate to narrowly spathulate to spathulate, 1.5–5 cm long, 4–19 mm wide, flat or convex, with recurved margins, usually incurved, spreading to erect, straight, innocuous, concolorous to slightly discolorous, not glaucous, moderately to densely hairy when immature, glabrescent or sparsely hairy when mature, strongly scabrous. Inflorescence usually auxotelic, 1–20-flowered; rachis 0–9 cm long. Flowers subtended by scale leaves and leaves; pedicels 1–3 mm long, erect, moderately to densely hairy; tepals 10–12 mm long, apiculate to caudate, moderately hairy on outside. Ovary glabrous; ovule(s) 1 or 2. Fig. 40D.

Occurs from the Liverpool Range, N.S.W., to the Grampians in western Vic., mostly west and north of the Great Dividing Range but also as far east as Springwood, N.S.W.; grows in dry sclerophyll woodland to forest, in well-drained soils derived from a variety of substrata including sandstone, granite and metasediments, from 300 to 1300 m alt. Flowers Nov.–Mar. Map 65.

N.S.W.: Rylstone–Capertee road, *P.H.Weston 1579 & P.G.Richards* (NSW); Weddin Ra., *R.G.Coveny 5240* (NSW). A.C.T.: Black Mtn, *M.D.Crisp 8192 & J.M.Taylor* (NSW). Vic.: Bendigo, *R.Melville 1253* (K, NSW); Grevillea Ck, Grampians Ra., *T.Whaite & J.Whaite 1585* (NSW).

*Persoonia rigida* hybridises sporadically with *P. sericea* where they grow together.

### 55. Persoonia mollis R.Br., *Trans. Linn. Soc. London* 10: 161 (1810)

*Linkia mollis* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: banks of Grose River, N.S.W., *R.Brown s.n.*; lecto: BM; isolecto?: B, BM, E, K, NSW, *fide* S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 186 (1991).

Erect to prostrate shrubs 0.2–5 m tall. Bark smooth. Hairs greyish to ferruginous, appressed to patent. Young branchlets moderately to densely hairy. Leaves linear to oblong to elliptic to lanceolate to spathulate or narrowly so, 1.5–12 cm long, 0.8–17 mm wide, flat or convex, with recurved to revolute margins, sometimes incurved, spreading to suberect, straight, innocuous, strongly discolorous, sometimes glaucous, sparsely to moderately hairy when immature, glabrescent to sparsely hairy when mature, smooth to scaberulous. Inflorescence usually auxotelic, 1–30-flowered; rachis 0–15 cm long. Flowers mostly subtended by leaves; pedicels 1–3 mm long, erect, moderately to densely hairy; tepals 8–11.5 mm long, obtuse to caudate, moderately to densely hairy on outside. Ovary glabrous; ovules 2.

Occurs in an area roughly bounded by the Blue Mountains, Bulli, Durras Lake, Monga and Goulburn, with a disjunct occurrence in the Hornsby area in central-eastern N.S.W.

*Persoonia mollis* is distinguished by its endocarp, which consists of small, lightly tanniniferous, dense stone cells, among which are scattered large, densely tanniniferous cells with large lumens. The endocarp of other *Persoonia* species is composed solely of small, evenly pigmented, dense stone cells.

*Persoonia mollis* is a complex species exhibiting considerable geographic variation, represented formally by 9 subspecies. However, only one of these, subsp. *maxima*, is allopatric and sharply distinct. The others have parapatric distributions, contiguous subspecies being connected by zones of intergradation of varying width.

**1** Leaves 4–12 cm long, 6–17 mm wide, with recurved margins, narrowly elliptic to lanceolate; plants erect

**2** Flower buds (and, to a lesser extent, young branchlets and young leaves) moderately to densely villous, with spreading, silky-white to copper-coloured hairs, 1–3 mm long

**3** Hairs on flower buds, etc., c. 1 mm long, silky-white when fresh, copper-coloured when dried — **55a.** subsp. **mollis**

**3:** Hairs on flower buds, etc., 2–3 mm long, copper-coloured when fresh or dried — **55b.** subsp. **maxima**

**2:** Flower buds (and, to a lesser extent, young branchlets and young leaves) moderately covered with antrorsely spreading, silky-white hairs, c. 0.5 mm long — **55c.** subsp. **nectens**

**1:** Leaves 1.5–6 cm long, 0.8–15 mm wide (those leaves wider than 6 mm are shorter than 4 cm), with revolute or rarely recurved margins

**4** Leaves 2–15 mm wide, elliptic to oblong or narrowly or rarely linearly so, acute to acuminate or obtuse, with recurved to revolute margins; undersurface exposed when dried

**5** Plants prostrate to decumbent; larger leaves usually more than 6 mm wide, usually obtuse — **55e.** subsp. **revoluta**

**5:** Plants erect; leaves less than 6 mm wide, acute to ±obtuse

**6** Leaves linearly to narrowly elliptic to lanceolate, 3–6 cm long, acute — **55h.** subsp. **caleyi**

**6:** Leaves narrowly elliptic to oblong, 2–4 cm long, ±obtuse

**7** Tepals 9–11.5 mm long; longest hairs on buds and young leaves 0.4–1 mm long — **55d.** subsp. **ledifolia**

**7:** Tepals 7.5–10.5 mm long; longest hairs on buds and young leaves 0.2–0.6 mm long — **55i.** subsp. **budawangensis**

**4:** Leaves 0.8–2 mm wide, linear, truncate to bluntly acute or obtuse, with tightly revolute margins that wholly or largely obscure the undersurface when dried

**8** Undersurface of leaves densely covered with appressed hairs; leaves green to grey-green — **55g.** subsp. **livens**

**8:** Undersurface of leaves sparsely to moderately covered with appressed hairs; leaves bright green — **55f.** subsp. **leptophylla**

## 55a. Persoonia mollis R.Br. subsp. mollis

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 17 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 178–179 (1992).

Erect shrub 1.5–5 m tall. Hairs c. 1 mm long, whitish-silky to copper-coloured, antrorsely spreading on leaves, patent on stems and tepals. Young branchlets moderately hairy. Leaves lanceolate, 4–10 cm long, 6–15 mm wide, flat, with recurved margins, not glaucous, sparsely to moderately hairy on undersurface when immature, glabrescent. Tepals moderately to densely hairy on outside.

Occurs in the Blue Mountains, N.S.W., in dry to wet sclerophyll forest on Hawkesbury and Narrabeen Sandstones, from 50 to 1150 m alt. Flowers chiefly Dec.–Apr. Map 66.

N.S.W.: 5.3 km W of Kurrajong Heights, *R.G.Coveny 12102 & C.Dunn* (B, K, NSW, PERTH); Katoomba area, along Six Foot Track to Nellies Glen, *M.Taylor 314 & R.G.Coveny* (B, K, MO, NBG, NSW, PERTH, RSA).

*Persoonia mollis* subsp. *mollis* hybridises sporadically with *P. linearis* where they grow together.

**55b. Persoonia mollis** subsp. **maxima** S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 189 (1991)

T: Ku-Ring-Gai Chase Natl Park, N.S.W., 33°40'S, 151°09'E, 24 Mar. 1990, *S.L.Krauss 206 & L.Howitt*; holo: NSW; iso: AD, B, BRI, CBG, K, MEL, MO, PERTH.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 17 (1991).

Erect shrub 2–5 m tall. Hairs c. 2–3 mm long, copper-coloured, antrorsely spreading on leaves, patent on stems and tepals. Young branchlets moderately hairy. Leaves lanceolate, 6–12 cm long, 10–17 mm wide, flat, with recurved margins, not glaucous, sparsely to moderately hairy on undersurface when immature, glabrescent. Tepals moderately hairy on outside.

Restricted to the Cowan–Hornsby area, N.S.W.; grows in dry to wet sclerophyll forest on Hawkesbury Sandstone, from sea level to 120 m alt. Flowers chiefly Dec.–Apr. Map 67.

N.S.W.: Cowan and Bobbin Ck, Mar. 1915, *W.F.Blakely* (NSW); Asquith, below the waterfall, 24 Feb. 1918, *W.F.Blakely* (NSW).

**55c. Persoonia mollis** subsp. **nectens** S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 191 (1991)

T: 10R Fire Trail, c. 100 m W of O'Hares Ck, N.S.W., 34°13'S, 150°53'E, 1 Apr. 1984, *D.Keith 122*; holo: NSW.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 17 (1991).

Erect shrub 1.2–3 m tall. Hairs c. 0.5 mm long on leaves, 0.5–1 mm long on tepals, whitish, antrorsely spreading on leaves, patent on stems and tepals. Young branchlets moderately hairy. Leaves lanceolate, 4–10 cm long, 8–15 mm wide, flat, with recurved margins, not glaucous, sparsely hairy on undersurface when immature, glabrescent. Tepals moderately hairy on outside.

Occurs from Oakdale south to Hill Top and east to the Illawarra escarpment, N.S.W.; grows in dry to wet sclerophyll forest on Hawkesbury Sandstone, from 400 to 600 m alt. Flowers chiefly Dec.–Apr. Map 68.

N.S.W.: Oakdale to Burragorang Lookout, 5 Sept. 1951, *L.A.S.Johnson* (NSW); Wattle Ridge Rd, 4 km NW of Hill Top P.O., *P.H.Weston 1040, M.D.Crisp & P.Kater* (NSW); Mt Keira, 3 Mar. 1912, *E.Cheel* (NSW).

**55d. Persoonia mollis** subsp. **ledifolia** (A.Cunn. ex Meisn.) S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 192 (1991)

*Persoonia ledifolia* A.Cunn. ex Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 339 (1856); *Linkia ledifolia* (A.Cunn. ex Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Illawarra [N.S.W.], *A.Cunningham*; lecto: NY; isolecto: K, *fide* S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 192 (1991).

*Persoonia revoluta* var. *angustifolia* Benth., *Fl. Austral.* 5: 398 (1870). T: Hanging Rock, Argyle County [N.S.W.], *McArthur*; lecto: K, *fide* S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 192 (1991); Blue Mountains [N.S.W.], *Atkinson;* syn: K.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 18 (1991).

Erect shrub 1–2.5 m tall. Hairs c. 0.7 mm long on leaves, 0.4–1 mm long on tepals, whitish, antrorsely spreading on leaves, patent on stems and tepals. Young branchlets moderately hairy. Leaves linear-oblong to oblong-lanceolate, 2–4 cm long, 3–6 mm wide, convex, with recurved to revolute margins, not glaucous, sparsely hairy on undersurface when immature, glabrescent. Tepals moderately hairy on outside.

Occurs from the Shoalhaven River north to Kangaloon, east to Jamberoo and west to Wingello, N.S.W.; grows in heath to dry sclerophyll forest on Hawkesbury Sandstone, from 450 to 700 m alt. Flowers chiefly Dec.–Apr. Map 69.

N.S.W.: East Kangaloon, c. 3 km NNW of Robertson, *R.G.Coveny 931* (NSW); car park, Barren Grounds Nature Reserve, *S.L.Krauss 204* (AD, B, BRI, CANB, CBG, HO, K, MEL, MO, NBG, NSW, PERTH, RSA); Bundanoon, 7 Jan. 1950, *E.F.Constable* (NSW).

*Persoonia mollis* subsp. *ledifolia* hybridises sporadically with *P. levis* and *P. linearis* where they grow together.

**55e. Persoonia mollis** subsp. **revoluta** (Sieber ex Spreng.) S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 193 (1991)

*Persoonia revoluta* Sieber ex Spreng., *Syst. Veg.* 4(2): 45 (1827); *Linkia revoluta* (Sieber ex Spreng.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: precise locality unknown, N.S.W., 1823, *F.W.Sieber 48*; lecto: B; isolecto: BM, FI, K, L, *fide* S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 193 (1991).

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 18 (1991).

Prostrate to decumbent shrub 10–50 cm tall. Hairs c. 0.7 mm long on leaves, 0.3–1 mm long on tepals, whitish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves elliptic to spathulate or narrowly so, 2.5–4 cm long, 4–15 mm wide, convex, with revolute margins, not glaucous, sparsely hairy on undersurface when immature, glabrescent. Tepals sparsely to moderately hairy on outside.

Restricted to an area bounded by the gorge of Nattai River, Bullio, Berrima and Canyonleigh, N.S.W.; grows in dry sclerophyll forest on Hawkesbury Sandstone, from 600 to 750 m alt. Flowers Dec.–Mar. Map 70.

N.S.W.: Soapy Flat Rd, 3.3 km NW of Wombeyan Caves Rd, *P.H.Weston 1418 & S.L.Krauss* (NSW); Bullio, 25 Feb. 1962, *Burgess* (NSW).

**55f. Persoonia mollis** subsp. **leptophylla** S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 194 (1991)

T: 5.8 km E of Tianjara Falls on the Nowra to Nerriga road, N.S.W., 35°06'S, 150°16'E, 17 Feb. 1990, *S.L.Krauss 205*; holo: NSW; iso: AD, B, BRI, CANB, CBG, CHR, DNA, HO, K, MEL, MO, NBG, PERTH, RSA.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 18 (1991).

Erect shrub 0.5–1.5 m tall. Hairs c. 0.7 mm long on leaves, 0.3–1 mm long on tepals, whitish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves linear, 1.5–4 cm long, 0.8–2 mm wide, convex, with revolute margins that wholly or partly obscure the undersurface, not glaucous, sparsely to moderately hairy on undersurface when immature, usually retaining hairs when mature. Tepals sparsely hairy on outside.

Occurs in an area bounded by the Shoalhaven River, the Budawang Range, Nerriga and Nowra and disjunctly on the Beecroft Peninsula, Jervis Bay, N.S.W.; grows in heath to dry sclerophyll forest on Nowra and Conjola Sandstones, from sea level to 800 m alt. Flowers chiefly Dec.–May. Map 71.

N.S.W.: 1.7 miles [2.8 km] W along Illaroo Rd, Nowra, *R.G.Coveny 3964 & Bisby* (NSW); 1 km NE of Honeymoon Bay on road to Lighthouse Rd, Beecroft Peninsula, *S.L.Krauss 241* (NSW); 17 miles [27 km] E of Nerriga along Braidwood–Nowra road, *T.Hartley 14272* (NSW).

*Persoonia mollis* subsp. *leptophylla* hybridises sporadically with *P. linearis* where they grow together.

**55g. Persoonia mollis** subsp. **livens** S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 195 (1991)

T: Lower Boro, 28 km N of Braidwood, N.S.W., 35°10'S, 149°16'E, Jan. 1989, *P.Kodela 4076*; holo: NSW; iso: CBG.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 18 (1991).

Erect shrub 0.5–1.5 m tall. Hairs c. 0.5 mm long, whitish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves linear, 1.5–3 cm long, 0.8–2 mm wide, convex, with revolute margins that wholly or partly obscure the undersurface, glaucous, densely hairy on undersurface when immature, usually retaining hairs when mature. Tepals moderately hairy on outside.

Occurs in an area bounded by Penrose, Goulburn and Braidwood, N.S.W.; grows in dry sclerophyll woodland on metasediments and conglomerates, from 550 to 750 m alt. Flowers Dec.–Mar. Map 72.

N.S.W.: Paddys R. bridge, Hume Hwy, *F.E.Davies 424 & T.Mulcahy* (NSW); top of Governors Hill, E side of Goulburn, on Hume Hwy, *A.N.Rodd 5425, S.Corbett & D.Wilson* (NSW); near Warri Bridge, Shoalhaven R., 13 km NNW of Braidwood, *L.Adams 2381* (CANB, K, L, NSW).

*Persoonia mollis* subsp. *livens* hybridises sporadically with *P. linearis* and *P. microphylla* where they grow together.

### 55h. **Persoonia mollis** subsp. **caleyi** (R.Br.) S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 196 (1991)

*Persoonia caleyi* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 13 (1830); *Linkia caleyi* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Jervis Bay, N.S.W., Mar. 1801, *G.Caley*; lecto: BM; isolecto: BM, *fide* S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 196 (1991); Wilsons Promontory, Vic., *W.Baxter*; syn: BM.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 18 (1991).

Erect shrub 1.5–4 m tall. Hairs c. 0.7 mm long on leaves, 0.1–1 mm long on tepals, whitish, antrorsely spreading. Young branchlets moderately hairy. Leaves linear-lanceolate to narrowly lanceolate, 3–6 cm long, 2–6 mm wide, convex, with recurved to revolute margins, not glaucous, sparsely hairy on undersurface when immature, glabrescent. Tepals sparsely hairy on outside.

Occurs from Jervis Bay south to Durras Lake, N.S.W.; grows in dry to wet sclerophyll forest in sandy soil derived from Conjola Formation sediments and Wandrawandian siltstone, from sea level to 500 m alt. Flowers chiefly Dec.–July. Map 73.

N.S.W.: 8 km SSE of Nowra, *S.Krauss 238* (NSW); Jervis Bay, July 1899, *J.H.Maiden* (FI, NSW); Pigeon House Mtn, 2 May 1982, *J.H.Willis* (NSW); Cockwhy Ck, S Brooman State Forest, *R.G.Coveny 2920* (NSW).

Wilsons Promontory, Vic., the collection locality of the residual syntype, is almost certainly erroneous, being about 370 km south of the most southern population of this taxon.

*Persoonia mollis* subsp. *caleyi* hybridises sporadically with *P. linearis* where they grow together.

### 55i. **Persoonia mollis** subsp. **budawangensis** S.L.Krauss & L.A.S.Johnson, *Telopea* 4: 197 (1991)

T: c. 4 miles [c. 7 km] SW of Corang Peak, Budawang Ra., N.S.W., 2 Feb. 1974, *T.G.Hartley 14236*; holo: NSW.

Illustration: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 18 (1991).

Erect shrub 1–2.5 m tall. Hairs c. 0.4 mm long on leaves, 0.2–0.6 mm long on tepals, whitish, antrorsely spreading. Young branchlets moderately hairy. Leaves linear-oblong to oblong-lanceolate, 2–4 cm long, 3–6 mm wide, convex, with recurved to revolute margins, not glaucous, moderately hairy on undersurface when immature, glabrescent. Tepals sparsely hairy on outside.

Restricted to the Budawang Range, N.S.W.; grows in dry sclerophyll woodland to wet sclerophyll forest on Merimbula Sandstone, from 600 to 1100 m alt. Flowers Dec.–May. Map 74.

N.S.W.: near Camp Rock, Endrick State Forest, SW of Sassafras, *D.F.Blaxell 87* (NSW); summit area of Mt Budawang, *L.Craven 685* (B, BH, CANB, CHR, G, K, L, MEL, NSW, US); Clyde Mtn, *E.F.Constable 6934* (NSW).

### 56. **Persoonia lanceolata** Andrews, *Bot. Repos.* 2: t. 74 (1799)

*Linkia lanceolata* (Andrews) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891); *P. lanceolata* var. *angustifolia* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 340 (1856), *nom. illeg.* T: cultivated from seeds, by L.Wilson, Islington, England, July 1799, *H.C.Andrews* (not extant); lecto: the plate in H.C.Andrews, *Bot. Repos.* 2: t. 74 (1799), *fide* P.H.Weston, *Fl. Australia* 16: 471 (1995).

*Persoonia latifolia* Andrews, *Bot. Repos.* 4: t. 280 (1803); *P. lanceolata* var. *latifolia* (Andrews) Endl., *Gen. Pl. Suppl.* 4: 82 (1848). T: cultivated at Hammersmith Nursery, England, Oct. 1802, from seeds sent by W.Paterson, from Port Jackson [N.S.W.], *H.C.Andrews* (not extant); lecto: the plate in H.C.Andrews, *Bot. Repos.* 4: t. 280 (1802), *fide* P.H.Weston, *Fl. Australia* 16: 471 (1995).

Illustrations: A.Fairley & P.Moore, *Native Pl. Sydney Distr.* 159, pl. 515 (1989); P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 18 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 180–181 (1992).

Erect to spreading shrubs 0.5–3 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves oblanceolate to obovate to narrowly spathulate, 3–10 cm long, 4–32 mm wide, flat or flat with slightly recurved margins, suberect, straight, twisted at base through 90°, innocuous, concolorous, not glaucous, glabrous to moderately hairy when immature, glabrescent, smooth. Inflorescence auxotelic, 4–54-flowered; rachis 1.5–2.8 cm long. Flowers mostly subtended by leaves; pedicels 1–5 mm long, erect, moderately to densely hairy; tepals 10–12 mm long, acuminate to caudate, sparsely to densely hairy on outside. Ovary glabrous; ovules (1–) 2.

Occurs on the coast and on ranges east of the Great Dividing Range, from Trial Bay to Sassafras, N.S.W.; grows in heath to dry sclerophyll forest in coastal sand and on sandstone, from sea level to 600 m alt. Flowers chiefly Jan.–Apr. Map 75.

N.S.W.: Trial Bay, Jan. 1966, *L.A.S.Johnson* (BRI, NSW); Redhead, *R.Story 7237* (NSW); Heathcote Rd, *R.G.Coveny 11165 & J.Thomas* (K, NSW, PERTH); Hill Top, *P.H.Weston 431 & J.Dalby* (B, K, MEL, NBG, NSW, PERTH, RSA); vicinity of Mt Sassafras, *T.G.Hartley 14292* (NSW).

*Persoonia lanceolata* occasionally hybridises with *P. katerae*, *P. levis*, *P. linearis*, *P. stradbrokensis* and *P. virgata* where they grow together.

### **57. Persoonia glaucescens** Sieber ex Spreng., *Syst. Veg.* 4(2): 45 (1827)

*Persoonia lanceolata* var. *glaucescens* (Sieber ex Spreng.) Endl., *Gen. Pl. Suppl.* 4(2): 82 (1848). T: precise locality unknown, N.S.W., 1823, *F.W.Sieber 47*; syn: B, BM, FI, K, L, M, MEL, NSW, NY.

Illustrations: P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 18 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 182–183 (1992).

Erect shrubs 0.5–1.6 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves oblanceolate to narrowly spathulate, 3–8 cm long, 4–18 mm wide, flat, suberect, straight, twisted at base through 90°, innocuous, concolorous, strongly glaucous especially when young, sparsely hairy when immature, glabrescent, smooth. Inflorescence auxotelic, 1–30-flowered; rachis 0–19 cm long. Flowers mostly subtended by leaves; pedicels 1–3 mm long, erect, moderately hairy; tepals 11–12 mm long, acuminate to caudate, sparsely to moderately hairy on outside. Ovary glabrous; ovule 1.

Restricted to the area bounded by Buxton, Bullio, Fitzroy Falls and Kangaloon in central-eastern N.S.W.; grows in dry sclerophyll woodland to forest on sandstone, from 400 to 650 m alt. Flowers Jan.–May. Map 76.

N.S.W.: Buxton, *P.H.Weston 438 & J.Dalby* (NSW); Hill Top, *P.H.Weston 430 & J.Dalby* (A, B, K, L, MO, NBG, NSW, PE, PERTH, RSA); Nattai Ck, Welby, *L.A.S.Johnson 8126* (NSW); Kangaloon, *L.J.Langley* (NSW 130595).

*Persoonia glaucescens* and *P. lanceolata* occur together in the Hill Top–Balmoral area, but no intermediates have been collected. Specific, not varietal, rank is thus appropriate for *P. glaucescens* which may be distinguished from all other species in eastern Australia by its strongly glaucous leaves.

### **58. Persoonia levis** (Cav.) Domin, *Biblioth. Bot.* 89: 582 (1921)

*Linkia levis* Cav., *Icon.* 4: 61, t. 389 (1797). T: Port Jackson, N.S.W., *L.Née*; lecto: MA *n.v.* (photo NSW), *fide* P.H.Weston, *Fl. Australia* 16: 471 (1995).

*Persoonia salicina* Pers., *Syn. Pl.* 1: 118 (1805); *Linkia salicina* (Pers.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: precise locality unknown, N.S.W., 1792, *J.White*; syn: LINN.

*Persoonia salicina* var. *muelleri* Benth., *Fl. Austral.* 5: 395 (1870). T: Twofold Bay, N.S.W., *F.Mueller*; syn: *n.v.*; Genoa R., Vic., *F.Mueller*; syn: K.

Illustrations: E.R.Rotherham *et al.*, *Fl. & Pl. New South Wales & Southern Queensland* 61, fig. 159 (1975); A.Fairley & P.Moore, *Native Pl. Sydney Distr.* 159, pl. 516 (1989); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 184–185 (1992).

Erect to spreading shrubs or trees 1–5 m tall. Bark lamellose-flaky. Hairs greyish, appressed to antrorse. Young branchlets glabrous to moderately hairy. Leaves oblanceolate to narrowly oblong to obovate to narrowly elliptic to spathulate, 6–14 cm long, 1.3–8 cm wide, flat, spreading to suberect, falcate, twisted at base through 90°, innocuous, concolorous, not glaucous, glabrous to sparsely hairy when immature, glabrescent, smooth. Inflorescence usually auxotelic, 4–34-flowered; rachis 0.8–15 cm long. Flowers mostly subtended by scale leaves; pedicels 3–8 mm long, erect to spreading, sparsely to moderately hairy; tepals 10–14 mm long, apiculate, glabrous to sparsely hairy on outside. Ovary glabrous; ovules 2. Fig. 40B.

Occurs east of the Great Dividing Range between the Macleay River in N.S.W. and Cann River in eastern Vic.; grows in heath to dry sclerophyll forest, in coastal sand and on sandstone, from sea level to 1000 m alt. Flowers chiefly Dec.–Apr. Map 77.

N.S.W.: Arakoon, 4 Sept. 1940, *C.K.Ingram* (NSW); Kings Tableland, *P.H.Weston 1264 & D.Catling* (NSW); near Tianjara Falls, *R.Pullen 8690* (NSW); Jervis Bay, *R.J.Rudd 90, A.M.Lyne & R.O.Makinson* (NSW). Vic.: Genoa, Mar. 1948, *N.A.Wakefield* (NSW).

*Persoonia levis* hybridises sporadically with *P. acerosa*, *P. lanceolata*, *P. linearis*, *P. mollis* subsp. *ledifolia*, *P. myrtilloides* subsp. *myrtilloides*, *P. oxycoccoides* and *P. stradbrokensis* where it grows with them. The type of *P. lucida* R.Br. [*Trans. Linn. Soc. London* 10: 161, 1810. T: 'In Novae Hollandiae orâ orientali, prope Port Jackson' [N.S.W.], *F.Bauer*; syn: BM, E, K] is a *P. levis* × *P. linearis* hybrid.

This species is readily distinguished by the combination of asymmetrical leaves, lamellose-flaky bark and actinomorphic flowers.

## 59. Persoonia linearis Andrews, *Bot. Repos.* 2: t. 77 (1799)

*Linkia linearis* (Andrews) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: cultivated from seeds, by J.Robertson, Stockwell, Surry [Surrey], England, 1798, *H.C.Andrews* (not extant); lecto: the plate in H.C.Andrews, *Bot. Repos.* 2: t. 77 (1799), *fide* P.H.Weston, *Fl. Australia* 16: 471 (1995).

*Pentadactylon angustifolium* C.F.Gaertn., *Suppl. Carp.* 3: 219, t. 220 (1807). T: Port Jackson, N.S.W., ex herb. Banks, *coll. unknown*; syn: not found.

*Persoonia linearis* var. *latior* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 335 (1856). T: Tambo, Vic., *F.Mueller*; syn: MEL.

*Persoonia breviuscula* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: precise locality unknown, Qld, 1902, *C.Walter*; holo: LY.

*Persoonia walteri* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: Mt Victoria, N.S.W., Feb. 1901, *C.Walter*; holo: LY.

*Persoonia phyllostachys* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: Mt Wilson, N.S.W., Dec. 1898, *J.Gregson*; holo: LY.

Illustrations: E.R.Rotherham, *et al.*, *Fl. & Pl. New South Wales & Southern Queensland* 74, fig. 212 (1975); A.Fairley & P.Moore, *Native Pl. Sydney Distr.* 159, pl. 517 (1989); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 186–187 (1992).

Erect to decumbent shrubs or trees 1–5 m tall. Bark lamellose-flaky. Hairs greyish, appressed to patent or curly. Young branchlets moderately to densely hairy. Leaves linear to narrowly oblong to linear-elliptic to linear-spathulate, 2–9 cm long, 1–7 mm wide, flat or convex (often with slightly recurved margins), spreading to suberect, straight, not twisted, innocuous, concolorous to slightly discolorous, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth. Inflorescence auxotelic, 1–50-flowered; rachis 0–17 cm long. Flowers subtended by scale leaves and leaves; pedicels 2–8 mm long, erect or spreading, moderately to densely hairy; tepals 9–14 mm long, apiculate to caudate, sparsely to densely hairy on outside. Ovary glabrous; ovules 2. Fig. 8.

Occurs east and south of the Great Dividing Range between the northern tributaries of the Macleay River in N.S.W. and Tambo River in eastern Vic.; grows in sclerophyll forest and woodland in well-drained soils derived from a wide variety of substrata, from sea level to 1300 m alt. Flowers chiefly Dec.–May. Map 78.

N.S.W.: Broken Bago Ra., *P.G.Richards 48 & P.H.Weston* (NSW); 17.1 km NE of Rylstone on road to Growee Gulph, *R.G.Coveny 10504 & P.Hind* (NSW); Lake Parramatta Reserve, *W.Bishop 137* (K, NSW, PERTH); 10 km SW of Candelo, *M.Parris 9679* (NSW). Vic.: between Bruthen and Buchan, *M.E.Phillips 160* (NSW).

*Persoonia linearis* hybridises sporadically with *P. chamaepeuce*, *P. conjuncta*, *P. curvifolia*, *P. lanceolata*, *P. levis*, *P. media*, *P. mollis* subsp. *mollis*, *P. mollis* subsp. *ledifolia*, *P. mollis* subsp. *leptophylla*, *P. mollis* subsp. *livens*, *P. mollis* subsp. *caleyi*, *P. myrtilloides* subsp. *cunninghamii*, *P. oleoides*, *P. pinifolia* and *P. sericea* where they grow together. The type of *P. lucida* R.Br. [*Trans. Linn. Soc. London* 10: 161, 1810. T: 'In Novae Hollandiae orâ orientali, prope Port Jackson' [N.S.W.], *F.Bauer*; syn: BM, E, K] is a *P. levis* × *P. linearis* hybrid.

The species shows ecogeographic variation in leaf width. For example, relatively broad-leaved populations (leaves 3–7 mm wide) occur in the upper Hunter River valley, between Merriwa and Denman, in the Gosford district and the area between Lake Conjola and Clyde River. In some areas (e.g. the Gosford district) broad- and narrow-leaved populations occur in close proximity and the variation appears to be ecotypic. However, these variants appear to intergrade.

The locality cited for the type of *P. breviuscula* ['Qld'] is likely to be an error.

### 60. Persoonia pinifolia R.Br., *Trans. Linn. Soc. London* 10: 180 (1810)

*Linkia pinifolia* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: in Novae Hollandiae orâ orientali, prope Port Jackson [N.S.W.], *R.Brown s.n.*; syn: BM, E, K, NSW.

*Persoonia patulifolia* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: Port Jackson, N.S.W., Sept. 1900, *C.Walter*; holo: LY.

*Persoonia pervagans* Gand., *Bull. Soc. Bot. France* 66: 227 (1919). T: Blue Mountains, N.S.W., Dec. 1899, *J.H.Camfield*; lecto: LY; isolecto: NSW, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 349 (1973); Blue Mountains, N.S.W., Dec. 1899, *C.Walter*; syn: LY; precise locality unknown, N.S.W., 1902, *C.Walter*; syn: LY.

Illustrations: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 482 (1989); A.Fairley & P.Moore, *Native Pl. Sydney Distr.* 160, pl. 520 (1989); P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 19, pl. 1 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 188–189 (1992).

Erect to spreading shrubs 2–4 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves linear, 3–7 cm long, 0.5 mm wide, terete, often recurved, spreading, straight, innocuous, concolorous, not glaucous, sparsely to moderately hairy when immature, glabrescent. Inflorescence anauxotelic, 30–200-flowered; rachis 3.5–26 cm long. Flowers subtended by reduced leaves and scale leaves; pedicels 1–4 mm long, spreading, moderately hairy; tepals 8–9 mm long, obtuse to apiculate, moderately hairy on outside. Ovary glabrous; ovule 1. Fig. 41A.

Occurs from Broken Bay to Cataract River in central-eastern N.S.W. and west to the lower Blue Mountains; grows in heath to dry sclerophyll forest on sandstone, from sea level to 600 m alt. Flowers chiefly Dec.–Mar. Map 79.

N.S.W.: Pearl Beach, *T.M.Whaite 689* (NSW); Fox Valley, *P.H.Weston 1245 & D.Catling* (K, NSW); Bowen Mtn, *T.James 267* (BRI, NSW); Gungulla Flat, Royal Natl Park, 34°09'S, 151°00'E, *R.G.Coveny 15180 & P.Bernhardt* (K, L, MO, NSW).

*Persoonia pinifolia* very occasionally hybridises with *P. isophylla* and *P. linearis* where they grow together. This species shows no significant intraspecific variation and is readily distinguished by its densely flowered, anauxotelic inflorescences in which all flowers are subtended by reduced foliage leaves.

**61. Persoonia isophylla** L.A.S.Johnson & P.H.Weston, *Telopea* 4: 291 (1991)

T: Peats Ridge–Kulnura road, 1.7 km S of Central Mangrove, N.S.W., 33°18'S 151°14'E, 26 Dec. 1989, *P.H.Weston 1425 & D.M.Weston*; holo: NSW; iso: AD, BRI, CBG, HO, K, MEL, MO, PERTH, RB.

Illustrations: A.Fairley & P.Moore, *Native Pl. Sydney Distr.* 160, pl. 522 (1989), as *Persoonia* sp.; P.H.Weston *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 19 (1991); A.M.Blombery & B.Maloney, *Proteaceae Sydney Reg.* 190–191 (1992).

Erect to spreading shrubs 0.3–1.5 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets sparsely hairy. Leaves linear, 12–30 mm long, 0.5 mm wide, terete, often recurved, spreading, straight, innocuous, concolorous, not glaucous, glabrous, smooth. Inflorescence usually auxotelic, mostly 10–70-flowered; rachis 0.5–9 cm long. Flowers mostly subtended by leaves; pedicels 0–1.5 mm long, erect to spreading, glabrous to moderately hairy; tepals 7–8 mm long, apiculate, glabrous to sparsely hairy on outside. Ovary glabrous; ovule 1.

Occurs from the Gosford–Kulnura district to Frenchs Forest in central-eastern N.S.W.; grows in heath to dry sclerophyll eucalypt forest in sandy or stony soils derived from Hawkesbury Sandstone, from near sea level to 250 m altitude. Flowers Jan.–July. Map 80.

N.S.W.: Kulnura, *R.G.Coveny 5849, P.Hind & R.Hancock* (AD, BRI, CBG, MEL, NSW, PERTH); near Empire Bay turn-off on Gosford–Kilcare road, 20 Apr. 1958, *J.G.McKern* (CBG, MEL, NSW); above 'The Duckhole', near head of McCarrs Ck, W of Church Point, 20 Feb. 1952, *L.A.S.Johnson* (CBG, NSW).

*Persoonia isophylla* closely resembles *P. pinifolia* but is distinguished by its shorter, usually brighter green leaves, and its inflorescences in which the great majority of flowers are subtended by full-sized leaves and which consistently grow on into a leafy shoot. They grow together south of the Hawkesbury River but hybrids between them seem to be very rare. It is not known to hybridise with any other species.

**62. Persoonia coriacea** Audas & P.Morris, *J. & Proc. Roy. Soc. W. Australia* 15: 81 (1929)

T: Merredin, W.A., 30 Nov. 1923, *M.Koch 3304*; lecto: MEL; isolecto: NSW, PERTH, *fide* P.H.Weston, *Telopea* 6: 99 (1994).

Erect to spreading shrubs 0.3–2 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves spathulate to obovate to elliptic or narrowly so to linear, 2–7 cm long, 3–13 mm wide, flat, sometimes slightly incurved, spreading to erect, usually falcate, twisted through 90–360°, innocuous, concolorous or with paler margins, usually slightly to strongly glaucous, sparsely hairy when immature, glabrescent, smooth to moderately scaberulous. Inflorescence usually auxotelic, 1–10-flowered; rachis 0–7 cm long. Flowers subtended by scale leaves and leaves; pedicels 2.5–9 mm long, erect, glabrous to moderately hairy; tepals 6.5–11.5 mm long, obtuse to acute to apiculate, glabrous to moderately hairy on outside. Ovary glabrous; ovules 2. Fig. 41D.

Occurs in an area roughly bounded by Carnamah, Lake Grace, Lake King and Plumridge Lakes, south-western W.A.; grows in heath and mallee heath communities, in yellow sand or sandy loam, often over laterite. Flowers Nov.–Feb. Map 81.

W.A.: c. 13 km N of Watheroo, July 1978, *C.Chapman* (PERTH); Raeside Soak, *P.H.Barrett 4* (PERTH); 3.9 km W of Yellowdine, *P.H.Weston 143* (SYD); 30 miles [49 km] E of L. Grace, *A.S.George 2273* (PERTH); c. 35 km W of Plumridge Lakes, *M.D.Crisp 5843, J.Taylor & R.Jackson* (CBG).

*Persoonia coriacea* hybridises sporadically with *P. helix* where they grow together.

Leaf morphology varies to some extent within and between populations. The northernmost (Bunjil area) and south-eastern (Lake Johnston area) populations are the only ones with mostly linear leaves. Some populations (e.g. Yellowdine) have helically twisted, non-linear leaves. This variation is ±erratic across the species distribution.

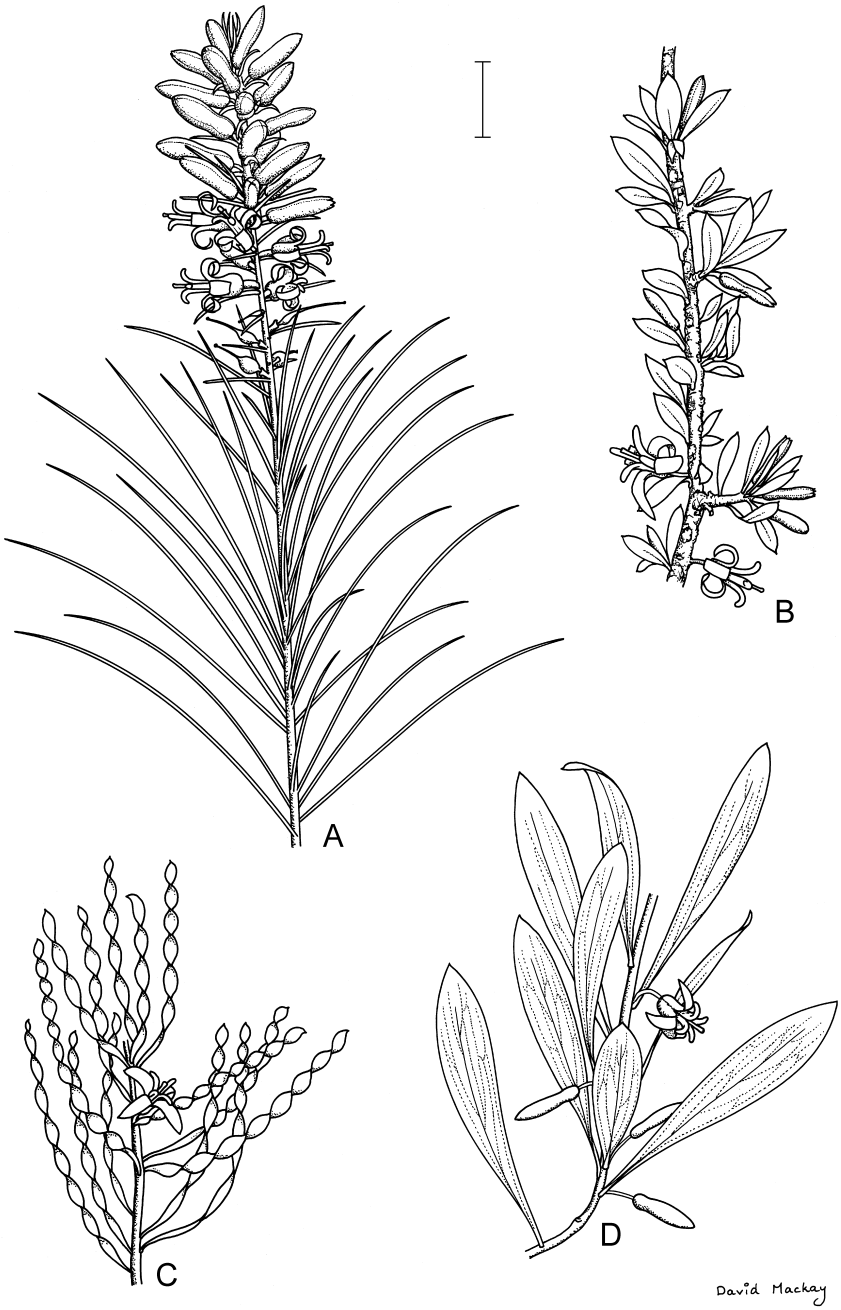



**Figure 41**. *Persoonia*. **A**, *P. pinifolia*, flowering branchlet (C.Dunn 22 & T.James, NSW); **B**, *P. pungens*, flowering branchlet (B.Smith 196, NSW); **C**, *P. helix*, flowering branchlet (K.Hill 579 et al., NSW); **D**, *P. coriacea*, flowering branchlet (A.Strid 21334, NSW). Scale bar = 1 cm. Drawn by D.Mackay.

### **63. Persoonia helix** P.H.Weston, *Telopea* 6: 101 (1994)

T: 29 miles E of Forrestania, W.A., 25 Nov. 1964, *F.F.Lullfitz L3875*; holo: PERTH; iso: KPBG.

Illustration: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 483 (1989), as *Persoonia* sp. nov.

Erect to spreading shrubs 0.4–2.8 m tall. Bark smooth. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves linear to narrowly oblong, 2–6 cm long, 1.5–4 mm wide, flat, suberect to erect, twisted through 180° to 6 complete turns, innocuous, concolorous or with paler margins, usually slightly to strongly glaucous, glabrous to sparsely hairy when immature, glabrescent, smooth to slightly scaberulous. Inflorescence usually auxotelic, 1–5-flowered; rachis 0–25 mm long. Flowers subtended by scale leaves and leaves; pedicels 3–6 mm long, erect, glabrous to moderately hairy; tepals 8–11 mm long, acuminate to mucronate, glabrous to sparsely hairy on outside. Ovary glabrous; ovules 2. Figs 16, 41C.

Occurs in an area roughly bounded by Kalgoorlie, Hyden, Ravensthorpe and Salmon Gums, south-western W.A.; grows in heath, mallee heath and mallee woodland, in yellow or white sand or sandy loam, often over laterite. Flowers Nov.–Feb. Map 82.

W.A.: 18 km NW of Bullabulling, *K.Newbey 8753* (PERTH); Hollands Track, 33 miles [53 km] SW of Queen Victoria Rock, *R.Filson 8900* (PERTH); junction of Salmon Gums–Lake King road with Peak Charles Rd, *P.H.Weston 245* (SYD); Peak Eleanora, *K.Newbey 6350* (PERTH); Mt Short, 5 Nov. 1968, *J.W.Wrigley* (CBG, PERTH).

*Persoonia helix* hybridises sporadically with *P. coriacea* where they grow together.

The degree of leaf twisting and, to a much lesser extent, leaf and flower dimensions vary between specimens. However, this does not seem to be geographically or ecologically correlated. It is possible that some specimens with wider, relatively less twisted leaves could be *P. helix* × *P. coriacea* hybrids.

### **64. Persoonia pertinax** P.H.Weston, *Telopea* 6: 103 (1994)

T: Queen Victoria Spring, W.A., 27 Jan. 1956, *R.D.Royce 5299*; holo: PERTH.

Erect to spreading shrubs 1–2.5 m tall. Bark smooth. Hairs greyish, appressed. Young branchlets moderately to densely hairy. Leaves linear, 2–5.5 cm long, 1–2.5 mm wide, flat, slightly to strongly incurved, spreading to erect, falcate, twisted through 90°, innocuous, concolorous, not glaucous, moderately hairy when immature, glabrescent, scaberulous. Inflorescence usually auxotelic, 1–10-flowered; rachis 0–6 cm long. Flowers subtended by scale leaves and leaves; pedicels 3.5–7 mm long, erect, moderately to densely hairy; tepals 8–11 mm long, acute to acuminate, moderately to densely hairy on outside. Ovary glabrous; ovules 2.

Restricted to within 50 km of Cundeelee, south-western W.A.; grows in open woodland, in red sand. Flowers Jan.–Mar. Map 83.

W.A.: 18 km N of Cundeelee, *P.M.Olde 88/16* (NSW, PERTH); 20 miles [32 km] E of Cundeelee, 9 Mar. 1963, *M.C.George* (DNA, NSW); Ponton Ck, *J.Taylor 549, M.D.Crisp & R.Jackson* (CBG, PERTH); near Queen Victoria Spring, *A.S.George 5873* (PERTH); near Streich Mound, 25 Aug. 1960, *A.R.Main* (PERTH).

### **65. Persoonia cymbifolia** P.H.Weston, *Telopea* 6: 104 (1994)

T: 14.5 km N of Mt Ridley, W.A., 33°09'30"S, 122°08'00"E, 7 Dec. 1991, *W.R.Archer 712912*; holo: PERTH; iso: K, NSW.

Spreading shrubs 0.2–0.6 m tall. Bark smooth. Hairs greyish to mid-brown, appressed to antrorsely spreading. Young branchlets densely hairy. Leaves linear to narrowly oblong, 1.5–4.5 cm long, 1–3 mm wide, flat to strongly concave, not incurved to strongly incurved, erect, straight to falcate, twisted through 0–90°, sharp but not pungent, concolorous, not glaucous, sparsely to moderately hairy when immature, glabrescent to sparsely hairy when mature, scabrous. Inflorescence auxotelic, 1–3-flowered; rachis 0–1 mm long. Flowers subtended by scale leaves; pedicels 2–3.5 mm long, erect to suberect, moderately to densely hairy; tepals 7–11.5 mm long, acuminate, moderately hairy on outside. Ovary moderately

hairy; ovules 2.

Occurs in an apparently narrow band stretching from Frank Hann Natl Park through the Mt Ridley–Dingo Rock area to Mt Buraminya and the Mt Ragged Range, south-western W.A.; grows in sandy soils or in rock crevices, in heath. Flowers Dec.–Jan. Map 84.

W.A.: 33.2 km SW of 90 mile tank on Hanns Track, *P.H.Weston 249* (SYD); 26 km NW of Roberts Swamp, *K.Newbey 8182* (PERTH); 35.5 km NE of Mt Heywood, *W.R.Archer 2612917* (CANB, K, NSW, PERTH); 2 km SW of Mt Buraminya, *W.R.Archer 3108915* (NSW); Mt Ragged Ra., 2.5 km S of Tower Peak, *M.D.Crisp 4823* (CBG).

Leaf concavity varies geographically. Specimens from Frank Hann Natl Park to the Mt Ridley area have strongly concave leaves while those from the Mt Ragged Range are either flat or slightly concave. Geographically intermediate specimens (e.g. Mt Buraminya) have shallowly concave leaves.

### 66. Persoonia leucopogon S.Moore, *J. Linn. Soc. Bot.* 34: 220 (1899)

T: between Uladdie and Yilgangie, W.A., Mar. 1895, *S.L.-M.Moore*; lecto: BM; isolecto: NY, *fide* P.H.Weston, *Telopea* 6: 106 (1994).

Erect to decumbent shrubs 30–60 cm tall. Bark not known. Hairs grey to ferruginous, appressed to antrorsely spreading. Young branchlets densely hairy. Leaves narrowly oblong to narrowly elliptic, 7–15 mm long, 1.3–2.2 mm wide, flat, spreading to erect, straight to slightly falcate, twisted through 0–360°, sharp but not pungent, concolorous, glaucous, glabrescent. Inflorescence auxotelic, 1–4-flowered; rachis 0–2 mm long. Flowers subtended by scale leaves and leaves; pedicels 2.5–4 mm long, moderately to densely hairy; tepals 8.5–10.5 mm long, densely hairy on outside. Ovary glabrous; ovules 2.

Collected at Bungalbin and the type locality between Coolgardie and Laverton, south-western W.A.; grows in heath, in yellow sand or loam. Flowers Nov.–Mar. Map 85.

W.A.: 3 km N of N end of Helena and Aurora Ra. [Bungalbin], *G.J.Keighery 4422* (PERTH); 16.5 km NE of Bungalbin Hill, *R.J.Cranfield 8140* (PERTH).

### 67. Persoonia pungens W.Fitzg., *J. Bot.* 50: 23 (1912)

T: Kellerberrin, W.A., Nov. 1907, *W.V.Fitzgerald*; lecto: NSW; isolecto: BM, NSW, PERTH, *fide* P.H.Weston, *Telopea* 6: 107 (1994); Kellerberrin, W.A., Dec. 1903, *F.H.Vachel*; syn: NSW.

Spreading to decumbent shrubs with abundant, short lateral shoots 20–80 cm tall. Bark smooth. Hairs greyish, antrorsely spreading to patent. Young branchlets densely hairy. Leaves elliptic to narrowly elliptic to narrowly oblong, 5–15 mm long, 1–5 mm wide, flat, spreading to suberect, straight to slightly falcate, twisted through 0–360°, pungent, concolorous, not glaucous, sparsely hairy when immature, glabrescent, scaberulous. Inflorescence auxotelic or anauxotelic, 1–5-flowered; rachis 0–5 mm long. Flowers subtended by scale leaves and leaves; pedicels 1–3 mm long, erect to spreading, glabrous to sparsely hairy; tepals 9–12.5 mm long, obtuse to acuminate, glabrous on outside. Ovary glabrous; ovule 1. Fig. 41B.

Occurs from the Coorow area south-east to Kellerberrin, south-western W.A.; grows in heath, in white or yellow sand to loam. Flowers Sept.–Dec. Map 86.

W.A.: c. 15 km W of Coorow, *P.H.Weston 162* (SYD); 18 km N of Watheroo on Midland Rd, 17 Dec. 1980, *C.Chapman* (SYD); Namelcatchem, 3 miles [c. 5 km] S of Minnivale, *B.H.Smith 196* (MEL, NSW, PERTH); L.Derdibin, *B.H.Smith 1033* (NSW); Dingo Rock, *B.H.Smith 1134* (NSW).

One specimen (*A.Strid 21723*, NSW) has larger leaves (10–24 mm long, 2–4 mm wide), and longer pedicels (3–5.5 mm long) than other specimens of *P. pungens* and also has few short, lateral shoots. This may be of a hybrid of *P. pungens*, perhaps with *P. coriacea*.

### 68. Persoonia baeckeoides P.H.Weston, *Telopea* 6: 108 (1994)

T: 200 m west of turn-off to Peak Charles on Hanns Track, W.A., 32°45'S, 121°18'E, Dec. 1980, *P.H.Weston 246*; holo: SYD; iso: CANB, K, PERTH.

Erect shrubs 50–90 cm tall. Bark smooth. Hairs greyish to pale brown, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves spathulate, 5–11 mm long, 2–4 mm wide, flat, suberect, straight, twisted through 90°, innocuous, concolorous, slightly glaucous, glabrous, smooth. Inflorescence auxotelic, 1–3-flowered; rachis 0–2 mm long. Flowers subtended by scale leaves and leaves; pedicels 2–3 mm long, erect to spreading, glabrous to sparsely hairy; tepals 7.5–9 mm long, obtuse to acute, glabrous on outside. Ovary glabrous; ovule 1.

Collected at two localities 20 km north-west and 20 km north-east of Peak Charles, south-western W.A.; grows in heath, in yellow sandy loam over laterite. Flowers Nov.–Dec. Map 87.

W.A.: 1 km W of Peak Charles turn-off on Norseman–L. King road, *K.Newbey 5627* (PERTH); near Peak Charles turn-off on L. King–Norseman road, *K.Newbey 7217* (PERTH); 50 km W of Kumarl, *P.G.Wilson 5679* (PERTH).

This species is distinguished by its short, spathulate leaves.

## *Dillwynioides* Group

Bark smooth. Leaves alternate or opposite, concolorous. Inflorescence axillary to terminal, usually auxotelic. Flowers actinomorphic, subtended by scale leaves and leaves; tepals yellow; lateral wings absent. Anthers sublatrorse, held close together and close to gynoecium at their bases but recurved outwards towards tips, yellow; appendage present, not recurved. Gynoecium exserted, shorter than, equal to, or slightly longer than stamens; abscission zone basal. Ovary glabrous; ovules 2. Drupes green with purple stripes. Cotyledons 3.

### 69. Persoonia cordifolia P.H.Weston, *Telopea* 6: 110 (1994)

T: 44 km NE of Mt Heywood, W.A., 33°03'S, 122°50'E, 26 Dec. 1991, *W.R.Archer 2612911*; holo: PERTH; iso: CANB, K, MO, NSW.

Erect shrubs 1–2 m tall. Hairs greyish, patent. Young branchlets moderately hairy. Leaves opposite-decussate, broadly cordate, 7–12 mm long, 6–13 mm wide, flat or slightly concave, not incurved, mostly spreading, straight, not twisted, innocuous, not glaucous, sparsely hairy when immature, glabrescent, scaberulous. Inflorescence auxotelic, 2–8-flowered; rachis 0–25 mm long. Pedicels 3–5 mm long, spreading, sparsely hairy. Tepals c. 11 mm long, acute, sparsely hairy. Anther appendage obtuse, 1.5–2 mm long.

Collected at two localities, 8.5 km apart, c. 130 km north-east of Esperance, south-western W.A.; grows in heath, in yellow sand or sandy loam. Flowers Dec.–Jan. Map 88.

W.A.: 44 km NE of Mt Heywood, *W.R.Archer 2212903, 2212904* (AD, CANB, NSW, PERTH); 42 km NE of Mt Heywood, *W.R.Archer 2212905* (NSW, PERTH).

*Persoonia cordifolia* is a distinctive species, not closely resembling any others. It is one of the few species with opposite-decussate phyllotaxis, and this feature, together with its broadly cordate leaves, is sufficient to distinguish it from all other species.

### 70. Persoonia dillwynioides Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 333 (1856)

*Linkia dillwynioides* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Swan R. Colony [W.A.], *J.Drummond 5: 403*; lecto: NY; isolecto: BM, CGE, K, MEL, NSW, PERTH, *fide* P.H.Weston, *Telopea* 6: 111 (1994).

Erect to spreading shrubs 0.6–1.8 m tall. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves alternate, linear, 10–20 mm long, 0.7–1.3 mm wide, concave to subterete, and grooved on upper surface, suberect to erect, straight, twisted through 90–360°, sharp but not pungent, not glaucous, sparsely hairy when immature, glabrescent, slightly scaberulous. Inflorescence usually auxotelic, 1–4-flowered; rachis 0–3

mm long. Pedicels 1.5–2.5 mm long, erect to spreading, glabrous. Tepals 10–12 mm long, acute, glabrous. Anther appendage obtuse, to 0.4 mm long on outside. Fig. 42B.

Restricted to within 50 km of the coast, between Gairdner River and Hopetoun, south-western W.A.; grows in low heath, in gravelly sand or loam to clay. Flowers Nov.–Dec. Map 89.

W.A.: Ravensthorpe Ra., 6 km NE of Ravensthorpe, *K.Newbey 8271* (PERTH); 0.2 km W of Susetta R. on Old Ongerup Rd, *P.H.Weston 239* (SYD); 2 miles [c. 3 km] N of Hopetoun, *K.Newbey 2755* (PERTH); W of lower Fitzgerald R., *A.S.George 11760* (CANB).

*Persoonia dillwynioides* is a distinctive species, readily distinguished from all others by its twisted, linear, deeply concave leaves.

### 71. Persoonia flexifolia R.Br., *Trans. Linn. Soc. London* 10: 162 (1810)

T: Bay I [Lucky Bay, W.A.], Jan. 1802, *R.Brown s.n.*; lecto: BM, *fide* P.H.Weston, *Telopea* 6: 113 (1994).

Erect shrubs. Hairs whitish or greyish, appressed to antrorsely spreading. Young branchlets moderately hairy. Leaves alternate, mostly narrowly oblong, 10–25 mm long, 1.8–3 mm wide, flat to slightly concave, sometimes slightly incurved, suberect to erect, straight to slightly falcate, usually twisted through 90–180°, sharp but not pungent, not glaucous, glabrous to sparsely hairy when immature, glabrescent, scaberulous. Inflorescence usually auxotelic, 1–3-flowered; rachis 0–4 mm long. Pedicels 1.5–3 mm long, erect to suberect, glabrous to sparsely hairy. Tepals 10–12 mm long, acute, glabrous on outside. Anther appendage obtuse, 0.3–0.5 mm long.

Collected from Lucky Bay and Lort River, south-western W.A.; grows in low heath, in gravelly sand. Flowers Jan. Map 90.

W.A.: Lort R. crossing, c. 70 km W of Esperance along road to Ravensthorpe, *B.Barnsley 410* (CBG, NSW).

## *Graminea* Group

Bark thin. Leaves alternate, usually in clusters of 2–5 at the end of each season's growth, concolorous. Inflorescence subterminal to terminal. Flowers actinomorphic, subtended by scale leaves; tepals yellow or green; lateral wings absent or present. Anthers sublatrorse, held close together and close to gynoecium from their bases to tips of loculi, yellow or green; appendage present. Gynoecium exserted, shorter than, equal to, or slightly longer than stamens; abscission zone basal. Ovary glabrous; ovules 2. Drupes green usually suffused with reddish purple. Cotyledons 3.

### 72. Persoonia graminea R.Br., *Trans. Linn. Soc. London* 10: 164 (1810)

*Linkia graminea* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: King George Sound [W.A.], Dec. 1801, *R.Brown s.n.*; lecto: BM; isolecto: BM, E, K, NSW, *fide* P.H.Weston, *Telopea* 6: 114 (1994).

Erect to decumbent, weak shrubs 20–60 cm tall. Hairs greyish, appressed to antrorsely spreading. Young branchlets sparsely to moderately hairy. Leaves linear, 10–35 cm long, 2–8 mm wide, flat, sometimes with incurved margins, with 3 prominent, parallel veins on lower surface and with thickened margins, often slightly incurved, suberect to erect, straight to slightly falcate, sometimes slightly twisted, innocuous, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth. Inflorescence anauxotelic, 10–25-flowered; rachis 2.5–22 cm long. Pedicels 2–6 mm long, recurved, glabrous to moderately hairy on outside. Tepals 4.2–4.5 mm long, acute, sparsely to moderately hairy. Anther appendage acute, 1.4–1.7 mm long, recurved through 45°. Figs 17, 42C.

Occurs within 40 km of the coast, between Margaret River and Albany, south-western W.A.; grows in heath to dry sclerophyll forest, in poorly drained peaty to sandy or loamy soils. Flowers Nov.–Jan. Map 91.


**Figure 42**. *Persoonia*. **A**, *P. chapmaniana*, flowering branchlet (C.Chapman & P.Weston 424, NSW). **B**, *P. dillwynioides*, flowering branchlet (Drummond 4: 403, NSW). **C**, *P. graminea*, flowering branchlet (Albany, W.A., C.Andrews s.n., NSW). **B**, *P. trinervis*, flowering branchlet (E.Canning, NSW 149620). Scale bar = 1 cm. Drawn by D.Mackay.

W.A.: Nillup via Margaret River, *R.D.Royce 40* (PERTH); Brockman Hwy, 5.4 km E of Great North Rd, Scott R. area, *P.H.Weston 211* (SYD); Scott R. plain, *A.S.George 11772* (PERTH, SYD); Wilsons Inlet, *A.F.Oldfield 737* (NSW); Albany, Dec. 1902, *C.R.P.Andrews* (NSW, PERTH).

This is a peculiar and distinctive species that does not look much like a member of the Proteaceae. It is easily recognised by its weak, almost herbaceous habit, its grass-like leaves, and its pendulous flowers which are the smallest of any species in the genus and which are borne on long, leafless, anauxotelic inflorescences.

### 73. Persoonia micranthera P.H.Weston, *Telopea* 6: 116 (1994)

T: summit plateau of Bluff Knoll, Stirling Range, W.A., 34°22'S, 118°15'E, 3 Dec. 1980, *P.H.Weston 230*; holo: SYD; iso: CANB, K, NY, PERTH.

Decumbent to prostrate shrubs 10–40 cm tall. Hairs greyish to tawny, appressed to patent. Young branchlets moderately hairy. Leaves spathulate to obovate to oblanceolate, 4–8 cm long, 8–30 mm wide, flat, with slightly recurved margins, spreading to erect, straight, twisted through 0–90°, innocuous, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth. Inflorescence anauxotelic, 4–15-flowered; rachis 1–6 cm long. Pedicels 2.5–8 mm long, erect to spreading, moderately hairy. Tepals 10.5–14 mm long, acute, moderately hairy on outside. Anther appendage obtuse, 0.2–0.3 mm long.

Restricted to the summit plateau of Bluff Knoll, Stirling Range, south-western W.A.; grows as an understory shrub in montane thicket vegetation, in sandy, stony soil. Flowers Feb. Map 92.

W.A.: top of Bluff Knoll, *F.Lullfitz 3383* (KPBG, PERTH); Coyanerup Peak, *G.J.Keighery 3370* (PERTH).

*Persoonia micranthera* is distinguished by its long staminal filaments which are 60–70% as long as the tepals, and its relatively short anthers, 2–3.3 mm long.

## *Chapmaniana* Group

Bark smooth. Leaves alternate, concolorous, with 5 prominent, parallel veins. Inflorescence axillary to terminal, anauxotelic. Flowers actinomorphic, mostly subtended by scale leaves; tepals yellow; lateral wings absent. Anthers sublatrorse, held close together and close to gynoecium at their bases but recurved outwards towards tips, yellow; appendage present but sometimes almost obsolete, not recurved. Gynoecium exserted, shorter than, equal to, or slightly longer than stamens; abscission zone basal. Ovary glabrous or densely hairy; ovules 2. Drupes green, usually suffused with reddish purple. Cotyledons 6–7.

### 74. Persoonia chapmaniana P.H.Weston, *Telopea* 6: 117 (1994)

T: 5.5 miles [c. 9 km] W of Winchester on Carnamah–Eneabba road, W.A., 11 Oct. 1981, *C.Chapman*; holo: SYD; iso: AD, BRI, CANB, K, MEL, NSW, NY, PERTH.

Erect shrubs 1–2 m tall. Hairs whitish or greyish to tawny, appressed to antrorsely spreading. Young branchlets densely hairy. Leaves linear, 2–8 cm long, 0.9–1.3 mm wide, subterete, often slightly incurved, spreading to suberect, straight, pungent, not glaucous, moderately to densely hairy when immature, glabrescent, smooth to slightly scaberulous. Inflorescence anauxotelic, 5–30-flowered; rachis 1.5–6 cm long. Flowers mostly subtended by scale leaves; pedicels 0–5 mm long, spreading, moderately to densely hairy; tepals 5.5–11.5 mm long, acute, glabrous on outside. Anther appendage obtuse, 0.3–0.4 mm long. Ovary densely hairy. Drupes verrucose. Figs 18, 42A.

Occurs in an area roughly bounded by Winchester, Coomberdale, Lake Ninan and Kulja, south-western W.A.; grows in dry sclerophyll woodland, in yellow sandy loam over clay, always in the vicinity of salt lakes. Flowers Sept.–Nov. Map 93.

W.A.: Carnamah–Eneabba road, 5.5 miles [c. 9 km] W of Winchester, *P.H.Weston 159* (CANB, K, NSW, NY, PERTH, SYD); Kalannie–Kulja road, *F.W.Humphries 247* (PERTH); Coomberdale, Sept. 1949, *E.Summerville* (PERTH); L.Ninan, *S.J.Forbes 1803* (MEL, NSW).

*Persoonia chapmaniana* is a distinctive species, not closely resembling any others except *P. pentasticha* with which it shares 5-ribbed, subterete leaves. It is the only *Persoonia* known to have verrucose drupes.

### 75. Persoonia pentasticha P.H.Weston, *Telopea* 6: 119 (1994)

T: 210 mile peg, N from Wubin, W.A., 10 Aug. 1963, *J.S.Beard 2607*; holo: PERTH; iso: KPBG.

Erect to spreading shrubs 0.4–1.8 m tall. Hairs whitish or greyish to tawny, appressed to antrorsely spreading. Young branchlets densely hairy. Leaves linear, 3.5–12 cm long, 0.7–1.2 mm wide, ±terete, usually slightly incurved, spreading to erect, straight, pungent, not glaucous, moderately to densely hairy when immature, glabrous to moderately hairy when mature, scabrous. Inflorescence anauxotelic, 1–15-flowered; rachis 0–45 mm long. Flowers subtended by scale leaves; pedicels 0–6 mm long, spreading, moderately to densely hairy; tepals 7–12 mm long, acute, sparsely to moderately hairy on outside. Anther appendage obtuse, to 0.6 mm long. Ovary glabrous. Drupes not known.

Occurs in an area roughly bounded by Mullewa, Mingenew, Wubin and Paynes Find, south-western W.A.; grows in heath, in sand, laterite, weathered granite or red loam. Flowers Aug.–Nov. Map 94.

W.A.: 6 miles [10 km] from Mullewa, W.A., towards Pindar, *M.E.Phillips 1623* (CBG); 'Carranya' property, c. 15 km NW of Morawa, 19 Oct. 1986, *J.White* (PERTH); Ebano, Mingenew, *W.D.Campbell 85* (K); 29.6 miles [c. 47 km] NE of No. 2 Rabbit Fence on Wubin–Paynes Find road, *B.H.Smith 1057* (NSW); 4.4 miles [c. 7 km] E of Paynes Find on road to 'Maranalgo', *B.H.Smith 1483* (NSW).

*Persoonia pentasticha* differs from *P. chapmaniana* in having slightly narrower, more flexible, more densely papillose leaves with much narrower grooves between the ribs, usually shorter, fewer-flowered inflorescences and a glabrous gynoecium.

## *Quinquenervis* Group

Bark smooth but sometimes fissured at base. Leaves alternate, concolorous or main veins paler than rest of lamina. Inflorescence axillary to terminal, anauxotelic or auxotelic. Flowers actinomorphic, subtended by scale leaves or by scale leaves and leaves; tepals yellow to greenish yellow; lateral wings usually present. Anthers introrse, held close together and close to gynoecium from their bases to tips of loculi, yellow; appendage present, recurved. Gynoecium exserted, shorter than, equal to, or slightly longer than stamens; abscission zone basal. Ovary glabrous to densely hairy; ovules 1 (–2). Drupes green, usually suffused with reddish purple, or green with purple stripes. Cotyledons 4–8.

### 76. Persoonia trinervis Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 332 (1856)

*Linkia trinervis* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: in coloniâ Swan River [W.A.], *J.Drummond 5: 5*; lecto: NY; isolecto: BM, CGE, FI, K, MEL, NSW, PERTH, TCD, *fide* P.H.Weston, *Telopea* 6: 120 (1994).

*Persoonia tortifolia* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 331 (1856); *Linkia tortifolia* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: in coloniâ Swan River [W.A.], *J.Drummond 4: 272*; lecto: NY; isolecto: BM, CGE, E, K, MEL, NSW, TCD, *fide* P.H.Weston, *Telopea* 6: 120 (1994).

Erect to spreading shrubs 0.3–1.8 m tall. Hairs greyish to ferruginous, appressed to patent. Young branchlets densely hairy. Leaves spathulate to oblanceolate to linear, 1.5–9 cm long, |1.6–20 mm wide, flat or concave with 3 prominent, parallel veins on undersurface and with thickened (and sometimes undulate) margins, or compressed-subterete with 6 prominent, parallel veins, often recurved or slightly incurved, spreading to erect, straight to slightly falcate, twisted through 0–2 complete turns, innocuous, not glaucous, moderately to densely hairy when immature, glabrescent to sparsely hairy when mature, scabrous to scaberulous. Inflorescence anauxotelic, 1–4-flowered; rachis 0–1 mm long. Flowers subtended by scale leaves; pedicels 1–3.5 mm long, erect, densely hairy; tepals 8.5–16 mm long, acute to acuminate, densely hairy on outside. Anther appendage obtuse to acute, 0.3–3.5 mm long,

recurved through 45–180°. Ovary densely hairy. Fig. 42D.

Occurs in an area roughly bounded by Mt Peron, Narrogin, Lake Grace, Frank Hann Natl Park and Watheroo, south-western W.A.; grows in low heath or mallee heath to mallee woodland, in white or yellow sand or loam, often over laterite. Flowers Sept.–Dec. Map 95.

W.A.: Coomallo Ck, *P.H.Weston 279* (SYD); 70 km S of Moora, *D.J.E.Whibley 4999* (AD); Quairading–Corrigan road, *A.S.George 12919* (PERTH); West Popanyinning, *F.Lullfitz 1728* (KPBG, PERTH); 10 km SE of Mt Gibbs, Frank Hann Natl Park, *K.Newbey 6499* (PERTH).

This is an extremely variable species, particularly in leaf morphology. Geographically correlated variation is evident in indumentum, leaf morphology, flower size, tepal morphology and anther appendage morphology. The extremes of variation are characterised below.

Southern form (Frank Hann Natl Park–Lake Grace–Popanyinning area): hairs appressed to antrorsely spreading; leaves spathulate to linear-spathulate or oblanceolate to linear, concave and occasionally undulate, sometimes twisted up to ½ a turn, often prominently curved or coiled downwards towards the tip, mostly 1.5–7 cm long, 4–10 mm wide; tepals not attenuate at the tip, 8.5–12 mm long; anther appendage 0.3–0.7 mm long.

Western form (Mogumber area): hairs antrorsely spreading to patent; leaves linear to linear-spathulate, dorsiventrally flattened to compressed, mostly 3–9 cm long, 1.6–3 mm wide, occasionally twisted up to ½ a turn, if curved downwards at the tip then only slightly so; tepals slightly attenuate at the tip, 12–13 mm long; anther appendage 0.5–1 mm long.

Northern form (Coomallo Creek–Watheroo area): hairs antrorsely spreading to patent; leaves narrow, spathulate, flat or slightly concave, mostly 2–6 cm long, 4–20 mm wide, mostly twisted through ¼–1 turn, curved downwards at the tip; tepals prominently attenuate at the tip, 12–16 mm long; anther appendage 2–3.5 mm long.

These extremes grade into one another in the intervening areas.

### 77. **Persoonia angustiflora** Benth., *Fl. Austral.* 5: 386 (1870)

*Linkia angustiflora* (Benth.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Swan R., W.A., *J.Drummond 1: 597*; lecto: K; isolecto: BM, FI, K, MEL, *fide* P.H.Weston, *Telopea* 6: 122 (1994); Swan R., W.A., *J.A.Preiss 729*; syn: FI, MEL, NY.

*Persoonia angustiflora* var. *burracoppinensis* D.A.Herb., *J. & Proc. Roy. Soc. W. Australia* 7: 88 (1921). T: Burracoppin, W.A., Nov. 1920, *D.A.Herbert & Wilson 100*; holo: PERTH.

[*Persoonia fraseri auct. non* R.Br.: C.F.Meisner *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 532 (1845)]

Erect shrubs 0.2–1.8 m tall. Hairs greyish to mid-brown, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves linear, 2–14 cm long, 0.7–1.3 mm wide, compressed to ±terete, with 6 prominent, parallel veins, often slightly incurved, suberect to erect, straight to slightly falcate, innocuous, not glaucous, moderately to densely hairy when immature, glabrescent, smooth to slightly scaberulous. Inflorescence anauxotelic or auxotelic, 1–4-flowered; rachis 0–1 mm long. Flowers mostly subtended by scale leaves; pedicels 1.5–12 mm long, erect, moderately to densely hairy; tepals 9–16 mm long, acuminate, moderately to densely hairy on outside. Anther appendage obtuse to acute, 0.3–3 mm long, recurved through 45–180°. Ovary densely hairy.

Occurs in an area roughly bounded by Eneabba, Perth, Frank Hann Natl Park and Maya, south-western W.A.; grows in low heath, mallee heath, and in *Eucalyptus* or *Banksia* woodland, in white, grey or yellow sand or loam, often over laterite. Flowers Sept.–Mar. Map 96.

W.A.: 4.5 km S of Maya, *P.H.Weston 307* (SYD); Hale Rd, Forrestfield, *R.J.Cranfield 266/77* (PERTH); 3 miles [c. 5 km] E of Manmanning, *B.H.Smith 1566* (NSW); 10 km N of Mt Holland, *G.J.Keighery 1078* (KPBG); Frank Hann Natl Park, *K.Newbey 6848* (PERTH).

This widespread species shows geographically correlated variation in leaf length, leaf cross-sectional shape, pedicel length, flower size and anther appendage length. Three extremes of variation in these characters are described below.

Western form (Perth area, coastal plain): leaves mostly 5–14 cm long, dorsiventrally compressed; pedicels 2.5–7 mm long; tepals 12–16 mm long; anther appendage 1.5–3 mm long.

Eastern form (Frank Hann Natl Park–Merredin area): leaves mostly 2–5 cm long, subterete; pedicels 5–9 mm long; tepals 9–10 mm long; anther appendage 0.3–0.6 mm long. This form includes the type of *P. angustiflora* var. *burracoppinensis*.

Northern form (Maya–Coorow area): leaves mostly 4–7 cm long, dorsiventrally compressed; pedicels 1.5–7 mm long; tepals 9–11 mm long; anther appendage 0.3–0.6 mm long.

Clinal variation links these extremes.

### **78. Persoonia papillosa** P.H.Weston, *Telopea* 6: 124 (1994)

T: SW of Yuna, W.A., 8 Sept. 1962, *F.W.Went 88*; holo: PERTH.

Erect shrubs c. 30 cm tall. Hairs mid-brown, appressed to patent. Young branchlets moderately to densely hairy. Leaves linear, 15–30 mm long, 1–1.3 mm wide, compressed, with 6 prominent, parallel veins, often slightly incurved, mostly erect, often slightly falcate, innocuous, not glaucous, moderately to densely hairy when immature, glabrescent to sparsely hairy when mature, scabrous. Inflorescence usually auxotelic, 1–20-flowered; rachis 0–6 cm long. Flowers subtended by scale leaves and leaves; pedicels 6–14 mm long, erect, moderately to densely hairy; tepals 9.5–11 mm long, acuminate, densely hairy on outside. Anther appendage obtuse, 1–1.3 mm long, recurved through 180°. Ovary densely hairy.

Collected from Murchison River and Yuna, south-western W.A.; grows in sand. Flowers Sept.–Jan. Map 97.

W.A.: Murchison R., *C.A.Gardner 12059* (PERTH).

### **79. Persoonia bowgada** P.H.Weston, *Telopea* 6: 125 (1994)

T: between Coolcalalaya Stn and Glasses Bore, W.A., 22 Oct. 1974, *J.S.Beard 7142*; holo: PERTH.

Erect to spreading shrubs 1–3.5 m tall. Hairs greyish to tawny, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves linear, 5–11 cm long, 0.7–1.3 mm wide, ±terete, with 6 prominent, parallel veins, often slightly incurved, suberect to erect, straight to slightly falcate, twisted through 0–180°, pungent, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth. Inflorescence usually auxotelic, 1–10-flowered; rachis 0–4 cm long. Flowers subtended by scale leaves and leaves; pedicels 2.5–7 mm long, erect, densely hairy; tepals 11–15.5 mm long, acute to acuminate, moderately to densely hairy on outside. Anther appendage acute, 1–2 mm long, recurved through 180°. Ovary densely hairy.

Occurs within 100 km of the coast, between Shark Bay and the Murchison River, south-western W.A.; most frequent in *Acacia* woodland but also found in *Eucalyptus* woodland and mallee heath, usually in red sand or sandy loam but also found in yellow sand. Flowers Oct.–Nov. Map 98.

W.A.: Hamelin Pool, *F.Lullfitz 2839* (KPBG, PERTH); Tamala Rd, 2 km WSW of junction with Denham Rd, *P.H.Weston 290* (SYD); 30 km S of Billabong Roadhouse on North West [Coastal] Hwy, *S.J.Forbes 1651* (NSW); 7 miles [11 km] N of Murchison R., North West Coastal Hwy, *A.S.George 7870* (PERTH).

One specimen (*L.A.Craven 7112*, NSW) is morphologically intermediate between *P. bowgada* and *P. hexagona*, having foliage typical of *P. bowgada* and flowers resembling those of typical *P. hexagona*. Its collection locality is well south of the area around the lower Murchison River where one might expect to find hybrids or a zone of intergradation between these species. More collections are required from the area north of Mullewa to clarify the pattern of geographic variation.


**Figure 43**. *Persoonia*. **A**, *P. quinquenervis*, flowering branchlet (from photographs and specimen: A.Ashby 1435, SYD). **B**, *P. filiformis*, flowering branchlet (A.Strid 21703, NSW). **C**, *P. acicularis*, flowering branchlet (R.Pullen 9644, NSW). **D**, *P. hexagona*, flowering branchlet (P.Weston 183A, SYD). Scale bar = 1 cm. Drawn by D.Mackay.

### **80. Persoonia hexagona** P.H.Weston, *Telopea* 6: 128 (1994)

T: road from Perenjori to Paynes Find via Warriedar, 3.2 km W of turn-off to Karara, W.A., 29°20'S, 116°40'E, 26 Nov. 1980, *P.H.Weston 182*; holo: SYD; iso: CANB, K, NSW, NY, PERTH.

Erect to spreading shrubs 1–3.5 m tall. Hairs greyish to tawny, appressed to antrorsely spreading. Young branchlets densely hairy. Leaves linear, 5–13 cm long, 0.7–1.3 mm wide, subterete, with 6 prominent, parallel veins, often slightly incurved, suberect to erect, straight or slightly falcate, twisted through 0–180°, pungent, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth. Inflorescence usually auxotelic, 1–10-flowered; rachis 0–4 cm long. Flowers subtended by scale leaves and leaves; pedicels 7.5–9 mm long, erect, moderately to densely hairy; tepals 10.5–20 mm long, acute to acuminate, sparsely to moderately hairy on outside. Anther appendage acute, 1–1.7 mm long, recurved through 180°. Ovary glabrous to sparsely hairy. Fig. 43D.

Occurs from Murchison River, south-east to the Perenjori area, south-western W.A.; usually grows in *Acacia* woodland but also found in communities dominated by *Casuarina* or *Eucalyptus*; usually grows in red sand or sandy loam but also in yellow sand or stony hillsides. Flowers Nov.–Dec. Map 99.

W.A.: Z bend, Murchison R., *A.C.Burns 19* (PERTH); 4 miles [6 km] N of Howatharra, *G.J.Keighery 185* (KPBG, PERTH); 24.3 km SW of Morawa P.O. towards Three Springs, *R.G.Coveny 7963 & B.R.Maslin* (NSW); road to Karara, 1 km E of rabbit-proof fence, *P.H.Weston 183* (SYD).

Dried specimens of this species may be easily recognised by the characteristically striated, 6-ribbed, linear, subterete, pungent leaves. The striations are due to the absence of stomata from the ribs. When dried, the stomatal guard cells turn black.

### **81. Persoonia spathulata** R.Br., *Trans. Linn. Soc. London* 10: 162 (1810)

T: Bay I [Lucky Bay, W.A.], *R.Brown s.n.*; lecto: BM; isolecto: BM, *fide* P.H.Weston, *Telopea* 6: 129 (1994).

Erect to spreading shrubs 20–60 cm tall. Hairs glandular and non-glandular, mostly greyish to whitish, antrorsely spreading to patent. Young branchlets moderately to densely hairy. Leaves mostly spathulate to narrowly spathulate, 1.5–4 cm long, 5–10 mm wide, flat, suberect to erect, straight to slightly falcate, twisted through 0–90°, sharp but not pungent, not glaucous, moderately hairy when immature, glabrescent, scabrous. Inflorescence mostly auxotelic, 1–2-flowered; rachis 0–2 mm long. Flowers subtended by scale leaves and leaves; pedicels 3.5–9 mm long, erect, moderately glandular-hairy; tepals 9–13 mm long, acute, moderately hairy on outside. Anther appendage obtuse, c. 2 mm long, recurved through 90–180°. Ovary glabrous.

Occurs in an area roughly bounded by Dingo Rock, Cape Le Grand and Israelite Bay, south-western W.A.; grows in sand heath. Flowers Dec.–Jan. Map 100.

W.A.: 14.5 km N of Mt Ridley, *W.R.Archer 712913*, (CBG, K, MEL, NSW, PERTH); 12 km SW of Israelite Bay, *B.Barnsley 365* (CBG); 44 km SW of Mt Ragged, *K.Newbey 6802* (PERTH).

*Persoonia spathulata* is clearly distinguishable from all other species of Persoonieae by its indumentum consisting of a mixture of glandular and non-glandular hairs.

### **82. Persoonia scabra** R.Br., *Trans. Linn. Soc. London* 10: 162 (1810)

*Linkia scabra* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Bay I [Lucky Bay, W.A.], *R.Brown s.n.*; holo: BM.

Erect to spreading shrubs 30–90 cm tall. Hairs greyish or whitish, antrorsely spreading. Young branchlets moderately to densely hairy. Leaves narrowly oblong to oblanceolate or, occasionally, spathulate, 1.5–3.5 cm long, 2.5–6 mm wide, flat, suberect to erect, straight to slightly falcate, twisted through 0–90°, often pungent, not glaucous, sparsely to moderately hairy when immature, glabrescent, scaberulous. Inflorescence anauxotelic or auxotelic, 1–3 flowered; rachis 0–5 mm long. Flowers usually subtended by scale leaves; pedicels 1.5–4.5 mm long, erect, glabrous or moderately hairy; tepals 6.5–10 mm long, obtuse to acute, glabrous or moderately hairy on outside. Anther appendage obtuse, 1.5–2 mm long, recurved through 90–180°. Ovary glabrous.

Occurs in an area roughly bounded by Frank Hann Natl Park, Mt Buraminya and Cape Le Grand, south-western W.A.; grows in very open shrub mallee, in white sand or sandy loam. Flowers Nov.–Jan. Map 101.

W.A.: 33.2 km SW of 90 Mile Tank on Hanns Track, *P.H.Weston 248* (SYD); 72 km W of Salmon Gums, *K.Newbey 6473* (PERTH); 5.5 km SE of Mt Ridley, *W.R.Archer 712916* (CBG, K, MEL, MO, NSW, PERTH); 12 km SW of Mt Buraminya, *K.Newbey 8207* (PERTH); Thistle Cove, *A.Strid 21916* (NSW).

The type specimen has moderately hairy pedicels and tepals while in the other flowering specimens the pedicels and tepals are glabrous. It is unclear whether this difference is taxonomically significant, given the small number of fertile specimens.

### **83. Persoonia quinquenervis** Hook., *Icon. Pl.* 5: 425 (1842)

*Linkia quinquenervis* (Hook.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Swan R., W.A., *J.Drummond s.n.*; lecto: K; isolecto?: E, FI, *fide* P.H.Weston, *Telopea* 6: 133 (1994).

*Persoonia striolata* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 72 (1855); *Linkia striolata* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: in coloniâ Swan River [W.A.], *J.Drummond 5: 6*; syn: BM, CGE, FI, K, MEL.

Erect to spreading shrubs 0.2–2.5 m tall. Hairs greyish or whitish, appressed to antrorsely spreading. Young branchlets sparsely to densely hairy. Leaves linear to narrowly oblong to oblanceolate to narrowly spathulate, 2–7.5 cm long, 0.8–10 mm wide, flat with 3–13 prominent, parallel veins on both surfaces or compressed to subterete with 8 prominent, parallel veins, often slightly incurved, suberect to erect, usually straight, twisted through 90° to 1.5 complete turns, innocuous, sometimes slightly to strongly glaucous, glabrous to moderately hairy when immature, glabrescent, smooth to moderately scaberulous. Inflorescence mostly auxotelic, 1–10-flowered; rachis 0–6 cm long. Flowers subtended by scale leaves and leaves; pedicels 4–17 mm long, erect, sparsely to moderately hairy; tepals 7.5–15 mm long, acuminate to apiculate, glabrous to sparsely hairy on outside. Anther appendage obtuse, 0.4–1 mm long, recurved through 45–90°. Ovary glabrous. Figs 19, 43A.

Occurs in an area roughly bounded by Latham, Boyagin Nature Reserve, Tarin Rock, Frank Hann Natl Park and Yellowdine, south-western W.A.; grows in heath, mallee heath, *Acacia*/*Allocasuarina*/*Eucalyptus* thicket or in *Eucalyptus* woodland or dry sclerophyll forest, usually in sand to loam, often over laterite or gravel. Flowers chiefly Nov.–Dec. Map 102.

W.A.: 15 km W of York, *P.H.Weston 151* (SYD); 3 miles [5 km] S of Latham, *J.S.Beard 7376* (PERTH); 15 miles [24 km] S of Tammin, *R.D.Royce 9333* (PERTH); 3.9 km W of Yellowdine, *P.H.Weston 141* (SYD); c. 14 km SE of Kulin, *R.J.Hnatiuk 770162* (PERTH).

This species exhibits spectacular variation in leaf morphology, which is geographically correlated. The extreme geographical variants are characterised below.

Western form (York area): leaves twisted through c. 90°, narrowly spathulate to oblanceolate, 2.5–5.5 cm long, 3–10 mm wide, flat with 5–13 prominent, parallel ridges on both surfaces, sometimes slightly glaucous.

Northern form (Bunjil–Buntine area): leaves twisted through 90–360°, linear, 2.5–7 cm long, 2–3 mm wide, flat, with 5, or occasionally 3 or 7 parallel ridges evident on both surfaces, sometimes glaucous.

Southern form (Lake Grace–Lake King area): leaves twisted through 90–360°, narrowly spathulate, 2–4.5 mm long, 3–7.5 mm wide, flat with 5 or 7 prominent ridges on both surfaces, glaucous.

Eastern form (Merredin–Narembeen–Hyden–Johnston Lakes, Yellowdine area): leaves twisted through 90° to 1.5 complete turns, linear, 3–7.5 cm long, 0.8–1.6 mm wide, subterete with 8 prominent, parallel ridges or dorsiventrally compressed with 3 prominent ridges on both surfaces, often glaucous.

Clinal variation in the intervening areas links these extremes.

### **84. Persoonia striata** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 13 (1830)

*Linkia striata* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: King George Sound, 1829, *W.Baxter*; lecto: BM; isolecto: BM, *fide* P.H.Weston, *Telopea* 6: 135 (1994).

Erect to spreading shrubs 15–70 cm tall. Hairs greyish or whitish, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves linear to linear-spathulate, 1–4.5 cm long, 0.7–2.7 mm wide, flat or compressed or semiterete, usually with 3 prominent, parallel veins on both surfaces, often slightly incurved, suberect to erect, straight to slightly falcate, innocuous, not glaucous, sparsely hairy when immature, glabrescent, scaberulous. Inflorescence mostly auxotelic, 1–5-flowered; rachis 0–2 mm long. Flowers mostly subtended by scale leaves; pedicels 2.5–9 mm long, erect, glabrous to sparsely hairy; tepals 8.5–12.5 mm long, acute to acuminate, glabrous on outside. Anther appendage obtuse, 1.4–2.8 mm long, recurved through 90–180°. Ovary glabrous.

Occurs in an area roughly bounded by Lake Hope, Dumbleyung and Albany, south-western W.A.; usually grows in low heath or mallee heath, in sand or loam to clay, often over laterite or gravel. Flowers Nov.–Dec. Map 103.

W.A.: near Dumbleyung, *W.E.Blackall 1342* (PERTH); Frank Hann Natl Park, *K.Newbey 6847* (PERTH); 13.6 km W of L. Grace, *P.H.Weston 256* (SYD); below Mt Bland, near West Mt Barren, *R.G.Coveny 3322, T.E.H.Aplin & I.Lethbridge* (NSW); N slopes of Stirling Ra., Salt Lake Rd, 25 Sept. 1973, *E.C.Nelson* (CANB, PERTH).

### **85. Persoonia sulcata** Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 333 (1856)

*Linkia sulcata* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Swan R., W.A., *J.Drummond 4: 274*; lecto: NY; isolecto: BM, CGE, K, MEL, PERTH, TCD, *fide* P.H.Weston, *Telopea* 6: 137 (1994).

Erect to decumbent shrubs, 20–100 cm tall. Hairs greyish, appressed to antrorsely spreading. Young branchlets moderately to densely hairy. Leaves linear, 1.5–5 cm long, 0.9–1.2 mm wide, concave or semiterete, with 3 prominent, parallel veins on undersurface, spreading to suberect, straight, twisted through 0–90°, pungent, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth. Inflorescence anauxotelic or auxotelic, 1–3-flowered; rachis 0–1 mm long. Flowers subtended by scale leaves and leaves; pedicels 2.5–12 mm long, erect, glabrous; tepals 8–11 mm long, acute to acuminate, glabrous on outside. Anther appendage obtuse, 1.5–2.2 mm long, recurved through 180°. Ovary glabrous.

Disjunctly distributed in the New Norcia–Calingiri–Mogumber area and at John Forrest Natl Park, south-western W.A.; occurs in *Eucalyptus* woodland in laterite, or on rocky granite slopes. Flowers Sept.–Nov. Map 104.

W.A.: Mogumber, 12 Nov. 1906, *A.Morrison* (CANB, PERTH); Great Northern Hwy, 12.4 km N of Toodyay turn-off, *P.H.Weston 326* (SYD); John Forrest Natl Park, *P.G.Armstrong 30/8 & 30/10* (PERTH).

*Persoonia sulcata* exhibits geographic variation in leaf and pedicel length. The northern populations have leaves 1.5–4 cm long and pedicels 2.5–8 mm long while the two specimens from John Forrest Natl Park have leaves 2.5–5 cm long and pedicels 7–12 mm long.

### **86. Persoonia acicularis** F.Muell., *Fragm.* 6: 220 (1868)

*Linkia acicularis* (F.Muell.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Murchison R., W.A., *A.F.Oldfield*; lecto: MEL; isolecto: K, NSW, *fide* P.H.Weston, *Telopea* 6: 138 (1994).

Erect shrubs 0.1–1.2 m tall. Hairs greyish, antrorsely spreading to patent or curly. Young branchlets moderately to densely hairy. Leaves linear, 1.2–2.5 cm long, 0.6–1 mm wide, ±terete or compressed-subterete, with 4 or 6 prominent, parallel veins, spreading to suberect, straight, twisted through 0–360°, pungent, strongly glaucous, glabrous to moderately hairy when immature, glabrescent, smooth to slightly scaberulous. Inflorescence anauxotelic or auxotelic, 1–80-flowered; rachis 0–12 cm long. Flowers subtended by scale leaves and leaves; pedicels 3–10 mm long, erect, glabrous to sparsely hairy; tepals 8.5–15.5 mm long, acuminate, glabrous on outside. Anther appendage obtuse, 0.3–0.6 mm long, slightly recurved. Ovary glabrous. Fig. 43C.

Apparently occurs in three disjunct areas at Shark Bay, Kalbarri Natl Park and Arrowsmith

River, south-western W.A.; grows in low heath and mallee heath, in acidic yellow or brown sand or sandy loam, often over laterite or in red calcareous sand. Flowers Aug.–Jan. Map 105.

W.A.: Tamala Stn, *H.Demarz 6125* (PERTH); Wittecarra Gully, 8 km SSE of Kalbarri, *P.G.Wilson 6602* (PERTH); E margin of Kalbarri Natl Park, *R.Pullen 9644* (CANB, NSW, PERTH); Skipper Rd, 5 km E of Brand Hwy, *P.H.Weston 301* (SYD).

*Persoonia acicularis* is readily distinguished by its short, pungent, glaucous leaves. It shows geographically correlated variation in leaf morphology. Thus, specimens collected south of Geraldton in the Arrowsmith River area have 6-ribbed leaves and those north of Geraldton have 4-ribbed leaves.

### **87. Persoonia rudis** Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 333 (1856)

*Linkia rudis* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Swan R., W.A., *J.Drummond 4: 273*; lecto: NY; isolecto: BM, CGE, FI, K, MEL, NSW, PERTH, TCD, *fide* P.H.Weston, *Telopea* 6: 140 (1994).

Erect shrubs 0.2–1 m tall. Hairs greyish to tawny, antrorsely spreading to patent. Young branchlets moderately to densely hairy. Leaves linear, 1.5–4.5 cm long, 0.7–1.4 mm wide, concave or semiterete, usually slightly incurved, suberect to erect, usually straight, sharp but not pungent, not glaucous, moderately to densely hairy when immature, glabrescent to moderately hairy when mature, scabrous. Inflorescence auxotelic, 5–30-flowered; rachis 0.3–10 cm long. Flowers subtended by scale leaves and leaves; pedicels 2–10 mm long, erect, moderately to densely hairy; tepals 8–14 mm long, acuminate, moderately hairy on outside. Anther appendage obtuse, 1.5–3 mm long, recurved through 180°. Ovary densely hairy.

Occurs from Three Springs south to Mogumber, south-western W.A.; grows in low heath and *Eucalyptus calophylla* forest, in yellow sand, often over laterite. Flowers Oct.–Jan. Map 106.

W.A.: 10 miles [16 km] W of Three Springs, *J.S.Beard 7257* (PERTH); W of Mt Peron, *A.S.George 11196* (PERTH, SYD); 16 km E of Jurien, *A.Strid 21685* (NSW); 0.8 km S of Mogumber turn-off, Brand Hwy, *A.S.George 16307* (PERTH).

*Persoonia rudis* is a distinctive species that may be recognised easily by its linear leaves and the long (mostly 2–4 mm), patent hairs on the young shoots.

### **88. Persoonia filiformis** P.H.Weston, *Telopea* 6: 141 (1994)

T: c. 0.5 km E of Jurien Bay turn-off from Brand Hwy, W.A., 30°13'S, 115°25'E, 11 Dec. 1980, *P.H.Weston 277*; holo: SYD; iso: PERTH.

Erect shrubs 7–40 cm tall. Hairs whitish or greyish, antrorsely spreading to patent. Young branchlets moderately hairy. Leaves linear, 1–2 cm long, 0.7–1 mm wide, concave or semiterete, with 6 prominent, parallel veins, suberect to erect, usually straight, pungent, slightly glaucous, glabrous to moderately hairy when immature, glabrescent, smooth or slightly scaberulous. Inflorescence auxotelic, 1–20-flowered; rachis 0–3 cm long. Flowers subtended by scale leaves and leaves; pedicels 1–2 mm long, erect, glabrous; tepals 11–16 mm long, acuminate, glabrous on outside. Anther appendage filiform, 2–4.5 mm long, recurved through 90–180°. Ovary glabrous. Fig. 43B.

Occurs from Arrowsmith River south to Badgingarra, south-western W.A.; grows in low heath, in yellow sand, often over laterite. Flowers Nov.–Dec. Map 107.

W.A.: Skipper Rd, 5 km E of Brand Hwy, *P.H.Weston 302* (SYD); 13.3 km S of Carnamah–Green Head road on Brand Hwy, 14 Nov. 1981, *C.Chapman* (SYD); W of Mt Peron, *A.S.George 11200* (PERTH); Brand Hwy, 22 km N of Badgingarra, *A.Strid 21703* (NSW).

This species is easily recognised by its filiform anther appendages.

## *Teretifolia* Group

Bark smooth (but often fissured at base) or lamellose-flaky. Leaves alternate, concolorous. Inflorescence axillary to terminal, anauxotelic or auxotelic. Flowers zygomorphic, subtended by scale leaves and leaves; tepals yellow or, rarely, yellow with red markings; lateral wings absent. Anthers introrse, held close together from their bases to tips of loculi or held close together from their bases to tips of appendages, yellow or yellow with white tips or white; anther appendage present. Gynoecium c. half length of stamens and hooked so that tip sits in pouch of ventral tepal below ventral anther; abscission zone basal. Ovary glabrous; ovules 2. Drupes green or green usually suffused with reddish purple. Cotyledons 5–9.

### **89. Persoonia falcata** R.Br., *Trans. Linn. Soc. London* 10: 162 (1810)

*Linkia falcata* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Carpentaria Island *k* [*sic.*], 20 Dec. 1802, *R.Brown s.n.*; lecto: BM; isolecto?: K, *fide* P.H.Weston, *Telopea* 6: 143 (1994); Endeavour R., [Qld], June–Aug. 1770, *J.Banks & D.Solander*; syn: BM.

Illustrations: J.Brock, *Top End Native Pl.* 279 (1988); J.R.Wheeler (ed.), *Fl. Kimberley Reg.* 479, fig. 148 (1992).

Erect shrubs or trees 1–9 m tall. Bark lamellose-flakey. Hairs greyish, antrorsely spreading to patent. Young branchlets glabrous to densely hairy. Leaves mostly oblanceolate to linear-oblanceolate, 8–35 cm long, mostly 4–30 mm wide, flat, spreading to suberect, falcate, twisted through 90°, innocuous, usually strongly glaucous, glabrous, smooth. Inflorescence anauxotelic or auxotelic, 10–80-flowered; rachis 3–20 cm long. Flowers subtended by scale leaves and leaves; pedicels 4–15 mm long, erect to spreading, glabrous to densely hairy; tepals 10–16 mm long, acute to acuminate, glabrous to moderately hairy on outside; ventral tepal shallowly saccate. Anthers white; appendage obtuse, 2–4.6 mm long, recurved. Fig. 44D.

Occurs from the north of the Great Sandy Desert in W.A. through N.T. to Blackdown Tableland in central-eastern Qld, mostly within 300 km of the coast. Grows most commonly in *Eucalyptus* woodland to forest but also found in *Melaleuca* woodland or mixed woodland or the margins of vine thickets and occasionally in heath, in well-drained substrata, most commonly in sand derived from sandstone or granite, or on dunes, but also in lateritic soils or on stony hillsides and rarely in clay. Flowers June–Nov. Map 108.

W.A.: McLarty Hills, Great Sandy Desert, *A.S.George 14726* (CANB); 12 miles [19 km] NNW of Elgie Cliffs Stn, *M.Lazarides 6394* (AD, BRI, CANB, DNA, NSW, PERTH). N.T.: 47 miles [75 km] N of Oenpelli, *G.Chippendale 8124* (AD, BRI, CANB, NSW, PERTH). Qld: Murrays Spring, *P.K.Latz 1636* (CANB, DNA, NSW); SE slope of Ropers Peak, *P.H.Weston 1548 & P.G.Richards* (NSW).

This species is easily recognised by the combination of its lamellose and deeply fissured, dark grey bark and zygomorphic flowers. This species is widespread and morphologically variable but no broad geographic trends are evident.

### **90. Persoonia biglandulosa** P.H.Weston, *Telopea* 6: 145 (1994)

T: North-West Coastal Highway, 45.8 km N of the Murchison R., W.A., 27°25'S, 114°40'E, 13 Dec. 1980, *P.H.Weston 289*; holo: SYD; iso: CANB, K, PERTH.

*Persoonia teretifolia* var. *amblyanthera* Benth., *Fl. Austral.* 5: 384 (1870). T: Murchison R., W.A., *A.F.Oldfield*; lecto: K; isolecto: PERTH, *fide* P.H.Weston, *Telopea* 6: 145 (1994).

Erect to decumbent shrubs 0.15–1.5 m tall. Bark smooth, sometimes fissured at base. Hairs greyish to mid-brown, appressed to patent or curly. Young branchlets densely hairy. Leaves linear, 5–10 cm long, 1–1.3 mm wide, subterete, grooved underneath, slightly to strongly incurved, suberect to erect, straight, innocuous, not glaucous, sparsely to moderately hairy when immature, glabrescent, scaberulous. Inflorescence auxotelic, 8–25-flowered; rachis 2.5–11 cm long. Flowers subtended by scale leaves and leaves; pedicels 6–10 mm long, erect to spreading, densely hairy; tepals 10–13 mm long, acuminate, moderately hairy on outside; ventral tepal shallowly saccate. Anthers white; appendage obtuse, 0.6–1.2 mm long, not recurved.


**Figure 44**. *Persoonia*. **A**, *P. brachystylis*, flowering branchlet (P.Weston 295, SYD). **B**, *P. saundersiana*, flowering branchlet (M.Phillips, NSW 118771). **C**, *P. hakeiformis*, flowering branchlet (J.Wrigley, CBG 032495). **D**, *P. falcata*, flowering branchlet (C.Gittins 2538, NSW). Scale bar = 1 cm. Drawn by D.Mackay.

Restricted to within 60 km of the mouth of Murchison River, south-western W.A.; grows in low heath, in yellow sand, often over laterite. Flowers Oct.–Dec. Map 109.

W.A.: 393 mile peg, North-West Coastal Hwy, *A.C.Burns 8* (PERTH); 12 km NE of Hawks Head Lookout, Kalbarri, *D. & B.Bellairs 1708B* (PERTH); Ajana road, just outside E boundary of Kalbarri Natl Park, *T.A.Halliday 141* (AD, AK *n.v.*, CANB, PERTH).

### **91. Persoonia brachystylis** F.Muell., *Fragm.* 6: 221 (1868)

*Linkia brachystylis* (F.Muell.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Murchison R., W.A., *A.F.Oldfield*; lecto: MEL; isolecto: K, NSW, *fide* P.H.Weston, *Telopea* 6: 147 (1994).

Erect to spreading shrubs 1–1.5 m tall. Bark smooth, sometimes fissured at base. Hairs greyish to mid-brown, appressed to patent. Young branchlets moderately to densely hairy. Leaves narrowly spathulate to linear-spathulate to linear-oblanceolate, 4.5–12 cm long, 2–10 mm wide, flat, with recurved to revolute margins, slightly incurved, spreading to suberect, straight to slightly falcate, innocuous, not glaucous, sparsely to moderately hairy when immature, glabrescent, scaberulous. Inflorescence auxotelic, 10–20-flowered; rachis 7–25 cm long. Flowers mostly subtended by leaves; pedicels 7–15 mm long, erect to spreading, moderately to densely hairy; tepals 10–13 mm long, acuminate, moderately hairy on outside; ventral tepal shallowly saccate. Anthers white; appendage obtuse, 0.8–1 mm long, not recurved. Fig. 44A.

Restricted to Kalbarri Natl Park, south-western W.A.; grows in low heath, in yellow sand, often over laterite. Flowers Nov.–Jan. Map 110.

W.A.: Kalbarri Natl Park, *P.H.Weston 295* (PERTH, SYD); Kalbarri Natl Park, *PH.Weston 296–297* (PERTH, SYD).

### **92. Persoonia kararae** P.H.Weston, *Telopea* 6: 148 (1994)

T: Karara boundary gate, W.A., 28 Oct. 1975, *E.Wittwer 1592*; holo: PERTH; iso: KPBG.

Erect shrubs 1–5 m tall. Bark not known. Hairs greyish, appressed to antrorsely spreading or curly. Young branchlets densely hairy. Leaves linear, 8–14 cm long, 3–3.5 mm wide, flat, spreading to suberect, straight to slightly falcate, innocuous, not glaucous, glabrous to sparsely hairy when immature, glabrescent, scaberulous. Inflorescence usually anauxotelic, 1–10-flowered; rachis 0–10 mm long. Flowers subtended by scale leaves and leaves; pedicels 5–7 mm long, erect to spreading, moderately to densely hairy; tepals 11.5–13.5 mm long, acuminate, moderately hairy on outside; ventral tepal shallowly saccate. Anther colour not known; appendage obtuse, 0.5–0.7 mm long, not recurved.

Collected twice from Karara Stn, Perenjori district, south-western W.A.; grows in sand. Flowers Sept.–Nov. Map 111.

W.A.: Karara Stn, *J.S.Beard 7198* (PERTH).

### **93. Persoonia stricta** C.A.Gardner ex P.H.Weston, *Telopea* 6: 150 (1994)

T: Manmanning, W.A., 24 Sept. 1931, *C.A.Gardner 2728*; holo: PERTH; iso: NSW.

Spreading shrubs 1–5 m tall. Bark smooth, usually fissured at base. Hairs greyish, appressed to patent or curly. Young branchlets glabrous to densely hairy. Leaves linear to linear-spathulate, 6–15 cm long, 2.5–8 mm wide, flat, often slightly incurved, straight to slightly falcate, innocuous, sometimes slightly glaucous, glabrous to sparsely hairy when immature, glabrescent, scaberulous. Inflorescence anauxotelic or auxotelic, 4–25-flowered; rachis 0.3–10 cm long. Flowers subtended by scale leaves and leaves; pedicels 4–10 mm long, erect to spreading, moderately to densely hairy; tepals 11–16 mm long, acuminate to apiculate, glabrous to sparsely hairy on outside; ventral tepal shallowly saccate. Anthers white; appendage obtuse, 1–2 mm long, not recurved. Fig. 20.

Occurs from the Ajana area to Manmanning, south-western W.A.; in heath and *Allocasuarina* and/or *Acacia* thicket or *Eucalyptus* woodland, in yellow sand or sandy loam, often over laterite. Flowers Aug.–Dec. Map 112.

W.A.: 390 to 394 mile pegs on North-West Coastal Hwy, *A.C.Burns 1057* (PERTH); N of Tenindewa, *A.M.Ashby 2275* (AD, PERTH); SW of Winchester, 9 Sept. 1969, *C.Chapman* (PERTH, SYD); 3 miles [c. 5 km] NNW of Buntine, *R.Melville 4299* (AD, K, NSW, PERTH); between Manmanning and Cadoux, *P.H.Weston 317* (SYD).

This species shows geographical variation in leaf size and shape. Leaves of the extreme southern form (Manmanning area) are mostly more than 9 cm long, 6–8 mm wide and linear-spathulate. This form grades into a more northern form (Perenjori–Bunjil area) with narrower (2.5–4.5 mm wide), linear-oblong leaves. Leaves of the extreme northern form (Ajana–Geraldton area) are mostly less than 9 cm long, 2.5–4 mm wide and linear-spathulate. Specimens from the Winchester area are intermediate in leaf characters between the Perenjori–Bunjil and Ajana–Geraldton forms.

### **94. Persoonia saundersiana** Kippist *in* C.F.Meisner, *Hooker's J. Bot. Kew Gard. Misc.* 7: 72 (1855)

*Linkia saundersiana* (Kippist) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Swan R., W.A., *J.Drummond 5: 4*; lecto: K; isolecto: BM, CGE, FI, K, MEL, PERTH, TCD, *fide* P.H.Weston, *Telopea* 6: 152 (1994).

*Persoonia diadena* F.Muell., *Fragm.* 10: 46 (1876); *Linkia diadena* (F.Muell.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Mt Churchman, W.A., *Young*; lecto: MEL; isolecto: K, *fide* P.H.Weston, *Telopea* 6: 152 (1994).

Erect to spreading shrubs 0.5–5 m tall. Bark smooth, usually fissured at base. Hairs greyish, appressed to patent or curly. Young branchlets glabrous to densely hairy. Leaves linear, 4–21 cm long, 1–3.2 mm wide, compressed, with 3–5 prominent, parallel veins on both surfaces to trigonous to subterete and grooved underneath, sometimes slightly to strongly incurved, spreading to erect, straight to slightly falcate, innocuous, sometimes glaucous, glabrous to sparsely hairy when immature, glabrescent, scaberulous. Inflorescence usually auxotelic, 1–25-flowered; rachis 0–10 cm long. Flowers subtended by scale leaves and leaves; pedicels 3.5–20 mm long, erect to spreading, moderately to densely hairy; tepals 9.5–14 mm long, acuminate to apiculate, glabrous to sparsely hairy on outside; ventral tepal shallowly saccate. Anthers white; appendage obtuse, 0.8–2 mm long, not recurved. Fig. 44B.

Occurs in an area roughly bounded by Minnivale, Tammin, Lake Hope and Comet Vale, south-western W.A.; grows in shrub-thicket communities dominated by *Allocasuarina campestris* and/or *Acacia* spp., or in heath or mallee heath, in sand to loam, often over laterite. Flowers chiefly Sept.–Nov. Map 113.

W.A.: 4.9 miles [c. 8 km] W of Minnivale, *P.H.Weston 319* (SYD); Muntadgin, *T.W.Stone 875* (CANB, PERTH); Comet Vale, *C.A.Gardner 13458* (PERTH); Eastern Hwy, 31 miles [50 km] W of Coolgardie, 4 Oct. 1961 *J.H.Willis* (MEL, NSW, PERTH); between L. Hope and Hatters Hill, *W.E.Blackall 1262* (PERTH).

*Persoonia saundersiana* shows a high degree of geographical variation in leaf morphology. The populations at the eastern limit of the distribution (Comet Vale–Coolgardie–Mt Holland–Southern Cross area) have leaves which are mostly 6–14 cm long, 1.5–2.1 mm wide, usually slightly curved upwards (to about 90°), ventrally plano-convex to triangular in cross-section with the midvein evident to prominent on the lower surface. West of Southern Cross these gradually grade into 'curly-leaved' populations which are exemplified by those in the Carrabin–Bodallin area with leaves mostly 4–8 cm long, 1–1.5 mm wide, curved markedly upwards (90–230°), subterete and grooved underneath. The far-western populations (Minnivale–Tammin–Kellerberrin) have leaves which are mostly 10–21 cm long, 2–3 mm wide, sometimes curved slightly upwards, dorsiventrally flattened with 2 or 4 grooves on both surfaces, with the midvein equally prominent on both surfaces. This 'western form' grades into the extreme curly-leaved, eastern form in the Mukinbudin–Merredin–Narembeen area. Some of these intermediates closely resemble the far-eastern forms in leaf morphology.

### **95. Persoonia teretifolia** R.Br., *Trans. Linn. Soc. London* 10: 160 (1810)

*Linkia teretifolia* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891); *Pycnonia teretifolia* (R.Br.) L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 175 (1975). T: Bay I [Lucky Bay, W.A.], 30 May 1803, *R.Brown s.n.*; lecto: BM; isolecto: K, NSW, *fide* P.H.Weston, *Telopea* 6: 154 (1994).

*Persoonia scoparia* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 329 (1856). T: Swan R., W.A., *J.Drummond 4: 276*; lecto: NY; isolecto: BM, K, MEL, *fide* P.H.Weston, *Telopea* 6: 154 (1994).

Illustration: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 483 (1989).

Erect to spreading shrubs 0.5–3 m tall. Bark smooth. Hairs greyish, appressed to patent or curly. Young branchlets moderately to densely hairy. Leaves linear, 1.5–7 cm long, 0.9–1.5 mm wide, terete, slightly to strongly incurved, suberect to erect, straight, innocuous, not glaucous, glabrous to sparsely hairy when immature, glabrescent, scaberulous. Inflorescence usually auxotelic, 1–20-flowered; rachis 0–10 cm long. Flowers subtended by scale leaves and leaves; pedicels 2–6 mm long, erect to spreading, densely hairy; tepals 9–13 mm long, acute, sparsely to densely hairy on outside; ventral tepal shallowly saccate. Anthers yellow with white tips; appendage obtuse, 1.7–2.7 mm long, recurved through c. 90°.

Occurs between Albany and Israelite Bay, south-western W.A., mostly within 100 km of the coast; grows in low heath and mallee heath communities, in yellow or white sand to clay, often over laterite. Flowers chiefly Oct.–Feb. Map 114.

W.A.: Albany, Dec. 1937, *W.E.Blackall* (PERTH); 19.8 km E of rabbit-proof fence on Hyden–Norseman road, *P.H.Weston 335* (SYD); 25 km NW of Roberts Swamp, *K.Newbey 8194* (PERTH); 1.5 km S of Tower Peak, *M.D.Crisp 4855* (CBG); 19 km S of Ravensthorpe, *A.E.Orchard 4428* (AD, CANB, PERTH).

*Persoonia teretifolia* is distinguished by its terete leaves and zygomorphic flowers.

The combination of locality ('Bay I', i.e. Lucky Bay) and date cited on the type sheet is erroneous. Brown collected at Lucky Bay in January 1802, and at Goose Island Bay, east of Lucky Bay, in May 1803. It seems most likely that the cited date is wrong because January is the peak of the flowering season for *P. teretifolia*, and the type specimens have both flowers and buds. Flowering material of this species has only occasionally been collected in May.

### 96. Persoonia comata Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 71 (1855)

*Linkia comata* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: north of Swan R., W.A., *J.Drummond 6: 178*; lecto: NY; isolecto: B, BM, CGE, K, L, MEL, NSW, PERTH, *fide* P.H.Weston, *Telopea* 6: 155 (1994).

Erect to spreading shrubs 0.2–1.5 m tall. Bark smooth, sometimes flaky towards base. Hairs greyish, antrorsely spreading to patent or curly. Young branchlets moderately to densely hairy. Leaves oblanceolate to narrowly spathulate to linear, 5–15 cm long, 2.5–18 mm wide, flat, usually with recurved margins, often slightly incurved, suberect to erect, straight to slightly falcate, innocuous, sometimes slightly glaucous, glabrous to moderately hairy when immature, glabrescent, scaberulous. Inflorescence usually auxotelic, 10–90-flowered; rachis 2–45 cm long. Flowers subtended by scale leaves and leaves; pedicels 5–25 mm long, erect to spreading, moderately to densely hairy; tepals 9–15 mm long, obtuse to acuminate, moderately to densely hairy on outside; ventral tepal deeply saccate. Anthers yellow with white tips; appendage obtuse, 0.8–3 mm long, not recurved.

Occurs from Mt Peron south to Yanchep, south-western W.A.; grows in *Eucalyptus* forest to woodland or *Banksia* forest to woodland or mallee heath to low heath, in grey or yellow sand, often over laterite. Flowers Nov.–Feb. Map 115.

W.A.: Dinner Hill, *A.M.Ashby 733* (AD); intersection of Green Head Rd and Brand Hwy, *B.Barnsley 854* (PERTH); Brand Hwy, 31 km N of junction with Wanneroo–Gingin road, *P.H.Weston 270* (SYD); Moore River road, N of Yanchep Natl Park, *N.T.Burbidge 8045* (CANB, NSW, PERTH).

Several characters vary in a north-south cline within *P. comata*. The extreme ends of this cline are characterised below.

Northern end (Eneabba area): leaves oblanceolate to narrowly spathulate, usually rather rigid, moderately hairy when immature; tepals densely covered with patent hairs (which are longer than those of southern plants); dorsal tepal 14–15 mm long.

Southern end (Yanchep area): leaves linear-oblanceolate to linear-spathulate, usually quite flexible, glabrous to sparsely hairy when immature; tepals moderately covered with antrorsely spreading to curly hairs; dorsal tepal 10–11 mm long.

## **97. Persoonia saccata** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 12 (1830)

*Linkia saccata* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: west coast, W.A., *N.Baudin*; lecto: BM, *fide* P.H.Weston, *Telopea* 6: 157 (1994).

*Persoonia fraseri* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 14 (1830). T: Swan R. district [W.A.], 1827, *C.Fraser*; lecto: BM; isolecto: K, *fide* P.H.Weston, *Telopea* 6: 158 (1994).

*Persoonia macrostachya* Lindl., *Sketch Veg. Swan R.* xxxv (1840). T: Swan R. district [W.A.], 1839, *J.Drummond*; lecto: CGE; isolecto: CGE, FI, *fide* P.H.Weston, *Telopea* 6: 158 (1994).

Illustration: R.Erickson *et al.*, *Fl. & Pl. W. Australia* 2nd edn, 27, pl. 40 (1979).

Erect to spreading shrubs 0.2–1.5 m tall. Bark smooth, sometimes flaky towards base. Hairs greyish, antrorsely spreading to patent or curly. Young branchlets moderately to densely hairy. Leaves linear, 5–17 cm long, 0.8–1.4 mm wide, flat with recurved to revolute margins to subterete and grooved underneath, usually slightly incurved, spreading to erect, straight, innocuous, sometimes slightly glaucous, sparsely to moderately hairy when immature, glabrescent, smooth to slightly scaberulous. Inflorescence usually auxotelic, 10–90-flowered; rachis 2–45 cm long. Flowers subtended by scale leaves and leaves; pedicels 3.5–12 mm long, erect to spreading, moderately to densely hairy; tepals 9–14 mm long, acute to acuminate, moderately to densely hairy on outside; ventral tepal deeply saccate. Anthers yellow with white tips; appendage obtuse, 1.2–2.2 mm long, not recurved. Fig. 21.

Occurs from Lake Pinjar south to Blackwood River, south-western W.A.; grows in forest and woodland dominated by *Eucalyptus marginata* and/or *E. calophylla* or, less frequently, in *Banksia* woodland or forest, in white or grey sand or in gravelly soil. Flowers July–Jan. Map 116.

W.A.: Trainor Rd, N side of L. Gnangara, *K.F.Keneally 7531* (NSW); Kelmscott, 27 Dec. 1902, *A.Morrison* (CANB, NSW, PERTH); Yalgorup Natl Park, *P.H.Weston 189* (SYD); Carbonup R. crossing on road from Busselton to Margaret River, *B.Barnsley 817* (CBG); Sues Bridge, Blackwood R., *R.Pullen 9914* (CANB).

In *P. saccata* a morphocline runs from north to south, the extremes of which are characterised below.

Northern populations (Wanneroo–Lake Pinjar area): leaves leathery, subterete, grooved underneath; flowers comparatively small (dorsal tepal 9–10 mm long).

Southern populations (Yallingup–Yalgorup area): leaves soft, dorsiventrally compressed; flowers comparatively large (dorsal tepal 12–14 mm long).

After fire, plants of *P. saccata* and *P. comata* regenerate vigorously and produce large inflorescences the following summer. The size of new shoots decreases each year thereafter until the plant becomes senescent and no flowers and only short vegetative shoots are produced.

## **98. Persoonia hakeiformis** Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 330 (1856)

*Linkia hakeiformis* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: Swan R., W.A., *J.Drummond 4: 275*; syn: BM, CGE, FI, K, MEL, NSW, NY, TCD.

Erect to spreading shrubs 0.3–1.8 m tall. Bark smooth, flaky towards base. Hairs greyish, appressed to patent. Young branchlets moderately to densely hairy. Leaves linear, 1.5–5 cm long, 0.8–1.4 mm wide, subterete, grooved underneath, slightly to strongly incurved, often recurved at tip, spreading to suberect, straight, innocuous, not glaucous, sparsely to moderately hairy when immature, glabrescent, smooth to scaberulous. Inflorescence usually auxotelic, 1–60-flowered; rachis 0–10 cm long. Flowers subtended by scale leaves and leaves; pedicels 3–7 mm long, erect to spreading, densely hairy; tepals 8–12 mm long, obtuse to acuminate to apiculate, glabrous on outside; ventral tepal deeply saccate. Anthers yellow; appendage obtuse, 0.7–2 mm long, not recurved. Fig. 44C.

Collected at Boyagin Nature Reserve, Tarin Rock and Newdegate, south-western W.A.; grows in heath, mallee heath and *Eucalyptus* woodland, in sandy loam over laterite. Flowers Nov.–Jan. Map 117.

W.A.: 1 km NW of Boyagin Rock, *P.H.Weston 259* (SYD); Tarin Rock, ½ mile [c. 0.8 km] W of siding along

railway line, 9 Nov. 1968, *J.W.Wrigley* (CBG); Newdegate, *W.E.Blackall 1296* (PERTH).

The ventral anther which is entirely adnate to the ventral tepal is diagnostic for this distinctive and beautiful species.

## Subfam. 2. BELLENDENOIDEAE

*P.H.Weston*

*Proteaceae* subfam. *Bellendenoideae* P.H.Weston, *Fl. Australia* 16: 472 (1995).

*Proteaceae* trib. *Bellendeneae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 171 (1975). T: *Bellendena* R.Br.

Subshrubs. Proteoid roots present. Leaves simple, lobed or entire. Inflorescence racemose, ebracteate. Flowers actinomorphic, bisexual, not in regular pairs. Stamen filaments free. Hypogynous glands absent. Style tip not modified as a pollen presenter. Ovules 2, orthotropous. Fruit indehiscent, finally dry, 2-winged; pericarp thin. Seed 1, fusiform. Cotyledons 2. Chromosomes moderately large, 4–6 μm at mitotic metaphase; $n = 5$.

A monogeneric subfamily, the sole species of which is a subshrub confined to alpine heathlands of Tas.

Johnson & Briggs (*Bot. J. Linn. Soc.* 70: 83–182, 1975) placed *Bellendena montana* in the monospecific tribe Bellendeneae of subfamily Persoonioideae. This plant, however, possesses proteoid roots, a derived character state that is a synapomorphy that groups *Bellendena* with the other 5 subfamilies rather than with the rest of the Persoonioideae. The Persoonioideae, as circumscribed by Johnson & Briggs, is therefore para- or polyphyletic and in need of taxonomic rearrangement. Since *Bellendena* lacks the morphological synapomorphies that characterise each of the other subfamilies, it requires its own subfamily.

## 4. BELLENDENA

*Bellendena* R.Br., *Trans. Linn. Soc. London* 10: 166 (1810); named in honour of John Bellenden Ker (1764–1842), a Scottish botanist.

Type: *B. montana* R.Br.

Shrubs. Leaves alternate, entire or imparipinnately to bipinnately lobed in distal half. Inflorescence terminal to subterminal. Flowers actinomorphic, bisexual, pedicellate. Tepals free. Stamens free; anthers introrse; connective protruding shortly beyond loculi. Gynoecium slightly shorter than stamens, glabrous; ovary shortly stipitate; stigma simple. Fruit flat, spathulate in outline, attenuate at base; style eccentric due to differential growth of ventral and dorsal fruit margins.

A monospecific genus, endemic in Australia.

C.Venkata Rao, Studies in the Proteaceae 1. Tribe Persoonieae, *Proc. Natl Inst. Sci. India* 26B: 300–337 (1960); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 122–123 (1989).

**Bellendena montana** R.Br., *Trans. Linn. Soc. London* 10: 166 (1810)

T: in insula Diemen [Tas.], 1804, *R.Brown s.n.*; syn: BM, K.

Illustrations: M.Cameron (ed.), *Guide Fl. & Pl. Tasmania* 35, pls 49, 50 (1981); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 119, 122 (1989).

Erect to decumbent, multi-stemmed shrub 0.1–1.8 m tall. Young stems moderately to densely covered in minute papillae, glabrous. Leaves narrowly to broadly oblanceolate to spathulate to cuneate in outline with recurved margins, shortly petiolate, acute to mucronate or rarely emarginate, 1–6 cm long, 2–22 mm wide, glabrous except for pubescence on upper surface of

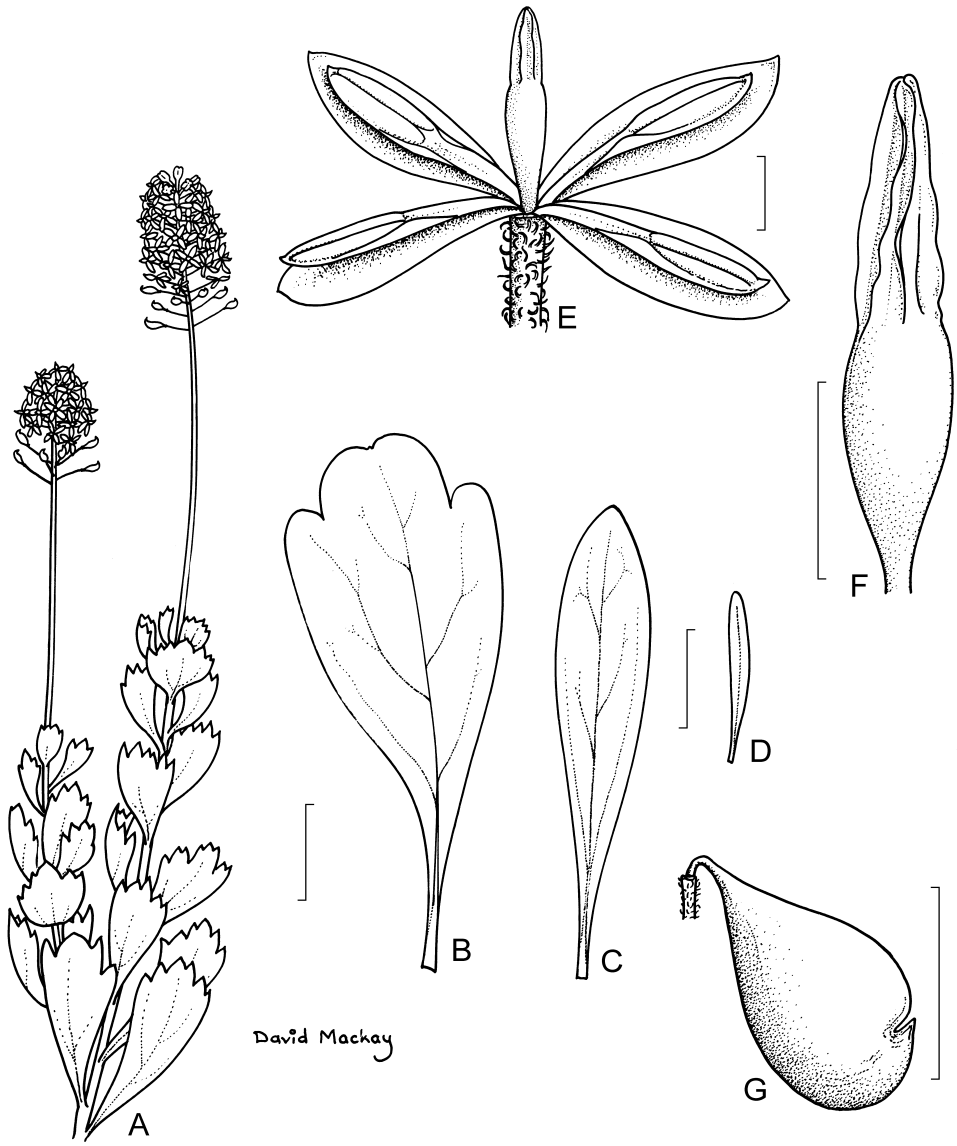



**Figure 45**. *Bellendena montana*. **A**, shoots with inflorescences, showing habit (P.Short 1771, NSW); **B–D**, leaf variations (**B**, A.Lucas, NSW 37600; **C**, H.Rupp, NSW 379435; **D**, I.Telford, NSW 379434); **E**, flower; **F**, gynoecium (**E–F**, P.Short 1771, NSW); **G**, fruit (S.Jacobs 2047, NSW). Scale bars: **A** = 2 cm; **B–D**, **G** = 1 cm; **E, F** = 1 mm. Drawn by D.Mackay.

petiole; primary lobes 0–5, to 12 mm long, each with 0–3 secondary lobes. Inflorescence 15–60-flowered; axis glabrous to moderately pubescent; peduncle 1.3–10 cm long; rachis 5–45 mm long. Flowers white to pale pink except for red ovary; pedicels spreading, 5–8 mm long, glabrous to moderately pubescent; tepals spreading, 2.5–4 mm long, glabrous. Stamens 2.5–3.5 mm long. Fruit pendulous, 10–17 mm long, red. Figs 24, 45.

Widespread in Tas., mostly from 1000 to 1500 m alt., but occasionally as low as 400 m in the north-west; most commonly in alpine to subalpine heath, rarely in forest or alpine herbfield, often in poorly drained sites, mostly in soil derived from dolerite, but occasionally on quartzite or basalt. Flowers Dec.–Feb.; fruits Feb.–May. Map 118.

Tas.: Ben Lomond Natl Park, *S.J.Forbes 1383* (HO, NSW); edge of Hounslow Heath, Cradle Mountain–L. St Clair Natl Park, *P.S.Short 1771* (HO, NSW); Mawson Plateau, Mt Field Natl Park, *P.S.Short 1820* (HO); Mt Wellington Plateau, *J.H.Hemsley 6524* (HO, NSW); summit of Ironbound Ra., *A.M.Buchanan 3413* (HO).

Specimens from north-eastern Tasmania (Ben Lomond, Ben Nevis and Mt Barrow) have predominantly entire, oblanceolate leaves that, on average, are narrower than those from other areas. The size of stem papillae varies geographically, being shortest in the north and longest in the south. Specimens from higher altitudes tend to have smaller, more crowded leaves than those from comparatively low altitudes.

## Subfam. 3. EIDOTHEOIDEAE

*A.W.Douglas & B.P.M.Hyland*

*Proteaceae* subfam. *Eidotheoideae* A.W.Douglas & B.Hyland, *Fl. Australia* 16: 472 (1995).

Type: *Eidothea* A.W.Douglas & B.Hyland

Rainforest trees. Leaves simple. Inflorescence a capitulate raceme. Flowers actinomorphic, andromonoecious, solitary in each bract axil. Tepals free except for a short, basal tube. Staminal filaments free or slightly adnate to base of tepals; anthers latrorsely dehiscent via longitudinal slits. Hypogynous glands absent. Style tip not modified as a pollen presenter; ovule 1, orthotropous, pendulous, longitudinally ribbed. Fruit a nut; inner layer hard and bony with internally and longitudinally arranged ribs, resembling a condyle. Chromosomes unknown.

A monogeneric subfamily confined to rainforest in north-eastern Qld.

The morphology of the flowers and fruit are unique to the family.

## 5. EIDOTHEA

*Eidothea* A.W.Douglas & B.Hyland, *Fl. Australia* 16: 472 (1995), named after Eidothea, one of the three daughters of Proteus in Greek mythology.

Type: *E. zoexylocarya* A.W.Douglas & B.Hyland

Tree lacking buttresses. Bark ash-grey, flaky with pale, irregular or round lenticels. Shoots with pseudoverticillate leaves and spirally ascending, reduced, bract- or scale-like leaves ('cataphylls'). Leaves entire and simple; juvenile leaves simple with dentate margins. Inflorescence simple, axillary, forming condensed racemes, usually 1 flower perfect, the others male; peduncles with many spirally ascending, obovate bracts. Flowers antero-posteriorly oriented. Tepal aestivation valvate, circinate after anthesis. Stamens with thin, elongate, cylindrical filaments, longer than tepals; anthers elongate, pendulous, with broad connectives, without terminal appendages; pollen grains with 3 pores. Ovary shortly stipitate, with ascending hairs in alternitepalous positions; style elongate, with fused suture; stigma slightly crestiform-lipped. Fruit globose or ovoid, glabrous, pericarp forming 3 layers: a very thin outer layer, a spongy middle layer, and a hard, bony inner layer with inward-facing, longitudinally arranged ribs. Seed large and multicanaliculate.

A monospecific genus endemic in rainforest in north-eastern Qld.

While *Eidothea* possesses features which are plesiomorphically similar to those of other proteaceous taxa, the combination of these features is unique within the family (A.W.Douglas & B.P.M.Hyland, in prep.). Thus, the white flowers and free anthers resemble *Sphalmium*; the pseudo-whorled leaf arrangement resembles *Macadamia*; the single-seeded and single-ovulate condition is similar to taxa in both Macadamiinae and most Proteoideae; and the orthotropous ovule is similar to that in taxa of Conosperminae. The combination of plesiomorphic and autapomorphic features suggests that *Eidothea* represents a new subfamily, one possibly leading to the line of Proteoideae. Further investigations should help to clarify its higher taxonomic position (A.W.Douglas & B.P.M.Hyland, in prep.).

**Eidothea zoexylocarya** A.W.Douglas & B.Hyland, *Fl. Australia* 16: 473 (1995)

T: Timber Reserve 1230, Boonjee Logging Area, Mt Bartle Frere, Qld, 9 Jan. 1980, *B.Gray* 1611; holo: QRS; iso: BRI, CANB, DNA, HO, K, L, LSU, MEL, MO, NSW, PERTH, PRE, QRS.

Tree 20–40 m tall; trunk 40–80 cm diam. Wood pinkish internally, with broad rays. Leaves with petiole c. 1–3 cm long, semiterete at base, somewhat thickened and flattened distally; lamina elliptic to ovate, 6–10 cm long, glabrous; margin entire, recurved; venation loosely brochidodromous to eucamptodromous. Inflorescence 6–10-flowered, 1.5–2 cm long. Tepals 6–7 mm long, ivory, with long trichomes on inside attached at base, otherwise glabrous. Stamens longer than tepals, 7.5–9 mm long, ivory; anthers pendulous, ivory. Gynoecium 4–5 mm long, ivory. Fruit 3.5–6 cm long, 3–6.5 cm diam., green. Fig. 46.

Apparently confined to rainforest at Mt Bartle Frere and the Pieter Botte Logging Area on the Bloomfield River watershed, north-eastern Qld. Flowers Sept.–Apr.; fruits Mar.–May. Map 119.

Qld: Mt Bartle Frere, *B.Gray 817, 818* (QRS); Timber Reserve 755, Coolamon Logging Area, *B.P.M.Hyland 25797/RFK* (QRS); Thornton Peak, *J.G.Tracey 14994* (QRS); Timber Reserve, Pieter Botte Logging Area, *B.P.M.Hyland 3505/RFK* (QRS).

There is pronounced variation in leaf venation patterns. Most leaves have loosely brochidodromous and/or eucamptodromous venation with a single primary vein; there can also be variation in the same leaf. Some, however, have 3 veins, originating within the petiole, which subsequently diverge in the lamina to resemble an acrodromous pattern *sensu* L.J.Hickey (*Amer. J. Bot.* 60: 17–33, 1973).

The fruit of *E. zoexylocarya* appear to be predated on the tree and probably also on the ground by a small mammal (probably the White-tailed Rat, *Uromys*). The hollowed nut endocarps are often found surrounding the base of the mother tree and vary in size. The range of variation in endocarp size appears to be greater on a single plant from one year to another, than it does among trees in different populations. A recent survey found numerous fruit and seedlings in the Boonjee Logging Area.

The nut is remarkably similar to the fossilised nut of *Xylocaryon lockii* F.Muell. from Victoria (F.J.H. von Mueller, Observations on new vegetable fossils of the auriferous drifts, *Geologic Survey of Victoria*, 1883, Douglas, in prep.).

The flowers have a subtle, sweet perfume and hovering insects appear to dart in and out of inflorescences of mature trees.

The number of populations of this plant appears low. Until a complete assessment has been made its conservation status should be considered to be at least vulnerable if not endangered.

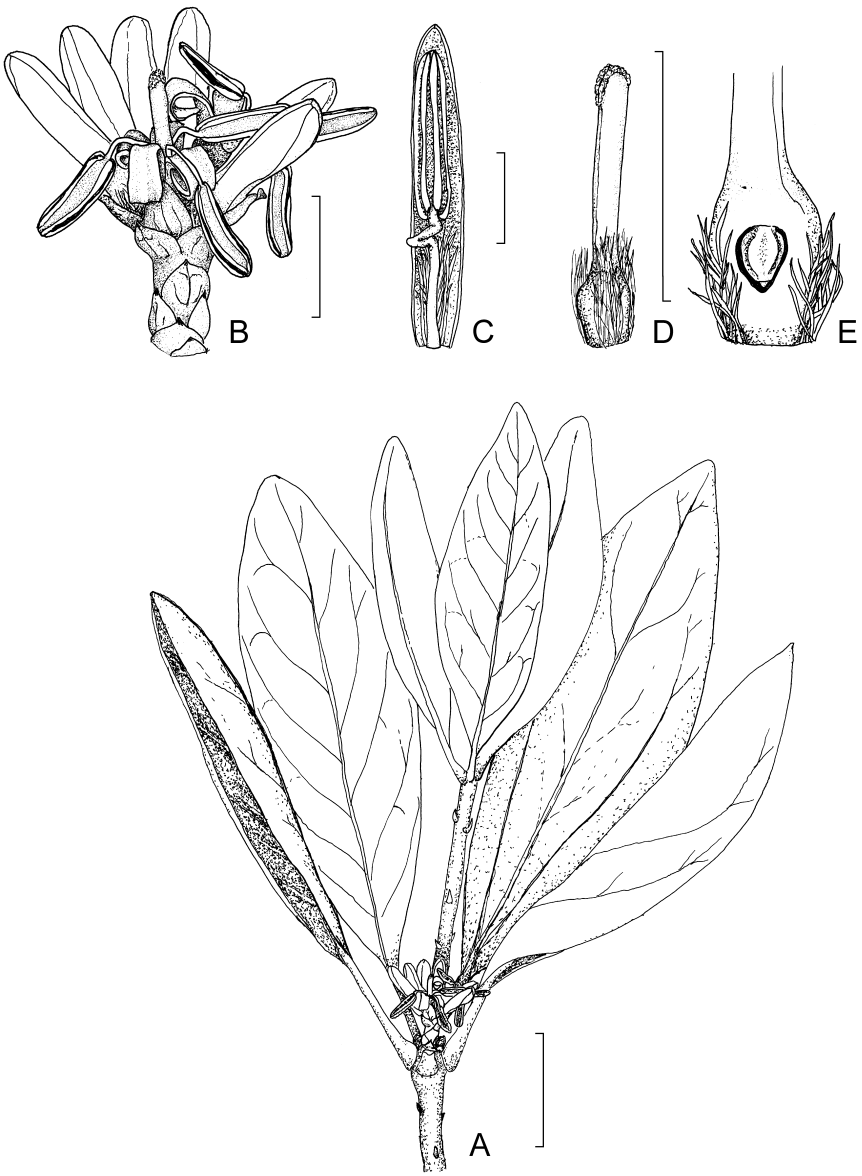



**Figure 46**. *Eidothea zoexylocarya*. **A**, flowering branchlet; **B**, inflorescence; **C**, tepal and stamen; **D**, gynoecium; **E**, partially dissected ovary showing single pendulous ovule, some hairs removed (**A–E**, A.Douglas, 377-PROT, MEL). Scale bars: **A** = 2 cm; **B** = 5 mm; **C**, **E** = 2 mm; **D** = 4 mm. Drawn by A.Douglas.

## Subfam. 4. PROTEOIDEAE

*Proteaceae* subfam. *Proteoideae.*

Type: *Protea* L.

Mostly sclerophyllous shrubs of infertile soils. Leaves simple, entire, toothed or variously divided. Inflorescence simple axillary racemes, compound terminal racemes, capitula ('cones') or reduced to single flowers. Flowers actinomorphic or zygomorphic, andromonoecious or bisexual, not in regular pairs; bracts present. Staminal filaments free or partly fused to tepals, or anthers sessile. Hypogynous glands present or absent. Pollen presenter present or absent. Fruit dry, indehiscent, usually a small nut or achene, rarely a drupe. Chromosomes usually small at mitotic metaphase, c. 0.5 μm long, but rarely to 5 μm; $n$ = 14, sometimes 13, 11, 10, 24 or 28.

A subfamily of 3 tribes, 26 genera and c. 637 species, with 2 major centres of diversity, southern Africa and Australia, but extending also to tropical and subtropical Africa, Madagascar and New Caledonia. In Australia, 2 tribes, 10 genera and 237 species, the majority subshrubs, shrubs or, rarely, small trees of sclerophyllous communities, often in poor soils.

## Trib. 1. CONOSPERMEAE

*Proteaceae* trib. *Conospermeae* Endl., *Gen. Pl.* 338 (1837).

Type: *Conospermum* Sm.

Leaves entire or variously divided; glandular cavities absent. Inflorescence capitate, spicate, racemose or cone-like. Flowers actinomorphic or zygomorphic. Stamens free, or often variously fused and with reduced anthers. Hypogynous glands absent or, if present (in *Cenarrhenes*), short and thick. Fruit usually a nut, rarely a drupe.

A tribe of 5 subtribes; 3 subtribes comprising 5 genera endemic in Australia, 1 (Dilobeiinae) confined to Madagascar, and 1 (Cenarrheninae) comprising 3 endemic Australian genera and 2 from New Caledonia.

## Subtrib. 1. CENARRHENINAE

*Proteaceae* subtrib. *Cenarrheninae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 171 (1975).

Type: *Cenarrhenes* Labill.

Leaves various, not dichotomous. Inflorescence a spike or raceme. Flowers actinomorphic, bisexual. Filaments often incurved beneath anthers. Hypogynous glands 4 or absent. Pollen presenter absent. Fruit drupaceous or dry, glabrous or almost so; endocarp woody, crystalliferous or absent. $n$ = 10, 11, 13 or 14.

Includes the Australian endemic genera *Agastachys*, *Cenarrhenes* and *Symphionema* as well as *Beauprea* Brongn. & Gris and *Beaupreopsis* Virot from New Caledonia.

## 6. AGASTACHYS

*I.R.H.Telford*

*Agastachys* R.Br., *Trans. Linn. Soc. London* 10: 158 (1810); from the Greek *aga* (many) and *stachys* (a spike), in reference to the inflorescences crowding towards stem apices.

Type: *A. odorata* R.Br.

*Lippomuellera* Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: *L. odorata* (R.Br.) Kuntze

Shrubs or small trees. Leaves simple, entire, coriaceous. Inflorescence an erect, axillary, densely-flowered spike, usually several crowded towards branch apices and apparently forming a terminal panicle; bracts narrowly elliptic, erect. Flowers regular. Perianth segments free from base, linear, spreading to recurved. Stamens all similar, epipetalous; filaments inserted just below middle of perianth segments, filiform; anthers 4-locular, dehiscing latrorsely. Hypogynous glands absent. Ovary sessile, ±pyramidal, 1-locular; ovule solitary, pendulous; style short; stigma lateral, thick. Fruit a nut, with 2 lateral wings and a narrower, abaxial wing, 1-seeded.

A monospecific genus endemic in Tasmania.

J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 74–75 (1989).

### **Agastachys odorata** R.Br., *Trans. Linn. Soc. London* 10: 158 (1810)

*Lippomuellera odorata* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 579 (1891). T: in Insulae Diemen [Tas.] plagis australioribus; prope Adventure Bay, ubi primum a D.Nelson detecta, nuperius lecta a *D.G.Caley*; syn: BM? *n.v.*

Illustrations: M.Stones *in* W.M.Curtis & M.Stones, *Endemic Fl. Tasmania* t. 105 (1971); M.Cameron (ed.), *Guide Fl. & Pl. Tasmania* 39, t. 60 (1981).

Shrub or small tree to 9 m tall. Leaves with petiole c. 3 mm long; lamina elliptic, narrowly obovate to spathulate, obtuse, 15–100 mm long. Spikes 4–12 cm long; bracts 4–10 mm long, white. Perianth segments 6–8 mm long, white or creamy yellow. Fruit c. 4 mm long. *White Waratah*. Figs 23, 47A–D.

Endemic in western and southern Tas. from near Cradle Mountain south and east to near Hobart. Grows in shrub communities or in open areas in rainforest, often at the margins of sedge swamps with *Gymnoschoenus sphaerocephalus* (Button Grass), in sand or gravel to c. 800 m altitude. Flowers Jan.–Feb. Map 120.

Tas.: Denison Ra., L. Rhona, *R.A.Burns 1* (BISH, CBG); Florentine River valley, along Gordon River Rd, *R.D.Hoogland 11752* (CANB, HO); Strahan Ridge, SW of Queenstown, 20 Jan. 1949, *L.A.S.Johnson* (HO, NSW); S end of Moinee Ridge, Cox Bight, *A.E.Orchard 5779* (BRI, HO, MEL); Hartz Mtns Natl Park, c. 1.5 km N of Arve R., *F.E.Davies 865 & P.Ollerenshaw* (AD, BISH, CBG, HO, MEL, NSW).

Grows as a shrub to 3 m in swampy habitats and as a tree to 9 m in rainforest. Flowers are fragrant.

## 7. CENARRHENES

*I.R.H.Telford*

*Cenarrhenes* Labill., *Nov. Holl. Pl.* 1: 36, t. 50 (1805); from the Greek *kenos* (empty) and *arrhen* (male), in reference to the 4 staminode-like hypogynous glands.

Type: *C. nitida* Labill.

*Cennarrhenes* Steud., *Nom. Bot.* 2nd edn, 1: 317 (1840), *orth. var.*

Shrubs or small trees, glabrous. Leaves simple, coriaceous. Inflorescence an open, axillary spike; bracts narrowly ovate, spreading. Flowers ±regular. Perianth segments narrowly ovate,

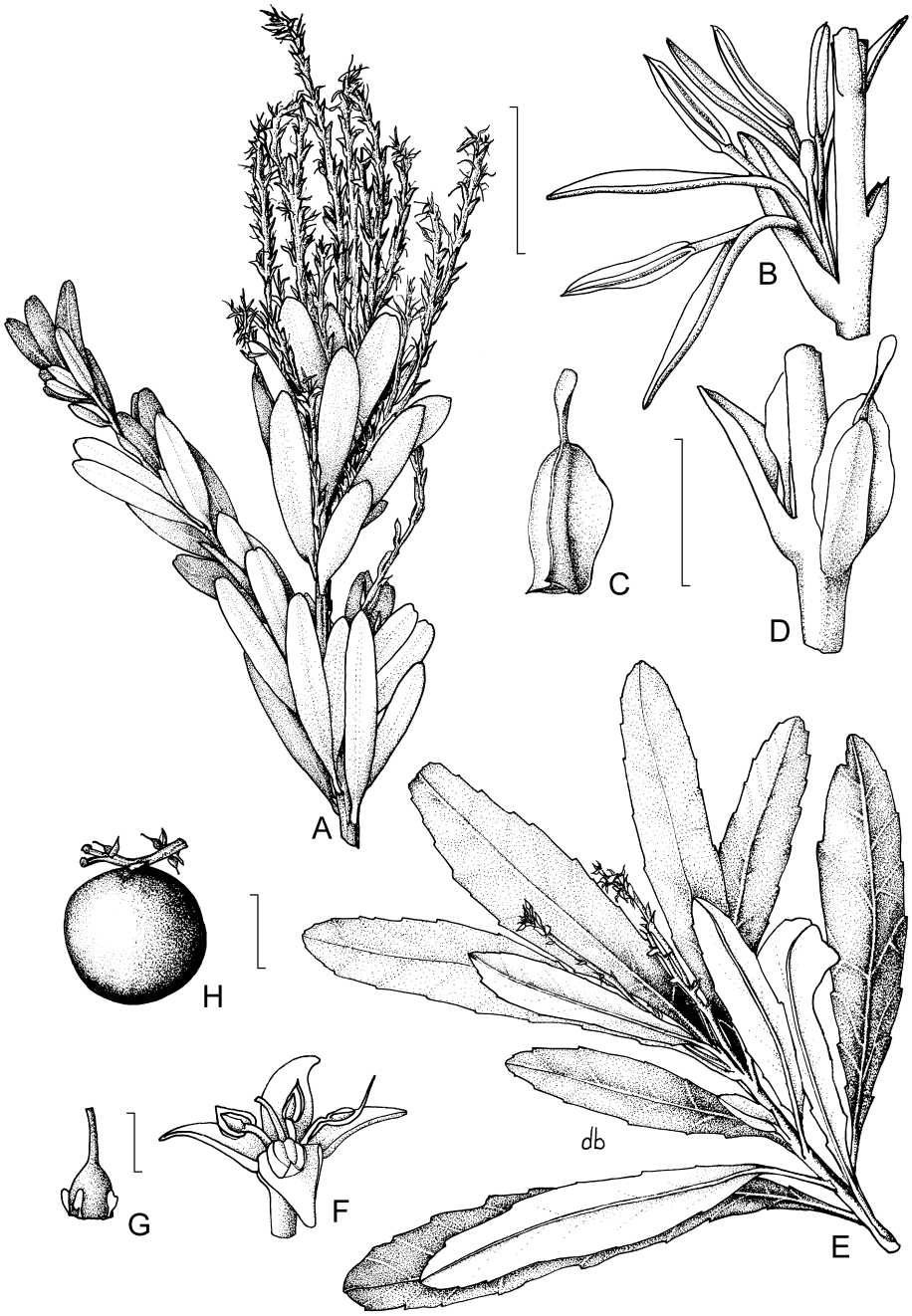



**Figure 47**. **A–D**, *Agastachys odorata*. **A**, flowering branchlet (I.Telford 2119, CBG); **B**, flower on part of inflorescence (R.Burns 1, CBG); **C**, fruit; **D**, fruit on part of infructescence (**C–D**, Hermit Valley, Tas., M.Phillips, CBG). **E–H**, *Cenarrhenes nitida*. **E**, flowering branchlet; **F**, flower; **G**, gynoecium with hypogynous glands (**E–G**, above Flowerdale R., Dip Ra., Tas., M.Phillips, CBG); **H**, fruit (Hermit Valley, Tas., M.Phillips, CBG). Scale bars: **A** = 4 cm; **B–D**, **H** = 5 mm; **E** = 2 cm; **F**, **G** = 2 mm. Drawn by D.Boyer.

acute; apices thickened and recurved. Stamens free, dimorphic; filaments inserted at base of perianth segments, compressed, expanded at their apices around anthers; adaxial filament with an awn-like extension; anthers 4-locular, dehiscing introrsely. Hypogynous glands 4, clavate. Ovary sessile, ovate, 1-locular; ovule solitary, pendulous; style short, filiform; stigma minute, terminal. Fruit a globose, 1-seeded drupe.

A monospecific genus endemic in Tasmania.

J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 130–131 (1989).

**Cenarrhenes nitida** Labill., *Nov. Holl. Pl.* 1: 36, t. 50 (1805)

T: in capite Van-Diemen [Tas.], *J.J.H. de Labillardière*; holo: FI? *n.v.*

Illustrations: W.M.Curtis, *Students Fl. Tasmania* 602, fig. 127 (1967); M.Stones *in* W.M.Curtis & M.Stones, *Endemic Fl. Tasmania* t. 152 (1973); M.Cameron (ed.), *Guide Fl. & Pl. Tasmania* 39, t. 60 (1981), as *Cenarrenes nitida*.

Shrub or tree to 10 m tall. Leaves with petiole 1–2 cm long; lamina narrowly obovate or spathulate, obtuse, 2–16 cm long; margin coarsely serrate. Spikes 2–7 cm long; bracts green, 2–4 mm long. Perianth segments c. 5 mm long, cream-coloured. Fruit 10–15 mm diam., purplish black. *Native Plum*. Figs 22, 47E–H.

Endemic in western and southern Tas. including the Central Plateau from near Cradle Mountain south and east to near Hobart; grows in shrub communities or in broken canopy areas in rainforest to c. 800 m altitude. Flowers Oct.–Nov. Map 121.

Tas.: Sanctuary Bay, *A.M.Buchanan 2611* (HO, MEL); N side, Mt Gaffney, *R.Buttermore 55* (HO); E end of Freyney Lagoon, Cox Bight, *A.E.Orchard 5767* (AD, HO); Adamsons Peak track, Feb. 1969, *I.R.Telford* (BISH, CBG); Celery Top Is., Bathurst Harbour, *M.Davis 1382* (CANB, MEL).

Grows to 2 m tall in more exposed sites and to 10 m in rainforest. Most parts of the plant are malodorous on crushing. Leaves turn black on drying. When the staminal awn is triggered, the stamens simultaneously spring back against the perianth, the anthers dehiscing.

## 8. SYMPHIONEMA

*I.R.H.Telford*

*Symphionema* R.Br., *Trans. Linn. Soc. London* 10: 157 (1810); from the Greek *symphio* (to unite) and *nema* (a thread), in reference to the staminal filaments being connate towards their apices.

Type: not designated.

*Symphyonema* Spreng., *Anleit. Kenntn. Gew.* 2nd edn, 2: 333 (1817), *orth. var.*

Shrubs or undershrubs; stems erect. Leaves simple, usually 1–3-pinnatisect; upper leaves sometimes less dissected, linear or trifid, acute. Inflorescence a spike or panicle, terminal, or in upper leaf axils; bracts small, deltoid. Flowers ±actinomorphic. Perianth segments free from base, ±equal, linear, spreading. Stamens epipetalous; filaments inserted towards bases of perianth segments, incurved and cohering around style near their apices; anthers erect, 2 locular, dehiscing longitudinally. Hypogynous glands absent. Ovary sessile, ellipsoidal, 1 locular; ovule solitary; style length equalling perianth; stigma capitate or slightly dilated. Fruit an ellipsoidal achene.

A genus of 2 species endemic in south-eastern Australia.

J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 530–531 (1989).

Leaf segments flat, 2–4 mm wide **1. S. montanum**

Leaf segments ±terete, 0.5–1.5 mm wide **2. S. paludosum**

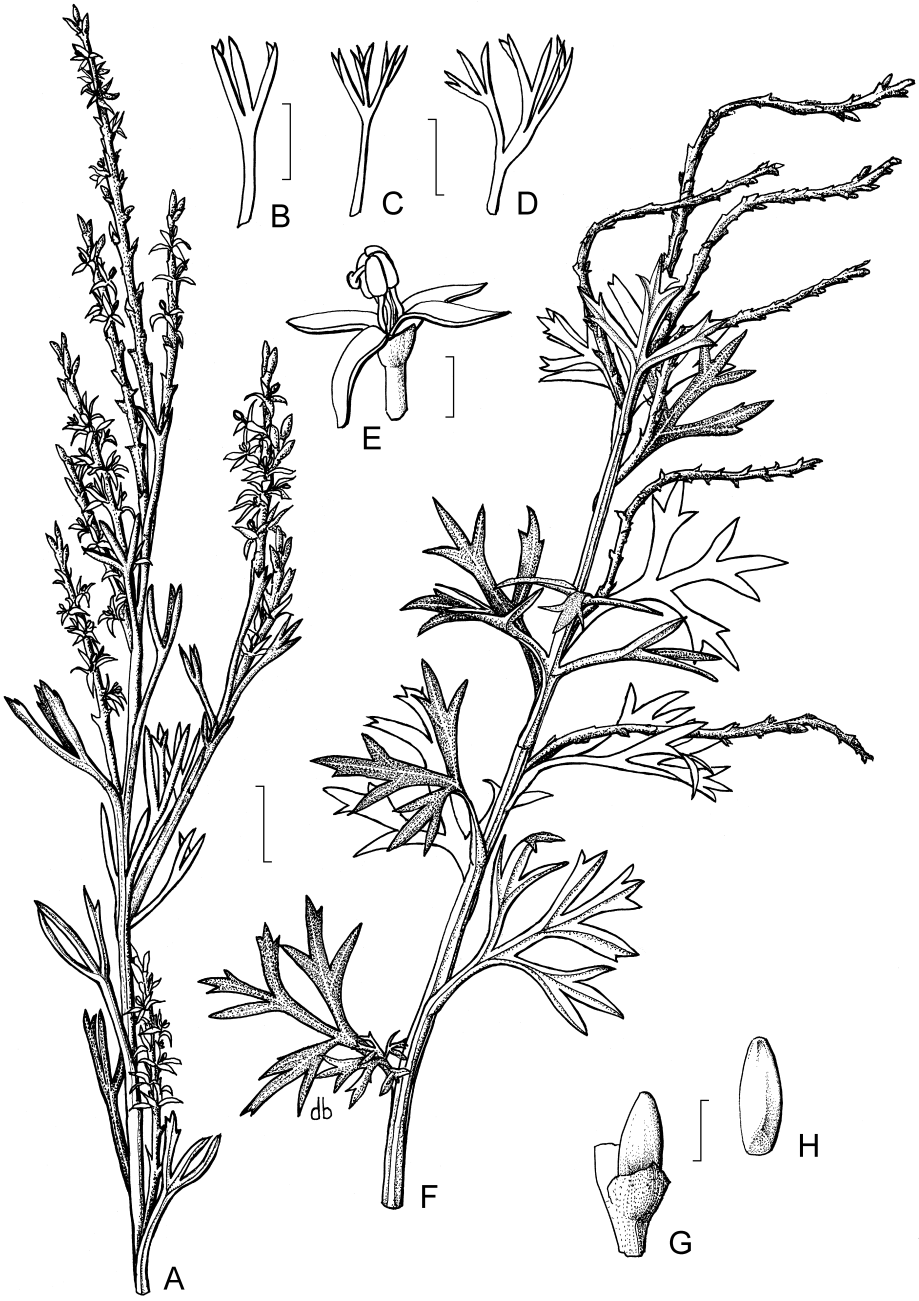



**Figure 48**. *Symphionema*. **A–E**, *S. paludosum*. **A**, flowering branchlet; **B–D**, leaf variations; **E**, flower (**A–E**, I.Telford 10741, CBG). **F–H**, *S. montanum*. **F**, fruiting branchlet; **G**, achene on part of infructescence; **H**, achene (**F–H**, P.Beesley 203 et al., CBG). Scale bars: **A–D**, **F** = 1 cm; **E** = 2 mm; **G**, **H** = 1 mm. Drawn by D.Boyer.

**1. Symphionema montanum** R.Br., *Trans. Linn. Soc. London* 10: 157 (1810)

T: near Port Jackson [Grose R., N.S.W.], *R.Brown s.n.*; holo: BM? *n.v.*

Illustrations: N.C.W.Beadle *et al., Fl. Sydney Reg.* 3rd edn, t. 10 (1982), as *S. paludosa*; E.R.Rotherham *et al., Fl. & Pl. New South Wales & Southern Queensland* 44, fig. 99 (1975).

Shrub to 80 cm tall. Leaves 2-pinnatisect, 2–5 cm long; segments flat, linear to linear-lanceolate, 2–4 mm wide. Inflorescence 2–6 cm long. Perianth 4–5 mm long, pale yellow. Achene c. 2 mm long. Figs 26, 48F–H.

Occurs on the Central Tablelands and Woronora Plateau, N.S.W., from near Putty south through the Blue Mountains to near Macquarie Pass; grows in heath or open forest, usually in moist sites in sandy soil on sandstone at altitudes of 400–1200 m. Flowers Oct.–Dec. Map 122.

N.S.W.: c. 8 km W of Mt Cameron, c. 30 km N of Bell, *J.Pickard 1242* (NSW); Cliff Drive, Katoomba, 19 Nov. 1970, *C.Burgess* (CBG, NSW); Blue Mtns Natl Park, Ingar Picnic Area, *I.R.Telford 2984* (BISH, CBG, MEL); Mt Werong, 26 Oct. 1940, *W.F.Blakely & F.L.Ludowier* (NSW); West Dapto, May 1901, *W.Cambage* (NSW).

Mature stamens may separate and the anthers dehisce almost explosively when triggered.

**2. Symphionema paludosum** R.Br., *Trans. Linn. Soc. London* 10: 157 (1810)

T: near Port Jackson [N.S.W.], *R.Brown s.n.*; holo: BM *n.v.*

Illustration: N.C.W.Beadle, *Students Fl. NE New South Wales* 231, fig. 105C (1972).

Shrub to 60 cm tall. Leaves mostly trifid or 1- or 2-pinnatisect; upper leaves sometimes undissected, linear; segments ±terete, 0.5–1.5 mm wide. Inflorescence 1–8 cm long. Perianth segments 4–5 mm long, pale yellow. Achene c. 2 mm long. Fig. 48A–E.

Occurs mainly in coastal N.S.W., including near-coastal and escarpment plateaus, rarely in the higher Central Tablelands, from the Port Macquarie area south almost to the Victorian border and inland to Kanangra Tops. Grows usually in wet heath, or in open woodland or open forest, usually in sandy soils, at altitudes mostly below 800 m, rarely to 1200 m. Flowers Aug.–Nov. Map 123.

N.S.W.: 2 km W of Point Plomer, 16 km N of Port Macquarie, *C.O.Boyd & D.J.McGillivray 1874* (NSW); Gosford, 6 Dec. 1922, *J.S.Fletcher* (NSW); 13 km E of Robertson, by Robertson–Jamberoo road, *M.Evans 2677* (CANB, NSW); northern Budawang Ra., below Corang trig., *I.R.Telford 10741* (AD, BRI, CBG, HO, MEL, NSW); Nadgee State Forest, 3.4 km N of Nagha, *M.D.Crisp 4615 & I.R.Telford* (BM, CBG, MEL, US).

One of the least woody members of the family with plants sometimes appearing annual-like and flowering when only c. 10 cm tall.

## Subtrib. 2. STIRLINGIINAE

*Proteaceae* subtrib. *Stirlingiinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 171 (1975).

Type: *Stirlingia* Endl.

Leaves ±dichotomous; subdivisions pinnate. Inflorescence a small head or short spike. Flowers actinomorphic, andromonoecious. Anthers fully developed; loculi 4, contiguous but not connate. Hypogynous glands absent. Pollen presenter absent. Fruit a small nut with long hairs. $n = 13$.

One genus endemic in south-western W.A.

# 9. STIRLINGIA

*A.S.George*

*Stirlingia* Endl., *Gen. Pl.* 339 (1837); named after James Stirling (1791–1865), who explored the Swan River in 1827 and was the first Governor of Western Australia.

Type: *S. anethifolia* (R.Br.) Endl.; lecto, *fide* A.S.George, *Fl. Australia* 16: 473 (1995).

*Simsia* R.Br., *Trans. Linn. Soc. London* 10: 152 (1810), *nom. illeg. non* Pers. T: *S. anethifolia* R.Br.; lecto, *fide* A.S.George, *Fl. Australia* 16: 473 (1995).

Shrubs or perennial herbs with woody rootstock, or with taproot, glabrous except bracts and fruit. Leaves mostly on lower part of stem, ±dichotomously divided, leathery or soft. Inflorescence scapose, paniculately branched or simple. Flowers in heads or very short spikes; each flower subtended by small bract, pale yellow, often tinged red-brown, turning black. Perianth straight, actinomorphic; lobes of limb separating and reflexed at anthesis. Anthers on short filaments, 2-locular. Hypogynous scales absent. Gynoecium straight; ovary sessile; ovule 1; style end broadly cupular. Fruit an obconical nut, densely silky, falling when mature. $n = 13$, *fide* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 103 (1975).

A genus of 7 species endemic in south-western W.A. Distinguished by the straight, regular perianth with lobes sharply reflexed after anthesis, the expanded stigma, the broad, hirsute nut and ±dichotomously divided leaves. Floral morphology is relatively uniform, species being delimited largely on the basis of habit, leaves and inflorescence. In the descriptions below, the relative width of the perianth limb and tube should be noted at the late bud stage. The leaves of the last 4 species are remarkably soft but persist through the typically dry, hot summer.

A.S.George, *Intr. Proteaceae W. Australia* 101–102 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 524–526 (1989); P.G.Ladd & S.W.Connell, Andromonoecy and fruit set in three genere of the Proteaceae, *Bot. J. Linn. Soc.* 116: 77–88 (1994).

**1** Leaf segments flat; scape robust, to 1.5 m tall — **1. S. latifolia**

**1:** Leaf segments terete; scape slender, not more than 1 m tall

**2** Leaves less than 3 cm long, borne along more than half the stem — **6. S. abrotanoides**

**2:** Leaves more than 5 cm long, mostly confined to lower part of stem

**3** Heads 6–10 mm diam.; perianth 3–3.5 mm long; leaves leathery — **2. S. anethifolia**

**3:** Heads 9–15 mm diam.; perianth 4.5–7 mm long; leaves ±soft

**4** Scape simple or sparsely branched — **7. S. simplex**

**4:** Scape openly branched

**5** Petiole 12–14 cm long; perianth limb broader than tube — **5. S. divaricatissima**

**5:** Petiole 1.5–6.5 cm long; perianth limb narrower than tube

**6** Leaves divided up to 10 times into curved, crowded segments; ultimate lobes 1–4 mm long; bracts hoary — **4. S. tenuifolia**

**6:** Leaves divided up to 6 times into straight, open segments; ultimate lobes 2–10 mm long; bracts glabrous — **3. S. seselifolia**

## 1. Stirlingia latifolia (R.Br.) Steud., *Nomencl. Bot.* 2nd edn, 2: 644 (1841)

*Simsia latifolia* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 9 (1830). T: Mt Manypeak[s], near King George Sound [W.A.], 1823, *W.Baxter*; holo: BM.

*Stirlingia paniculata* Lindl., *Sketch Veg. Swan R.* xxx (1839). T: Swan River district, W.A., 183–, *J.Mangles*; holo: CGE.

*Simsia latifolia* var. *gracilis* Ostenf., *Biol. Meddel. Kongel. Danske Vidensk. Selsk.* 3: 50 (1921). T: Kings Park, Perth, W.A., 13 Oct. 1914, *C.H.Ostenfeld 681*; iso: PERTH.

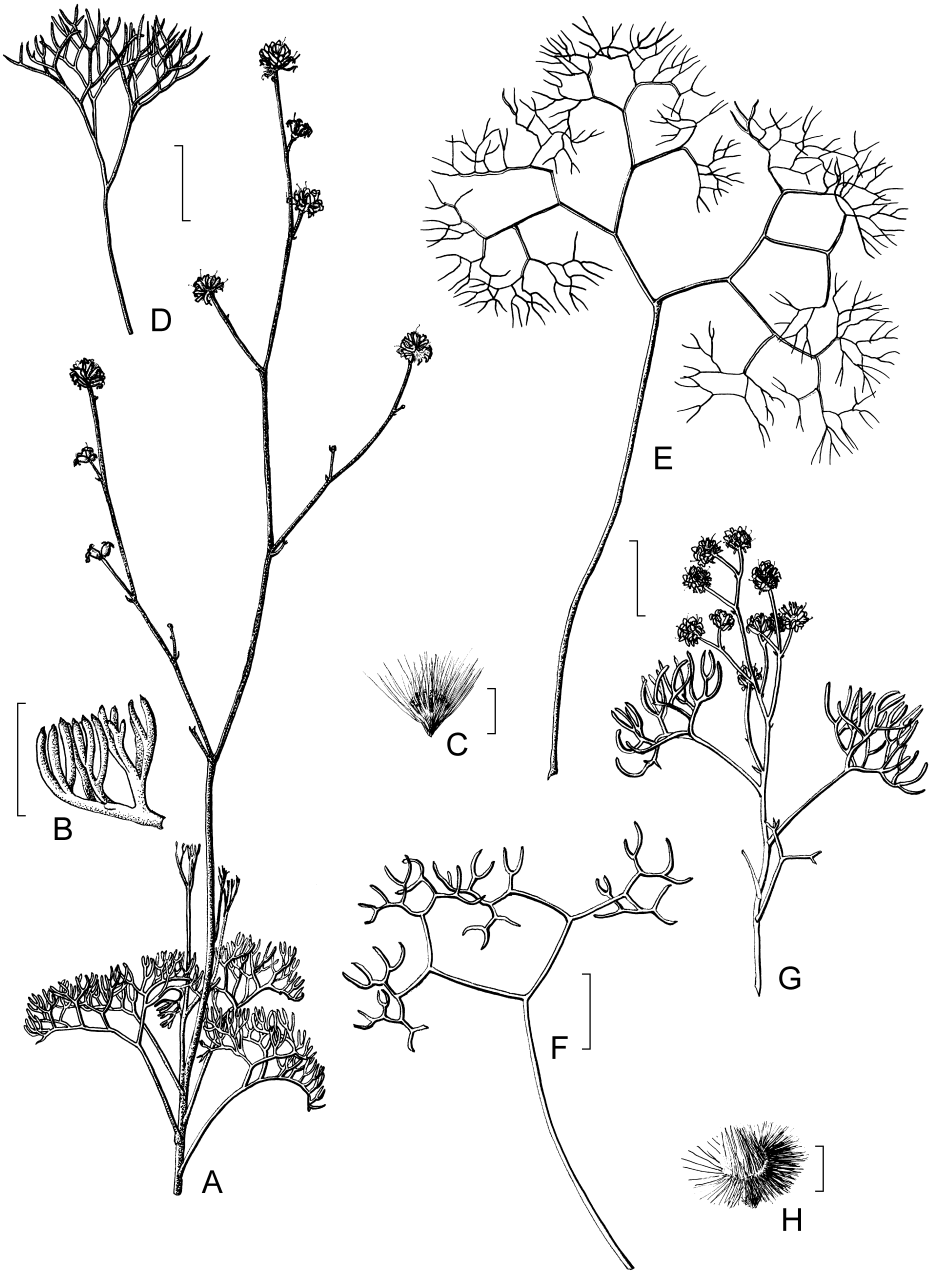



**Figure 49**. *Stirlingia*. **A–C**, *S. tenuifolia*. **A**, flowering branchlet; **B**, detail of ultimate leaf lobes; **C**, nut (**A–C**, A.George 16887, PERTH). **D**, *S. seselifolia*, leaf (A.George 15240, PERTH). **E**, *S. divaricatissima*, leaf (J.Boyd 33, PERTH). **F–H**, *S. anethifolia*. **F**, leaf (R.Cranfield 1034, PERTH); **G**, flowering branchlet (N.Donner 2691, PERTH); **H**, nut (H.Demarz 1077, PERTH). Scale bars: **A**, **D–G** = 2 cm; **B** = 5 mm; **C**, **H** = 2 mm. Drawn by D.Boyer.

Illustrations: R.Erickson *et al.*, *Fl. & Pl. W. Australia* 27, pl. 39 (1973); A.S.George, *Intr. Proteaceae W. Australia* 102, figs 151–153 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 525 (1989).

Shrub with woody rootstock. Stems many, to 70 cm long. Leaves extending well up stem, leathery; petiole 3–10 cm long, ±terete at base, flattened upwards; lamina to 10 cm long, divided up to 3 times into flat, obtuse, often shallowly hooded lobes 1–15 mm wide. Scape to 1.5 m tall; panicle much-branched; heads 9–15 mm diam.; bracts ovate, obtuse to acute, 0.5–1 mm long, glabrous. Perianth 3–7 mm long; limb narrower than tube. Nut 4–5.5 mm diam., silky, hairy on top. *Blueboy*.

Widespread and often common in south-western W.A. from Kalbarri to Albany, mostly within 50 km of the coast, but extending inland to the Stirling Range. Grows in deep sand, in kwongan, shrubland and woodland. Flowers Sept.–Oct.; fruits Oct.–Jan. Map 124.

W.A.: Cockleshell Gully, *W.E.Blackall 3587* (PERTH); South Perth, *R.J.Cranfield 491* (PERTH); Yelverton State Forest, ENE of Margaret River, *G.J.Keighery 11515* (PERTH); 25 km E of Cranbrook, *R.H.Kuchel 1909* (AD, PERTH); 19 km E of Green Head, *A.E.Orchard 423* (AD, PERTH).

Easily distinguished by the robust habit, flat leaf segments and large nut. Variable in the width of leaf lobes and in the size and density of the panicle. Flowers pungently scented. The common name refers to the fact that wall plaster made using sand from where the species occurs turns blue. Flowering is enhanced the first season after fire.

### 2. **Stirlingia anethifolia** (R.Br.) Endl., *Iconogr. Gen. Pl.* t. 23 (1837)

*Simsia anethifolia* R.Br., *Trans. Linn. Soc. London* 10: 153 (1810); *Stirlingia tenuifolia* var. *anethifolia* (R.Br.) Benth., *Fl. Austral.* 5: 358 (1870). T: Lucky Bay [W.A.], Jan. 1802, *R.Brown s.n.*; holo: BM.

*Stirlingia teretifolia* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 515 (1845); *Simsia teretifolia* (Meisn.) F.Muell., *Syst. Census Austral. Pl.* 66 (1882). T: interior of south-western W.A., Feb. 1841, *L.Preiss 768*; iso: B.

*Stirlingia affinis* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 516 (1845). T: Mt Wuljenup [= Mt Willyung], W.A., 14 Oct. 1840, *L.Preiss 770*; iso: B, MEL (2 sheets), P (2 sheets).

*Stirlingia acutifolia* Endl., *Gen. Pl. Suppl.* 4(2): 81 (1848), apparently an error for *S. anethifolia* (R.Br.) Endl.

*Stirlingia intricata* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 325 (1856). T: Swan River Colony, W.A., *J.Drummond 268* (or herb. *Shuttleworth 286*); iso: BM (2 sheets), CGE, K (2 sheets).

Shrub with perennial rootstock. Stems several, to 10 cm long. Leaves mainly basal or extending a short way up the stem, leathery; petiole terete, 2–12 cm long; lamina divided to 6 times into terete, curved lobes; ultimate lobes divergent, 3–20 (–50) mm long. Scape 4–25 cm tall, often scarcely exceeding leaves, openly branched; stems ±curved; heads 6–10 mm diam.; bracts ovate, obtuse to almost acute, 1–1.5 mm long, glabrous, ciliate or hoary. Perianth 3–3.5 mm long; limb wider than tube. Nut 2–2.5 mm diam., densely silky. Fig. 49F–H.

Widespread in near-coastal regions of south-western W.A. from near Albany to Israelite Bay. Grows in sand in kwongan. Flowers Sept.–Nov.; fruits Dec.–Jan. Map 125.

W.A.: 22.5 km [S]E of Mt Ragged road junction towards Israelite Bay, *D.B.Foreman 1312* (AD, CANB, MEL, PERTH); Betty Beach, E of Albany, *G.J.Keighery 8721* (PERTH); c. 8.5 km WSW of Howick Hill, *A.E.Orchard 1081* (AD, PERTH); Cape Le Grand Natl Park, *R.D.Royce 8738* (PERTH); Cape Riche, 25 Oct. 1968, *J.W.Wrigley* (CBG, PERTH).

Very variable in leaf size and scape height, but without recognisable infraspecific taxa. Leaf lobes usually divaricate and curved, but also often erect and ±straight. The most xeromorphic of the terete-leaved species. For many years it has been known as *S. teretifolia*.

### 3. **Stirlingia seselifolia** Domin, *Vestn. Král. Ceské Spolecn. Nauk. Tr. Mat.-Prír.* 1921–22(2): 7 (1923)

T: 'Mallet', W.A., 1910, *A.A.Dorrien-Smith*; holo: K.

Perennial herb with verrucose taproot. Stems 1–several, to 15 cm long. Leaves at or near base of stem, rather soft; petiole terete, 1–3.5 cm long; lamina divided up to 6 times into

terete, ±straight lobes; ultimate lobes divergent, 2–10 mm long. Scape 35–70 cm tall, openly branched; stems ±straight; heads 10–12 mm diam.; bracts broadly ovate, acute to obtuse, 1–1.5 mm long, glabrous. Perianth 5–6 mm long; limb narrower than tube. Nut 3 mm diam., silky. Fig. 49D.

Recorded from scattered localities between Bunbury and Frankland, south-western W.A. Grows in low-lying areas, in sand, sometimes over laterite in open Jarrah (*Eucalyptus marginata*) forest. Flowers Oct.; fruits Nov.–Dec. Map 126.

W.A.: near Moorinup L., N of L. Muir, *A.S.George 11128* (PERTH); 49 km SW of Kojonup, *A.S.George 15240* (MEL, NSW, PERTH); Milyeannup Coast Rd, 1 km SW of Brockman Hwy, *A.S.George 17122* (CANB, MEL, NSW, PERTH); Lowden, *M.Koch 2052* (K, NSW).

Closely related to *S. tenuifolia* but of stiffer habit, the leaf lobes straighter and longer, the scape less branched and the bracts glabrous. Flowers not scented. Epithet was given wrongly as *sessilifolia* in A.D.Chapman, *Austral. Pl. Name Index* Q–Z: 2747 (1991).

### 4. **Stirlingia tenuifolia** (R.Br.) Steud., *Nomencl. Bot.* 2nd edn, 2: 644 (1841)

*Simsia tenuifolia* R.Br., *Trans. Linn. Soc. London* 10: 152 (1810). T: Princess Royal Harbour [Albany, W.A.], 22 Dec. 1801, *R.Brown s.n.*; holo: BM.

Illustrations: A.S.George, *Intr. Proteaceae W. Australia* 101, pl. 150 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 517 (1989).

Perennial herb with verrucose taproot, probably fire-sensitive. Stems 1–several, 5–25 cm long. Leaves soft; petiole 1.5–6.5 cm long; lamina divided up to 10 times into terete, curved lobes; ultimate lobes erect, 1–4 mm long. Scape 10–100 cm tall, openly branched; stems ±curved; heads 10–12 mm diam.; bracts ovate-triangular, obtuse, 0.8–1.2 mm long, tomentose. Perianth 5–6 mm long; limb narrower than tube. Nut 2 mm diam., densely silky. Fig. 49A–C.

Occurs in south-western W.A. from the Frankland River to Middle Mt Barren. Grows in sand and shale, in kwongan or woodland on hillsides and low-lying areas. Flowers Sept.–Oct.; fruits Nov.–Dec. Map 127.

W.A.: Red Gum Spring, Stirling Ra., *E.M.Canning CBG 28444* (CBG, NSW); Middle Mt Barren, *C.A.Gardner 9172* (PERTH); Grasmere L. (L. Powell), *G.L.Webster 18770* (NSW); 23.7 km S of Muir Hwy on Nornalup Rd, *A.S.George 17140* (CANB, PERTH).

Variable in size of plant, sometimes flowering when c. 10 cm tall, possibly in the first year.

### 5. **Stirlingia divaricatissima** A.S.George, *Fl. Australia* 16: 473 (1995)

T: 20 miles [32 km] N of Bow Bridge, N of Peaceful Bay, W.A., 22 Oct. 1971, *J.Boyd 33*; holo: PERTH.

Shrub to 1.7 m tall. Branching habit unknown. Leaves soft; petiole terete, 12–14 cm long; lamina divaricately and intricately divided up to 10 times; ultimate segments straight to slightly curved, very slender, 2–4 mm long. Scape at least 45 cm long (not seen complete), sparsely branched; stems ±straight; heads 9 mm diam.; bracts ovate, obtuse to ±acute, 1.5 mm long, closely tomentose. Perianth 4.5–5 mm long; limb broader than tube. Nut not seen. Fig. 49E.

Known from only two collections from north of Bow River, W.A. Grows in loam (habitat unknown) and in sand in shrubland among Jarrah–Marri forest. Flowers Oct. Map 128.

W.A.: N of Walpole, *A.S.Weston 95.3.11* (PERTH).

The tall habit and very finely divided leaves characterise the species.

### 6. **Stirlingia abrotanoides** Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 517 (1845)

*Simsia abrotanoides* (Meisn.) F.Muell., *Syst. Census Austral. Pl.* 66 (1882). T: near Swan River, W.A., 30 Sept. 1839, *L.Preiss 2622*; *n.v.*; Swan River, W.A., *J.Drummond 587*; syn: CGE, MEL, P (3 sheets).

Shrub or perennial herb with fire-tolerant rootstock. Stems several, to 15 cm long. Leaves borne along more than half the stem, soft; petiole terete, 4–10 mm long; lamina divided 4 or

5 times into terete, ±straight lobes; ultimate lobes ±erect, 1–5 mm long. Scape 14–16 cm tall, simple or sparingly branched; branches erect; stems ±curved; heads 12–14 mm diam.; bracts lanceolate, acute, 1.5–3 mm long, glabrous. Perianth 5 mm long; limb c. as wide as tube. Fruit 2 mm diam., silky. Fig. 25.

Occurs between Eneabba and Mogumber and further inland near Wongan Hills, Northam, Tammin and Narembeen, south-western W.A. Grows in sand in kwongan. Flowers Sept.–Oct.; fruits Nov.–Dec. Map 129.

W.A.: Hill R., *J.S.Beard 1878* (PERTH); 10 km E of Eneabba, *D.B.Foreman 516* (NSW); Coomallo, *E.A.Griffin 5459* (PERTH); Tammin, Sept. 1909, *J.H.Maiden* (NSW); W of Wongan Hills, 2 Oct. 1903, *A.Morrison* (PERTH).

Distinguished especially by the small leaves that are less divided and extend further up the stem than in the other terete-leaved species. Inland specimens have more woody stems. It has often been included in the synonymy of *S. simplex*.

### 7. **Stirlingia simplex** Lindl., *Sketch Veg. Swan R.* xxx (1839)

*Simsia simplex* (Lindl.) F.Muell., *Syst. Cens. Austral. Pl.* 66 (1882). T: Swan River district, W.A., before 1839, *J.Drummond s.n.*; lecto: CGE, *fide* A.S.George, *Fl. Australia* 16: 474 (1995); Swan River, W.A., *D.Toward*; syn: CGE.

*Stirlingia capillifolia* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 70 (1855). T: south-western W.A., 1850–1851, *J.Drummond 6: 173*; iso: CGE, K, NSW, PERTH.

Illustration: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 517 (1989).

Herb with perennial rootstock. Stems few to many, short-lived, to 10 cm long. Leaves mainly basal, crowded, soft; petiole terete, 3–13 mm long; lamina divided up to 7 times into terete, slightly curved lobes; ultimate lobes erect to spreading, 2–20 mm long. Scape 10–60 cm tall, simple or sparingly branched; heads 10–15 mm diam., sometimes slightly elongated; bracts lanceolate, acute, 1.5–2 mm long, glabrous. Perianth 5.5–7 mm long; limb narrower than tube. Nut 2 mm diam., densely silky. Fig. 27.

Occurs in scattered localities from Eneabba to Waroona and east to Hyden, south-western W.A. Grows in sand, gravelly sand, gravelly clay and gravel in kwongan and eucalypt woodland. Flowers late Sept.–early Nov.; fruits Nov.–Dec. Map 130.

W.A.: Bendering, *C.A.Gardner 1830* (PERTH); Yandanooka West Rd, S of Mingenew, *A.S.George 16863B* (CANB, MEL, NSW, PERTH); Greenmount, Darling Ra., 21 Oct. 1908, *A.Morrison* (PERTH); Waroona, *R.D.Royce 3135* (PERTH); 10 km from Pingaring towards Hyden, 10 Nov. 1968, *J.W.Wrigley* (CBG, NSW).

Plants from the Darling Range near Perth have larger flowers than those from elsewhere. Flowers sweetly scented.

**Figure 50.** *Petrophile plumosa*.
Photograph — M.Fagg.

**Figure 51.** *Petrophile serruriae*.
Photograph — M.Fagg.

**Figure 52.** *Petrophile shuttleworthiana* (reproduced with permission).
Photograph — M.Fagg.

**Figure 53.** *Petrophile linearis*.
Photograph — D.Foreman.

**Figure 54.** *Isopogon scabriusculus* subsp. *scabriusculus*.
Photograph — A.George.

**Figure 55.** *Isopogon asper*.
Photograph — M.Fagg.

**Figure 56.** *Isopogon teretifolius* subsp. *teretifolius*.
Photograph — M.Fagg.

**Figure 57.** *Isopogon trilobus* (reproduced with permission).
Photograph — M.Fagg.

**Figure 58.** *Isopogon dubius.*
Photograph — M.Fagg.

**Figure 59.** *Isopogon latifolius.*
Photograph — A.George.

**Figure 60.** *Isopogon gardneri.*
Photograph — A.George.

**Figure 61.** *Conospermum petiolare.*
Photograph — G.Keighery.

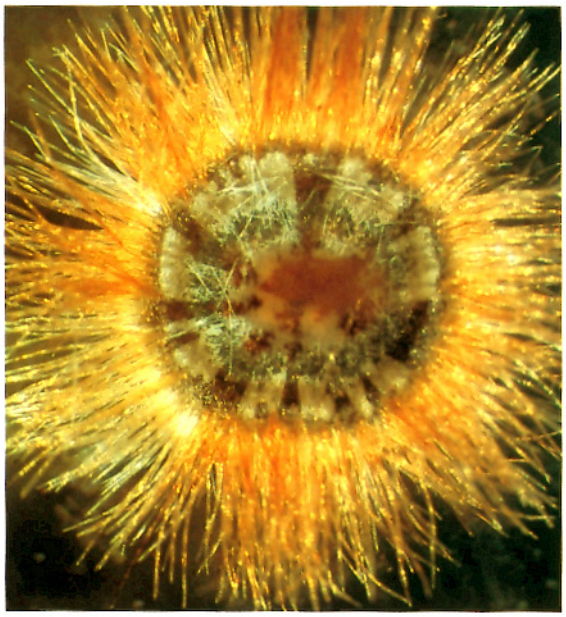


**Figure 62.** *Conospermum multispicatum*.
Photograph — E.Bennett.

**Figure 63.** *Conospermum ephedroides*.
Photograph — E.Bennett.

**Figure 64.** *Conospermum brownii*.
Photograph — E.Bennett.

**Figure 65.** *Conospermum acerosum* subsp. *acerosum*.
Photograph — A.George.

**Figure 66.** *Conospermum wycherleyi* subsp. *glabrum* (in bud).
Photograph — F.Humphreys (ANBG)

**Figure 67.** *Conospermum incurvum*.
Photograph — M.Fagg.

**Figure 68.** *Conospermum crassinervium*.
Photograph — A.George.

**Figure 69.** *Synaphea lesueurensis*.
Photograph — A.George.

**Figure 70.** *Synaphea panhesya.*
Photograph — A.George.

**Figure 71.** *Synaphea floribunda.*
Photograph — A.George.

**Figure 72.** *Synaphea canaliculata.*
Photograph — A.George.

**Figure 73.** *Synaphea spinulosa* subsp. *spinulosa*, narrow-lobed variant.
Photograph — M.Fagg (ANBG).

**Figure 74.** *Franklandia fucifolia*.
Photograph — A.George.

**Figure 75.** *Adenanthos glabrescens* subsp. *glabrescens*.
Photograph — M.Fagg.

**Figure 76.** *Adenanthos obovatus*.
Photograph — M.Fagg.

**Figure 77.** *Adenanthos detmoldii*.
Photograph — M.Fagg.

**Figure 78.** *Adenanthos cuneatus.*
Photograph — M.Fagg.

**Figure 79.** *Adenanthos cygnorum* subsp. *cygnorum.*
Photograph — M.Fagg.

**Figure 80.** *Adenanthos macropodianus.*
Photograph — T.Low.

**Figure 81.** *Sphalmium racemosum.*
Photograph — G.Sankowsky.

## Subtrib. 3. PETROPHILINAE

*Proteaceae* subtrib. *Petrophilinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 171 (1975).

Type: *Petrophile* R.Br. ex Knight

Leaves various, not dichotomous. Inflorescence a dense cone-like head with imbricate, scale-like floral bracts. Flowers actinomorphic, bisexual; bases of tepals connate. Anthers 4, fully developed; loculi of adjacent anthers not closely appressed. Hypogynous glands absent. Style modified as pollen presenter, often with a brush of hairs. Fruit a nut, often with long hairs; endocarp frequently crystalliferous. *n* = 13.

Comprises the extra-tropical Australian endemic genera *Petrophile* and *Isopogon*.

## 10. PETROPHILE

*D.B.Foreman*

*Petrophile* R.Br. ex Knight, C*ult. Prot.* 92 (1809); from the Greek *petra* (a rock) and *phileo* (to love), referring to the rocky habitats from which many of the species were first collected.

Type: *P. pulchella* (Schrad. & Wendl.) R.Br.

*Atylus* Salisb., *Parad. Lond.* 67 (1807) [Description incorporates features of both *Petrophile* and *Isopogon*].

*Petrophila* R.Br., *Trans. Linn. Soc. London* 10: 67 (1810), *orth. var.*

Shrubs. Leaves coriaceous, variable. Inflorescence terminal or axillary, cone-like, globular, ovoid or cylindrical; axis woody, sessile or pedunculate; involucral scales usually present, often deciduous; 'cone' scales broad, becoming hardened, persistent; floral bracts absent. Flowers sessile. Tepals separating from base, falling united or separated. Stamens 4, sessile; connective short. Hypogynous glands absent. Ovary sessile; ovules 1 (rarely 2), pendulous; style filiform, straight; pollen presenter fusiform or distinctly enlarged, basally truncated, terminally brush-like, glabrous or hairy; stigmatic surface glabrous, minute. Fruiting 'cones' persistent, sessile or pedunculate. Fruit a small nut, often compressed, ±ovoid to obovoid; style base ±persistent, usually marginally or basally long-haired, sometimes winged. *Conesticks*. *n* = 13, H.P.Ramsay, *Austral. J. Bot*. 11: 4 (1963).

A genus of 53 species, including 2 subspecies, endemic in extra-tropical Australia. Most species (47) are confined to south-western W.A.

*Petrophila* was widely used before the priority of *Petrophile* was recognised. All but the most recently described species treated here were originally ascribed to *Petrophila*.

The cones of *Petrophile* are derived from the cone scales which subtend each flower and become woody. Thus they are clearly not homologous with those of conifers or Casuarinaceae**.**

A.S.George, *Intr. Proteaceae W. Australia* 94–99 (1984); B.L.Rye, *Petrophile, in* N.G.Marchant *et al.*, *Fl. Perth Reg.* 1: 350–354 (1987); R.M.Sainsbury, *Field Guide Isopogons & Petrophiles* 58–138 (1987); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 498–510 (1989); D.B.Foreman, New species of *Petrophile* R.Br. (Proteaceae) from Western Australia, *Muelleria* 7: 301–310 (1990).

**1** Leaves terete

**2** Leaves undivided

**3** Leaves smooth

**4** Leaves spirally twisted **14. P. helicophylla**

**4:** Leaves straight

**5** Cones and inflorescences pedunculate

**6** Peduncle 2–3 mm long; leaves to 20 cm long; flowers pink or mauve, 17–25 mm long **15. P. teretifolia**

**6:** Peduncle 6–12 mm long; leaves to 13.5 cm long; flowers pink to cream, c. 10–12 mm long **16. P. stricta**

**5:** Cones and inflorescences sessile

**7** Most leaves more than 15 mm long

**8** Leaves terminating in a pungent point to c. 1.5 mm long

**9** Involucral bracts narrow, linear-subulate; flowers 12–20 mm long; leaves to 10 cm long, but usually less than 5 cm long **20. P. brevifolia**

**9:** Involucral bracts broad, ovate to ±elliptic; flowers c. 30 mm long; leaves to 8.5 cm long **21. P. megalostegia**

**8:** Leaves blunt or acute, but without a prominent pungent point

**10** Flowers mauve or pink turning whitish; cones terminal or axillary; pollen presenter to 4.5 mm long; brush densely villous, c. 3 mm long **15. P. teretifolia**

**10:** Flowers cream or yellow; cones terminal; pollen presenter to 4 mm long; brush variously hairy but not densely villous, c. 2 mm long

**11** Cone scales prominently striate; involucral bracts very numerous; flowers c. 10 mm long; leaves 5–18 cm long **18. P. acicularis**

**11:** Cone scales not prominently striate; involucral bracts few to numerous; flowers 15–25 mm long; leaves to 30 cm long

**12** Cone scales often ±reflexed; involucral bracts usually numerous; flowers velvety to villous, 15–20 mm long; leaf tips sometimes with a recurved point **19. P. media**

**12:** Cone scales not reflexed; involucral bracts not numerous; flowers hirsute, c. 25 mm long; leaf tips straight **17. P. longifolia**

**7:** Leaves 6–15 mm long

**13** Flowers glabrous **35. P. phylicoides**

**13:** Flowers villous

**14** Flowers c. 12 mm long, deep creamy yellow to yellow **24. P. arcuata**

**14:** Flowers 17–25 mm long, pink, mauve or whitish **15. P. teretifolia**

**3:** Leaves scabrous, sometimes minutely so

**15** Leaves 15–30 cm long, often curled at the apex or slightly twisted over their entire length **22. P. aspera**

**15:** Leaves to c. 2 cm long, not curled or twisted

**16** Leaves closely appressed to branchlets, less than 10 mm long; tips blunt

**17** Involucral bracts glabrous, acute or acuminate, but not extended into a long thin tip; cone scales often persistently villous at base **23. P. ericifolia**

**17:** Involucral bracts fringed with pale, ferruginous hairs, with a long, thin acuminate tip; cone scales glabrous at old fruit stage **30. P. wonganensis**

**16:** Leaves ±appressed or spreading, to 16 mm long; tips blunt, acute or pungent-pointed

**18** Involucral bracts persisting around the fruiting cone

**19** Involucral bracts cohering and forming a persistent cup-like structure around the cone **27. P. cyathiforma**

**19:** Involucral bracts imbricate, fringed with long white hairs, free from each other, sometimes persisting around the cone **26. P. imbricata**

**18:** Involucral bracts deciduous before fruit matures

**20** Leaves appressed, sometimes ±imbricate

**21** Flowers to 14 mm long

**22** Flowers villous; inflorescence ovoid, to c. 20 mm wide; involucral bracts slightly glutinous; leaves mostly straight **28. P. scabriuscula**

**22:** Flowers pilose to tomentose; inflorescence ±globular, 10–15 mm wide; involucral bracts glutinous; leaves mostly recurved **29. P. recurva**

**21:** Flowers to 20 mm long

**23** Flowers pilose, viscid; pollen presenter c. 4.5 mm long **23. P. ericifolia**

**23:** Flowers villous, not viscid; pollen presenter c. 6 mm long **26. P. imbricata**

**20:** Leaves spreading

**24** Flowers viscid, to 20 mm long; cones ovoid, to 25 mm wide **23. P. ericifolia**

**24:** Flowers not viscid, to 15 mm long; cones usually globose, sometimes ovoid, to 20 mm wide

**25** Leaves very scabrous; flowers to 15 mm long; cones ovoid to globose, to 20 mm wide **25. P. merrallii**

**25:** Leaves almost smooth or minutely scabrous; flowers to 12 mm long; cones globose, to 15 mm wide

**26** Leaves tomentose, minutely scabrous **32. P. misturata**

**26:** Leaves ±glabrous, smooth to very minutely scabrous

**27** Flowers villous, c. 12 mm long; leaves slightly curved, smooth or sparsely and very minutely scabrous, all simple; involucral bracts glabrous inside **24. P. arcuata**

**27:** Flowers hirsute, c. 10 mm long; leaves straight, very minutely scabrous, mostly divided into 3 short lobes, sometimes simple; involucral bracts tomentose inside **33. P. trifurcata**

**2:** Leaves variously divided

**28** Inflorescence and cones pedunculate

**29** Cones to 8 cm long, narrowly ovoid to ovoid; leaves bipinnate or tripinnate **1. P. shirleyae**

**29:** Cones to 4 cm long, ovoid to to globose; leaves forked, or 2- or 3-lobed, or tripinnate, bipinnate, tripinnate, or di- or trichotomous

**30** Cones less than 2 cm long; leaves bipinnate or tripinnate or 3-forked

**31:** Inflorescence few-flowered, globose, c. 8 mm diam.; leaves 3-forked; cones 6–8 mm long **34. P. pauciflora**

**31:** Inflorescence many-flowered, ovoid, c. 10 mm diam.; leaves bipinnate or tripinnate; cones 10–12 mm long **49. P. serruriae**

**30:** Cones to 4 cm long; leaves 2- or 3-lobed or di- or trichotomous

**32:** Flowers sparsely pubescent, 7–10 mm long; leaves di- or trichotomous [N.S.W.] **2. P. pedunculata**

**32:** Flowers silky-villous, 14 cm long; leaves 2- or 3-lobed [W.A.] **44. P. semifurcata**

**28:** Inflorescence and cones sessile

**33** Flowers glabrous

**34** Leaves obtuse at apex, 2–3 times ternately divided **13. P. fastigiata**

**34:** Leaves pungent-pointed, pinnate or divided into 2 or 3 main lobes; pinnae often further divided

**35** Cone scales woolly-tomentose at base; leaves usually divided into 2 to 3 main lobes which are often further divided; pollen presenter not ridged, very shortly and sparsely hairy **12. P. seminuda**

**35:** Cone scales villous at base; leaves pinnate; pinnae further divided 2–3 times; pollen presenter ridged, covered with short, erect hairs **11. P. crispata**

**33:** Flowers variously hairy

**36** Nuts winged

**37** Leaves bipinnate, 4–11 cm long; flowers shortly silky-villous, 20–25 mm long **48. P. divaricata**

**37:** Leaves pinnate, 0.5–2 cm long; flowers densely hairy, to c. 14 mm long **31. P. chrysantha**

**36:** Nuts not winged

**38** Flowers to 40 mm long; leaves slightly glaucous, 2–3-pinnate, to c. 20 cm long **10. P. circinata**

**38:** Flowers to 20 mm long; leaves not glaucous, variously divided, mostly to 11 cm long

**39** Leaves less than 20 mm long

**40** Leaves bipinnate or tripinnate, crowded, never simple **49. P. serruriae**

**40:** Leaves 3-lobed or pinnate, not crowded; some may be simple

**41** Leaves tomentose, simple to pinnate; involucral bracts tomentose to villous on both surfaces; flowers villous, dull yellow **32. P. misturata**

**41:** Leaves ±glabrous, mostly divided into 3 short lobes, sometimes simple; involucral bracts glabrous outside; margin fringed, tomentose inside; flowers hirsute, yellow **33. P. trifurcata**

**39:** Leaves more than 20 mm long

**42** Inflorescence axillary or clustered towards the ends of branchlets

**43** Cones 20 mm or more long; leaves to 9 cm long, divaricate, di- or trichotomous, or bipinnate or tripinnate

**44** Cones to 40 mm long; flowers tomentose or villous, to 15 mm long

**45** Leaves divaricate, di- or trichotomous; cones ovoid, to 40 mm long; flowers tomentose **6. P. multisecta**

**45:** Leaves trichotomous, bipinnate or tripinnate; cones globose, c. 20 mm long; flowers villous **9. P. rigida**

**44:** Cones to 65 mm long; flowers ferruginous-velvety, to 10 mm long **4. P. pulchella**

**43:** Cones 10–12 mm long; leaves to 3.4 cm long, bipinnate or tripinnate **49. P. serruriae**

**42:** Inflorescence terminal

**46** Leaves rigid and pungent-pointed

**47** Involucral bracts glutinous; flowers viscid, c. 20 mm long **8. P. drummondii**

**47:** Involucral bracts not glutinous; flowers not viscid, to c. 15 mm long

**48** Leaves divaricately divided; flowers silky [N.S.W.] **5. P. sessilis**

**48:** Leaves bipinnately divided; flowers villous or hirsute [W.A.]

**49** Branchlets tomentose to woolly, glabrescent; involucral bracts tomentose outside; cones narrowly ovoid to ovoid **7. P. conifera**

**49:** Branchlets glabrous; involucral bracts glabrous outside; cones globose **9. P. rigida**

**46:** Leaves not rigid or pungent-pointed

**50** Inflorescence 10–25 mm long; flowers 9–12 mm long; cones ovoid or sometimes globose, 1.5–4 cm long **3. P. canescens**

**50:** Inflorescence 20–35 mm long; flowers 6–10 mm long; cones ovoid, to 6.5 cm long **4. P. pulchella**

**1:** Leaves flattened

**51** Leaves undivided; margin entire

**52** Leaves plumose, glabrescent **37. P. plumosa**

**52:** Leaves glabrous, or with a sparse covering of fine, spreading hairs

**53** Flowers to 15 mm long, villous to silky, yellow to cream

**54** Leaves to 6.5 cm long, rarely simple; flowers 8–10 mm long **52. P. squamata**

**54:** Leaves to 14 cm long, often or mostly simple; flowers more than 10 mm long

**55** Leaves with acute, very narrowly winged margins, to c. 11 cm long; flowers c.15 mm long **46. P. anceps**

**55:** Leaves with ±rounded margins, not extended into a narrow wing, to 14 cm long; flowers 10–15 mm long **50. P. heterophylla**

**53:** Flowers to c. 30–35 mm long, glabrous, silky to densely villous, yellow, cream to whitish, or pink to grey

**56** Leaves terminating in a pungent-point; flowers c. 3 cm long, yellow to cream **21. P. megalostegia**

**56:** Leaves recurved at apex, obtuse or with a short, straight or curved point; flowers to 3.5 cm long, grey-pink, mauve to almost white **45. P. linearis**

**51:** Leaves variously divided; margin variously toothed

**57** Leaves shortly lobed or toothed, sometimes irregularly so

**58** Leaves less than 3.5 cm long, plumose, glabrescent, with 2–3 short lobes **37. P. plumosa**

**58:** Leaves more than 4 cm long, hirsute and glabrescent or glabrous, irregularly toothed or with 2–5 incurved lobes

**59** Leaves hirsute, 4–9 cm long, irregularly toothed in the upper half; teeth curving backwards **53. P. aculeata**

**59:** Leaves glabrous, 5–12 cm long; teeth triangular, or lobes shortly pungent and incurved

**60** Leaves deeply toothed; teeth triangular; lower teeth sometimes stipule-like **38. P. carduacea**

**60:** Leaves 2–5-lobed; lobes incurved, shortly pungent, not triangular or stipule-like **43. P. incurvata**

**57:** Leaves pinnate or otherwise deeply divided

**61** Leaves glaucous **40. P. glauca**

**61:** Leaves not glaucous

**62** Leaves villous when young, pinnate, bipinnate or tripinnate; juvenile foliage soft and fern-like **39. P. diversifolia**

**62:** Leaves not as above

**63** Cones more than 20 mm long, mostly narrowly ovoid, ovoid, globose or oblong to cylindrical

**64** Involucral bracts, outer cone scales and flowers viscid **36. P. biternata**

**64:** Involucral bracts, outer cone scales and flowers not viscid

**65** Leaves with a well-defined midrib and main veins **42. P. macrostachya**

**65:** Leaves faintly striated or smooth, without a well-defined midrib and main veins

**66** Leaves 3.5–7 cm long, faintly striated, pinnate or deeply trifid; cones 3.5–6 cm long; peduncle c. 14 mm long **41. P. shuttleworthiana**

**66:** Leaves 7–12 cm long, smooth, with 2–5 short, pungent lobes; cones 2–3 cm long; peduncle c. 6 mm long **43. P. incurvata**

**63:** Cones to 20 mm long, mostly ±ovoid

**67** Leaves pinnate or bipinnate; pinnae to 3 mm wide; nut lacking a wing-like margin **47. P. striata**

**67:** Leaves variously lobed, not bipinnate; pinnae more than 3 mm wide; nut flattened, with a wing-like margin

**68** Leaves 14 cm long overall, deeply divided into 2 or 3 lobes **50. P. heterophylla**

**68:** Leaves to c. 6.5 cm long overall, usually shorter, primarily 3-lobed; each lobe often subdivided

**69** Flowers villous, to 22 mm long, grey to pink; central leaf lobe often narrow and pointed **51. P. biloba**

**69:** Flowers sericeous to almost villous, 8–10 mm long, yellow or creamy yellow; central lobe not narrow and pointed **52. P. squamata**

## 1. Petrophile shirleyae F.M.Bailey, *Queensland Bot. Bull.* 2: 17 (1891)

T: Moreton Island, Qld, Nov. 1890, *J.F.Shirley s.n.*; lecto: BRI, *fide* D.B.Foreman, *Fl. Australia* 16: 478 (1995); Fraser Island, Qld, *H.Tryon s.n.*; syn: *n.v.*

Erect shrub 0.3–1.2 m tall. Branchlets and leaves ±glabrous. Leaves 8–20 cm long overall; petiole 3–5 cm long; lamina terete, acute to pungent-pointed, 2–3-pinnate; pinnae 3–6.5 cm long. Inflorescence narrowly ovoid, terminal, pedunculate, solitary or with 2 arising from near the same point, 3–5.5 cm long; peduncle to 4 cm long; involucral bracts few, velvety, glabrescent, broadly ovate, acuminate; cone scales velvety, broadly ovate, acuminate. Flowers to c. 12 mm long, white to pale cream, appressed-silky-pubescent. Pollen presenter fusiform, c. 3.5 mm long, with short, ±erect hairs. Cones ovoid to narrowly ovoid, to c. 8 cm long; peduncle usually 3–4 cm long. Nuts c. 3.5 mm long. Fig. 82A–B.

Occurs in south-eastern coastal districts of Qld; grows in heath and open sclerophyll forest, in sand and sandy soils. Flowers Oct.–Feb. Map 131.

Qld: Stradbroke Is., Moreton Bay, *S.T.Blake 7131* (BRI); c. 6.4 km SW of Cape Moreton, *L.Durrington & G.Batianoff s.n.* (BRI 190306); Beerwah State Forest, c. 71 km N of Brisbane, *R.Melville 7131* (BRI, MEL, NSW); Mt Emu, c. 2 km N of Coolum Beach, *P.R.Sharpe 2467* (BRI); upper Noosa R., 24 km N of Tewantin, *I.R.Telford 3756* (CBG).

Plants are sometimes found with several stems arising from a common rootstock, indicating that this species will regenerate from a lignotuber after fire.

## 2. **Petrophile pedunculata** R.Br., *Trans. Linn. Soc. London* 10: 70 (1810)

T: near Port Jackson [N.S.W.], *R.Brown (Britten 3238)*; lecto: BM; isolecto: BM, NSW, *fide* D.B.Foreman, *Fl. Australia* 16: 476 (1995).

*Petrophile bakersiana* Gand., *Bull. Soc. Bot. France* 66: 226 (1919). T: Picton, N.S.W., Nov. 1896, *R.T.Baker s.n.*; holo: LY, *fide* L.A.S.Johnson & D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 350 (1973).

*Petrophile obtusifida* Gand., *Bull. Soc. Bot. France* 66: 226 (1919). T: Wingello, N.S.W., Dec. 1899, *C.Walter s.n.*; lecto: LY, *fide* L.A.S.Johnson & D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 351 (1973); isosyn: NSW.

Erect, spindly to bushy shrub to 2.5 m tall. Branchlets and leaves glabrous. Leaves 7–18.5 cm long overall; petiole 2.5–9.5 cm long; lamina terete, dichotomous to trichotomous; pinnae usually less than 20 mm long, occasionally to 6 cm long. Inflorescence ovoid, axillary, pedunculate, 10–15 mm long; peduncle pubescent, 12–15 mm long; involucral bracts acute to acuminate, some persisting; cone scales pubescent, ±rhomboid to ±broadly ovate, acute. Flowers 7–10 mm long, yellow or cream, sparsely pubescent. Pollen presenter fusiform, 2–3 mm long, shortly and sparsely hairy. Cones ovoid, to 4 cm long; peduncle c. 20 mm long. Nuts 3–4.5 mm long. Fig. 82F.

Frequent throughout the central and southern coast and the central tablelands of N.S.W.; grows in dry sclerophyll forest, often on sandstone or in gravelly clays. Stunted forms may be found in swampy areas. Flowers Oct.–Jan. Map 132.

N.S.W.: near Edith Falls, Woodford, *R.G.Coveny 2953* (CANB); near Picton Lakes, 8.1 km SW of Picton, *R.G.Coveny 3409* (NSW); Penrose State Forest, 21 km NE of Marulun, *J.Everett 495* (NSW); c. 6.5 km WSW of Bundanoon, *D.J.McGillivray 1431* (NSW); Carrington Falls, Kangaroo R., 6 km SE of Robertson, *H.Streimann 8083* (CBG).

Isolated hybrid plants or hybrid intergrading plants or populations occur where *P. pedunculata* is found in association with *P. pulchella*.

## 3. **Petrophile canescens** A.Cunn. ex R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 6 (1830)

*Petrophile pulchella* var. *canescens* (A.Cunn. ex R.Br.) Domin, *Biblioth. Bot.* 89: 24 (1921). T: ora orient., Moreton Bay [Qld], 1827, *A.Cunningham s.n.*; *n.v.*

Erect shrub 2–3 m tall. Branchlets and leaves hoary to ±silky, glabrescent. Leaves 3–11 cm long overall; petiole 2–5 cm long; lamina terete, pinnately divided, not rigid; pinnae usually divided once or twice, acute or obtuse, 2–18 mm long. Inflorescence ovoid, terminal, sessile, solitary or in clusters of 2–4, 10–25 mm long; involucral bracts ±hairy on both surfaces, narrowly triangular, acute; cone scales ferruginous-velvety, glabrescent, broadly ovate, acuminate. Flowers 9–12 mm long, white to pale cream, appressed-silky. Pollen presenter fusiform, c. 3–4 mm long, with short, ascending hairs. Cones ovoid or sometimes globose, 15–40 mm long. Nuts c. 3 mm long. Fig. 82E.

Occurs from Blackdown Tableland and Carnarvon Gorge in Qld to the north coast, north-west slopes and the northern, central and southern tablelands of N.S.W.; grows in dry sclerophyll forest, sandy heath and *Eucalyptus* forest in sandy soils derived from granite or sandstone. Flowers Sept.–Jan. Map 133.

Qld: Mt Moffatt, Carnarvon Gorge, Feb. 1944, *N.Geary* (BRI); Blackdown Tableland, c. 32 km SE of Blackwater, *R.J.Henderson 00620, S.B.Andrews & P.Sharpe* (BRI). N.S.W.: Rocky Ck, 30 km N of Grafton, on Coaldale road, *D.B.Foreman 922* (MEL); Girraween Natl Park, 3 km E of Information Centre, *J.H.Ross 3112* (MEL); Braidwood–Jinglemoney road, near turn-off to Little Bombay, S of Braidwood, *L.A.S.Johnson s.n.* (NSW 191482).

Intergrades between *P. canescens* and *P. pulchella* occur where the two species are found together, e.g., the central tablelands of N.S.W. *Petrophile canescens* has been observed to regenerate from a lignotuber after fire.

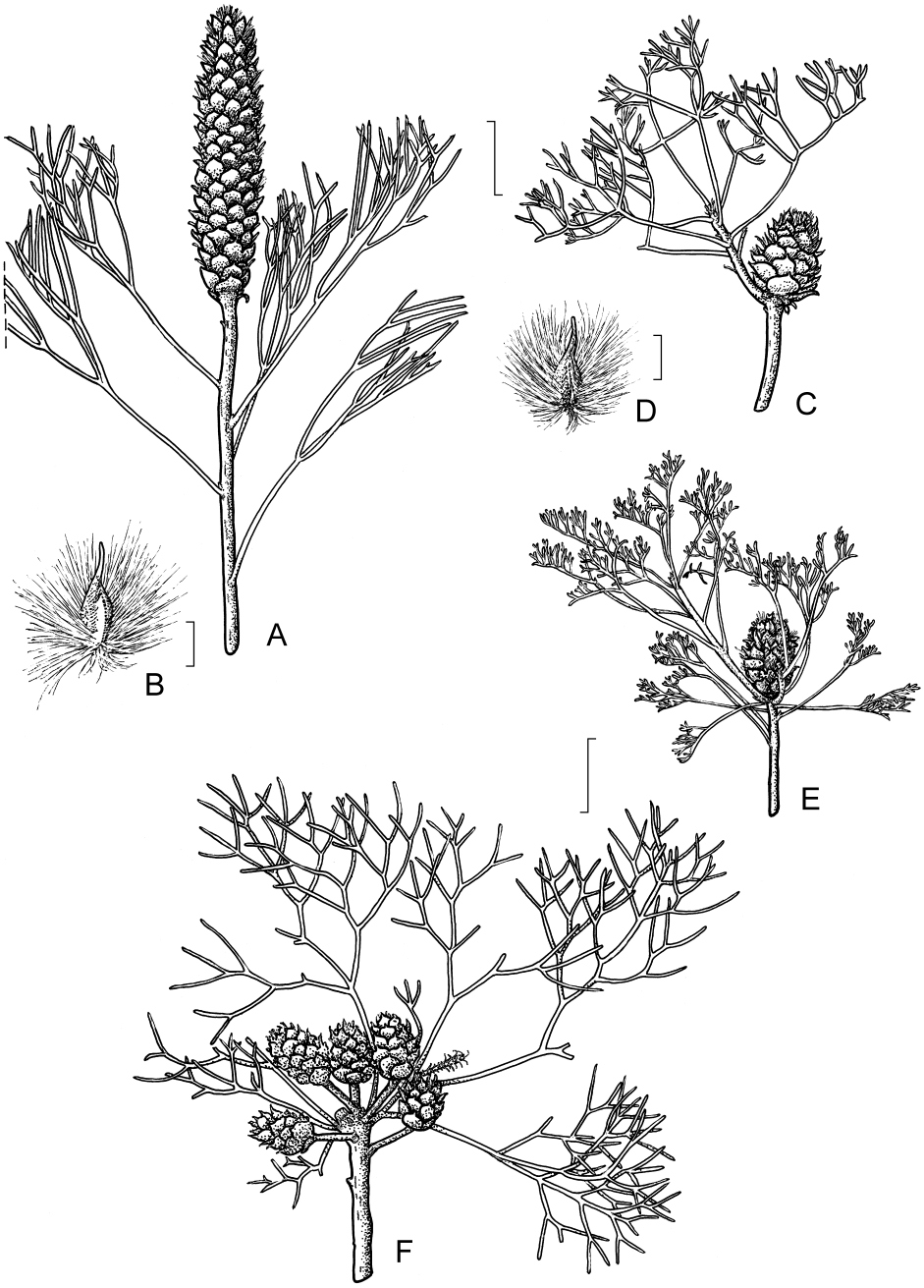



**Figure 82**. *Petrophile*. **A–B**, *P. shirleyae*. **A**, fruiting branchlet; **B**, abaxial view of nut (**A–B**, R.Melville 3546, MEL). **C–D**, *P. sessilis*. **C**, fruiting branchlet; **D**, adaxial view of nut (**C–D**, Royal Natl Park, N.S.W., A.Petrie, MEL). **E**, *P. canescens*, fruiting branchlet (J.Ross 3112, MEL). **F**, *P. pedunculata*, fruiting branchlet (Marulan, N.S.W., E.Gauba, MEL). Scale bars: **A**, **C**, **E**, **F** = 2 cm; **B**, **D** = 2 mm. Drawn by P.Cooper.

**4. Petrophile pulchella** (Schrad. & Wendl.) R.Br., *Trans. Linn. Soc. London* 10: 69 (1810)

*Protea pulchella* Schrad. & Wendl., *Sert. Hann.* 1(2): 15, t. 7. (1796). T: Botany-bay [N.S.W.], 1803, *R.Brown (Britten 3240)*; syn: BM.

*Protea fucifolia* Salisb., *Prodr. Stirp. Chap. Allerton.* 48 (1796); *Atylus fucifolia* (Salisb.) Salisb., *Parad. Lond.* 66 (1807); *Petrophile fucifolia* (Salisb.) Knight, *Cult. Prot.* 92 (1809). T: Port Jackson [N.S.W.], *auct. J.Lee*; *n.v.*

*Protea dichotoma* Cav., *Anal. Hist. Nat.* 1: 239 (1800). T: entre Port Jackson y la Bahía-botánica [N.S.W.]; *n.v.*

Shrub 1.5–3 m tall. Branchlets and leaves pubescent, glabrescent. Leaves ±erect, 4–9 cm long overall; petiole 3–5 cm long; lamina terete, 2–3-pinnate; pinnae acute, usually less than 10 mm long, occasionally to 30 mm long. Inflorescence ovoid, terminal, axillary, sessile or with a peduncle to c. 6 mm long, solitary, or several clustered together, sessile, 20–35 mm long; involucral bracts few, lanceolate; cone scales acuminate, becoming ±cuneate, ferruginous-velvety. Flowers 6–10 mm long, cream, silky-pubescent. Pollen presenter fusiform, to 3 mm long, with short, sparse, erect hairs, fusiform. Cones ovoid, to 6.5 cm long. Nuts 3–4 mm long. Fig. 30.

Frequent throughout the north, central and south coast and central tablelands of N.S.W. and extending into south-eastern Qld; grows in dry sclerophyll forest and heathland in sandy and clay soils. Flowers Aug.–Mar. (occasionally in Apr., May and July). Map 134.

Qld: walking tracks to Twin Falls, Springbrook Mtns, c. 30 km SSW of Southport, *V.Jaegerman 313* (AD). N.S.W.: along Kaliana Ridge, Yadboro State Forest, Budawang Ra., *E.M.Canning 924* (CBG); 3.2 km NNE of Wisemans Ferry, on Old North Rd, *L.A.S.Johnson* (NSW 89347); Tianjara Falls, SW of Nowra, *D.Verdon 55* (CBG).

Apparent hybrids with *P. pedunculata* occur on the central coast, south coast and central tablelands of N.S.W. Intermediates with *P. canescens* also occur in areas of the central tablelands of N.S.W.

**5. Petrophile sessilis** Sieber ex Schult. *in* J.A. & J.H.Schultes, *Mant.* 3: 26 (1827)

*Petrophile pulchella* var. *sessilis* (Sieber ex Schult.) Domin, *Biblioth. Bot.* 89: 24 (1921). T: New Holland [Australia], *F.W.Sieber 21*; syn: MEL 1534426, 1534427.

Erect shrub to 3 m tall. Branchlets and leaves glabrous or minutely hairy, almost silky when young. Leaves rigid, terete, acute, divaricately-divided, 3.8–10 cm long; pinnae pungent, usually less than 10 mm long, occasionally to 30 mm long. Inflorescence ovoid, terminal, sessile, solitary or sometimes 2 occurring beneath terminal inflorescence, 20–25 mm long; involucral bracts broadly ovate, acuminate, ferruginous-velvety, glabrescent; cone scales broadly ovate, acute, shortly villous. Flowers usually c. 14 mm long, creamy yellow, silky. Pollen presenter fusiform, c. 2.5 mm long, with short hairs. Cones ovoid, to 35 mm long. Nuts c. 3 mm long. Fig. 82C–D.

Confined to an area from the central coast to the central and southern tablelands of N.S.W.; grows in dry sclerophyll forest, in open woodland and in low heath scrub, in sandy and rocky soils. Flowers May–Feb. Map 135.

N.S.W.: 1 km along Heathcote Rd from New Illawarra Rd junction, *P.Hind 5423* (MEL, NSW); Royal Natl Park, Jun. 1923, *A.H.K.Petrie* (MEL); 1 km from Danjera Dam, Yalwal State Forest, *T.James 56 & R.G.Coveny* (MEL, NSW).

**6. Petrophile multisecta** F.Muell., *Fragm.* 6: 242 (1868)

T: near Wallans Hut, Kangaroo Is., S.A., *F.G.Waterhouse s.n.*; syn: MEL.

Illustration: J.P.Jessop & H.R.Toelken, *Fl. S. Australia* 4th edn, 1: 154, fig. 80 (1986).

Densely branched shrub to 60 cm tall. Branchlets densely grey-puberulent. Leaves 4–8 cm long overall; petiole 2–5 cm long; lamina divaricate, terete, rigid, glabrous; first branches trichotomous; later branches dichotomous; pinnae pungent, 2–10 mm long. Inflorescence ovoid to globose, axillary, solitary, sessile, 20–25 mm long; involucral bracts lanceolate,

acuminate, glabrous outside, sericeous inside; cone scales broad, circular, prominently acuminate, sericeous, becoming partly glabrous towards tip. Flowers 8–15 mm long, cream, tomentose. Pollen presenter fusiform, 2.5–3.5 mm long, hirsute. Cones ovoid, to 4 cm long. Nuts c. 3 mm long. Fig. 83F.

Endemic in Kangaroo Is., S.A.; grows in lateritic and calcareous sands. Flowers Oct.–Feb. Map 136.

S.A.: Kangaroo Is., c. 11 km E of Kelly Hill, *Hj.Eichler 15410* (AD); lower slopes of W side of Mt Taylor, *G.Jackson 720* (AD); 12 km E of Cape Borda, *R.Schodde 534* (AD).

Reported to regrow from a lignotuber after fire; young foliage coppery red.

### 7. Petrophile conifera Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 67 (1855)

T: Murchison R. [W.A.], *J.Drummond 6: 167*; syn: MEL.

Bushy, rigid, much-branched shrub 0.3–1.5 m tall. Branchlets tomentose to ±woolly, glabrescent. Leaves 4–11 cm long overall; petiole 2–5 cm long; lamina pinnate, rigid, terete, pungent, usually divided 2 or 3 times, glabrous; pinnae often divaricate, 4–35 mm long. Inflorescence ovoid, terminal, solitary, sessile, 20–30 mm long; involucral bracts ±tomentose outside, sericeous inside, lanceolate-acuminate, deciduous; cone scales sericeous, becoming partly glabrous towards tip, acuminate, becoming broad and rounded. Flowers 8–15 mm long, cream, creamy yellow or yellowish white, sometimes tinged with green, hirsute. Pollen presenter fusiform or narrowly ovoid, c. 4 mm long, yellow, sparsely hirsute. Cones narrowly ovoid to ovoid, 10–30 mm long. Nuts c. 3–4 mm long. Fig. 83A.

Common north of Geraldton, W.A., especially from the Kalbarri/Murchison River area to near Mullewa; grows on sandplains and in scrubby heath. Flowers Aug.–Oct. Map 137.

W.A.: c. 0.5 km S of Murchison River Gorge, *R.Filson 8650* (MEL); on the Yerina Springs Rd, c. 44 km NW of Northampton, *D.B.Foreman 612* (MEL); Kalbarri Natl Park, 2 km from the The Loop Lookout, Murchison R., *D.B.Foreman 627* (MEL); 3 km along the Howatharra road from Brand Hwy, *C.E.Woolcock P13* (MEL).

### 8. Petrophile drummondii Meisn. *in* J.G.C.Lehmann, *Pl. Priess.* 1: 496 (1845)

T: locality not stated [Swan R. district, W.A., Sept. 1839], *J.Drummond 1: 570*; syn: MEL.

*Petrophile triternata* Kippist ex Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 67 (1855). T: locality unknown [W.A.], *J.Drummond 5, suppl. 2*; syn: MEL.

Shrub to 1.2 m tall. Branchlets and leaves glabrous or pubescent when young. Leaves 20–50 mm long overall; petiole 10–26 mm long; lamina terete, 2–3-times ternately-divided or pinnate, rigid, pungent; lower pinnae 2–3-divided, 20–50 mm long overall; ultimate pinnae to 20 mm long. Inflorescence globular, terminal, solitary, sessile, c. 3–4 cm long; involucral bracts numerous, glutinous, ovate-lanceolate, deciduous, glabrous; cone scales broad, woolly-villous at base; tip acuminate, becoming obtuse, glabrous. Flowers c. 20 mm long, yellow, shortly villous, viscid, fragrant. Pollen presenter fusiform, c. 5 mm long, orange, hirsute. Cones ±ovoid, 25–30 mm long. Nuts c. 4 mm long. Fig. 83B.

Scattered throughout Irwin and Avon districts, W.A.; grows in low, closed heath in sandy laterite and in pale bleached or deep grey sand; also in sandheath shrubland in grey to light brown sand. Flowers Aug.–Dec. Map 138.

W.A.: on Brand Hwy, 11–14 km N of Eneabba, *D.B.Foreman 506* (CANB, MEL, PERTH); 3 km N of Arrowsmith R., *M.G.Corrick 8101* (HO, MEL, PERTH); No. 2 Rabbit Fence, c. 3 km S of Old York Rd, *B.H.Smith 774* (CANB, CHR, MEL); 15 km W of Coomerdale, *D.J.E.Whibley 4949* (AD).

### 9. Petrophile rigida R.Br., *Trans. Linn. Soc. London* 10: 69 (1810)

*Protea rigida* (R.Br.) Poir. *in* J.B.A.P. de M. de Lamarck, *Encycl.*, Suppl. 4: 559 (1816), *nom. inval.* T: Lewins Land [W.A.], 1802–5, *R.Brown (Britten 3241)*; lecto: BM; syn: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 477 (1995); Cunningham in King's 1st Voyage no. 47 [W.A.]; lectopara: BM.

Divaricate shrub to c. 1.5 m tall. Branchlets and leaves glabrous. Leaves 3–8.5 cm long overall; petiole 12–34 mm long; lamina trichotomous, bipinnate or tripinnate, terete, rigid,

pungent; ultimate pinnae variable, usually 1–2 (–25) mm long. Inflorescence ±globose, terminal or axillary, solitary, sessile, c. 25 mm long; involucral bracts lanceolate, acuminate, glabrous outside, silky inside, deciduous; cone scales broad, acuminate to acute, silky-villous at base; tip glabrous. Flowers c. 15 mm long, cream with a yellow apex, villous. Pollen presenter fusiform, c. 4 mm long, yellow, sparsely hirsute. Cones globose, c. 20 mm long. Nuts c. 3.5 mm long. Fig. 83C.

Scattered from near Regans Ford to around the Stirling Range and extending to the Fitzgerald River Natl Park, W.A.; grows in heath in sand, with *Banksia* and *Nuytsia*. Flowers Sept.–Oct. Map 139.

W.A.: Dillon Bay, SW of Bremer Bay, *M.G.Corrick 7704* (MEL); Upper King R., 28 Oct. 1946, *W.H.Nicholls* (MEL); Cheyne Beach, 5 Feb. 1970, *W.H.Butler* (PERTH); c. 10 km S of South Bluff, Stirling Ra., *R.J.Hnatiuk 761440* (PERTH).

### **10. Petrophile circinata** Kippist ex Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 67 (1855)

T: [W.A.], *J.Drummond 5, suppl. 3*; syn: MEL.

Spreading, prickly, ground-hugging shrub, mostly 25–80 cm tall, occasionally to 1.2 m tall and wide. Branchlets hoary to almost villous when young, glabrescent. Leaves to 20 cm long overall; petiole to c. 13 cm long; lamina terete, 2–3-pinnate, pungent, glabrous, slightly glaucous; pinnae 5–22 mm long. Inflorescence ±globular, appearing flattened when perianths extend, terminal, sessile, c. 25 mm diam.; involucral bracts prominent, numerous, broad, acuminate, coriaceous, often over 20 mm long, ±hoary outside, silky-villous inside, persisting; cone scales linear to narrowly ovate, minutely hairy. Flowers c. 40 mm long, white, yellow or cream, villous. Pollen presenter fusiform, c. 3 mm long, yellow, shortly and sparsely hairy. Cones ±globular, c. 4 cm diam. Nuts c. 8 mm long . Figs 31, 83D–E.

Scattered over a comparatively wide area from the Tutanning Reserve east of Pingelly, to near Boorabbin and south to the area around Lake Grace and Lake King, W.A.; grows in low shrubland in yellow, white and grey sand, gravel or laterite; also in scrub and heath, in low open mallee and in eucalypt woodland. Flowers June–Nov. Map 140.

W.A.: Tutanning Reserve, c. 30 km E of Pingelly, *M.G.Corrick 8433* (MEL); 50 km N of South Coast Hwy, on Old Ravensthorpe road, *D.B.Foreman 1197* (CANB, MEL, NSW, PERTH); 14 km N of Bungalbin Hill, c. 65 km NNE of Koolyanobbing, *K.Newbey 5924* (PERTH); c. 30 km N of Hopetoun, on road to Ravensthorpe, *D.B.Foreman 1210* (AD, CANB, MEL, NSW, PERTH); c. 19 km N of Esperance, *W.E.Blackall 1069* (PERTH).

New leaf growth is reported to be pink in colour. Bentham (1870) reported the cone scales to be 'apparently deciduous', but on the fruiting specimens seen by me they are persistent, but not as woody as in some other species.

### **11. Petrophile crispata** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 6 (1830)

T: ora occid.-merid., King George's Sound [W.A.], 1828–29 [1829], *W.Baxter s.n.*; syn: BM.

Shrub to c. 0.8 m tall. Branchlets minutely pubescent, glabrescent. Leaves 4–11 cm long overall; petiole 2–4.5 cm long; lamina pinnate, terete, pungent, rigid, glabrous; pinnae divided 2–3 times, variable, 6–40 mm long. Inflorescence ovoid, terminal, solitary, sessile, to c. 20 mm long; involucral bracts ovate, acuminate, deciduous, glabrous outside, villous inside; cone scales acute to acuminate, becoming obtuse, villous; tip glabrous. Flowers c. 10 mm long, yellow, glabrous. Pollen presenter ridged, fusiform, c. 3 mm long, with short, erect hairs. Cones ovoid, 15–25 mm long. Nuts c. 3 mm long.

Scattered from west of Cranbrook to Cheyne Bay and north to near Woodanilling, W.A.; |grows in shrubland and open woodland, in laterite and in sand over laterite. Flowers Sept.–Nov. Map 141.

W.A.: Gordon Inlet Rd, Fitzgerald River Natl Park, *D.B.Foreman 1385* (MEL, PERTH); Cheyne Bay, *D.B.Foreman 1423* (MEL); Stirling Range Natl Park, 23 Sept. 1985, *W.Huggins* (MEL).

Bentham's description, *Fl. Austral.* 7: 334 (1870), of the flowers of *P. crispata* as being villous appears to have been based on incomplete, misidentified material that I have now determined to be *P. drummondii*. This has lead to some confusion as to the identity of *P. crispata* which, from recent collections is known to have glabrous flowers not unlike those of *P. seminuda*.

### 12. Petrophile seminuda Lindl., *Sketch Veg. Swan R.* xxxiv (1840)

T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; lecto: CGE, *fide* D.B.Foreman, *Fl. Australia* 16: 477 (1995); Swan River district [W.A.], date unknown, *D.Toward 42*; syn: CGE.

*Petrophile seminuda* var. *indivisa* Benth., *Fl. Austral.* 5: 333 (1870). T: locality unknown [W.A.] Dec. 1870; *J.Drummond s.n.*; syn: K, MEL.

*Isopogon pedunculatus* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 5 (1830). T: Swan River [W.A.], 1827, *C.Fraser 8*; syn: BM.

Shrub to 1.2 m tall. Branchlets and leaves glabrous, rarely puberulous. Leaves 3–12.8 cm long overall; petiole 14–40 mm long; lamina terete, usually divided into 2 or 3 main lobes which are often further divided, rigid, pungent; pinnae variable, 5–50 mm long. Inflorescence globular or ovoid, terminal, sessile, 10–20 mm long; involucral bracts numerous, ±ovate-lanceolate, acute or acuminate, glabrous outside, densely hairy inside; cone scales broad, woolly-tomentose at base; tips glabrous, deciduous. Flowers 8–12 mm long, yellow, glabrous. Pollen presenter fusiform, c. 3 mm long, yellow, very shortly and sparsely hairy. Cones ovoid or almost globular, 10–40 mm long. Nuts c. 5 mm long.

Widely distributed from near Geraldton to the Fitzgerald River Natl Park on the Darling Range to near Southern Cross, W.A.; grows in disturbed, open woodland, in shrubland and heathland in laterite, in low shrubland in brownish sandy soil and on sandplain. Flowers Sept.–Nov. Map 142.

W.A.: Carnamah Rd, 14 km E of Eneabba, *D.B.Foreman 522* (MEL, PERTH); Dumbleyung–Katanning road, 23 km S of Dumbleyung, *D.B.Foreman 733* (CANB, MEL, NSW, PERTH); c. 257 km N of Perth, on Geraldton Hwy, between Watheroo and Coorow, *W.E.Blackall 2573* (PERTH); 23 km W of L. Cronin, c. 60 km E of Hyden, *K.Newbey 6215* (PERTH); c. 10 km S of South Bluff, Stirling Ra., *R.J.Hnatiuk 761412* (PERTH).

Young foliage has a distinctive reddish brown colour.

### 13. Petrophile fastigiata R.Br., *Trans. Linn. Soc. London* 10: 70 (1810)

*Protea fastigiata* (R.Br.) Poir. *in* J.B.A.P. de M. de Lamarck, *Encycl.*, Suppl. 4: 559 (1816), *nom. inval.* T: in Novae Hollandiae ora australi, Lewin's Land [W.A.], *R.Brown (Britten 3239)*; syn: BM.

Erect shrub to 1.5 m tall. Branchlets glabrous or slightly tomentose. Leaves erect, to c. 11 cm long overall; petiole 2–5 cm long; lamina terete, 2 or 3 times ternately divided, ±obtuse, glabrous. Inflorescence ovoid, terminal, sessile, viscid; involucral bracts numerous, imbricate, broadly triangular, deciduous, glabrous outside, silky inside; cone scales broad, ±circular, woolly at base. Flowers c. 10 mm long, yellow to cream, glabrous. Pollen presenter fusiform, c. 3 mm long, yellow, shortly hirsute. Cones ovoid, 20–40 mm long. Nuts c. 5 mm long. Fig. 83G–I.

Occurs in an area extending from near Ravensthorpe to Mt Burdett, north-north-east of Esperance, W.A.; grows in open mallee scrub in gravelly clay soil; also in shrubland, in open scrub in laterite and in low open heath in light grey-brown sandy silt. Flowers Sept.–Nov. Map 143.

W.A.: Elverdton Rd, 3 km from junction with Ravensthorpe–Hopetoun road, SE of Ravensthorpe, *M.G.Corrick 9576* (MEL); c. 30 km N of Hopetoun, on road to Ravensthorpe, *D.B.Foreman 1210 (*AD, CANB, MEL, NSW, PERTH); 19 km N of Esperance, *W.E.Blackall 1069* (PERTH).

The new leaf growth has a distinctive bronze-red colour.

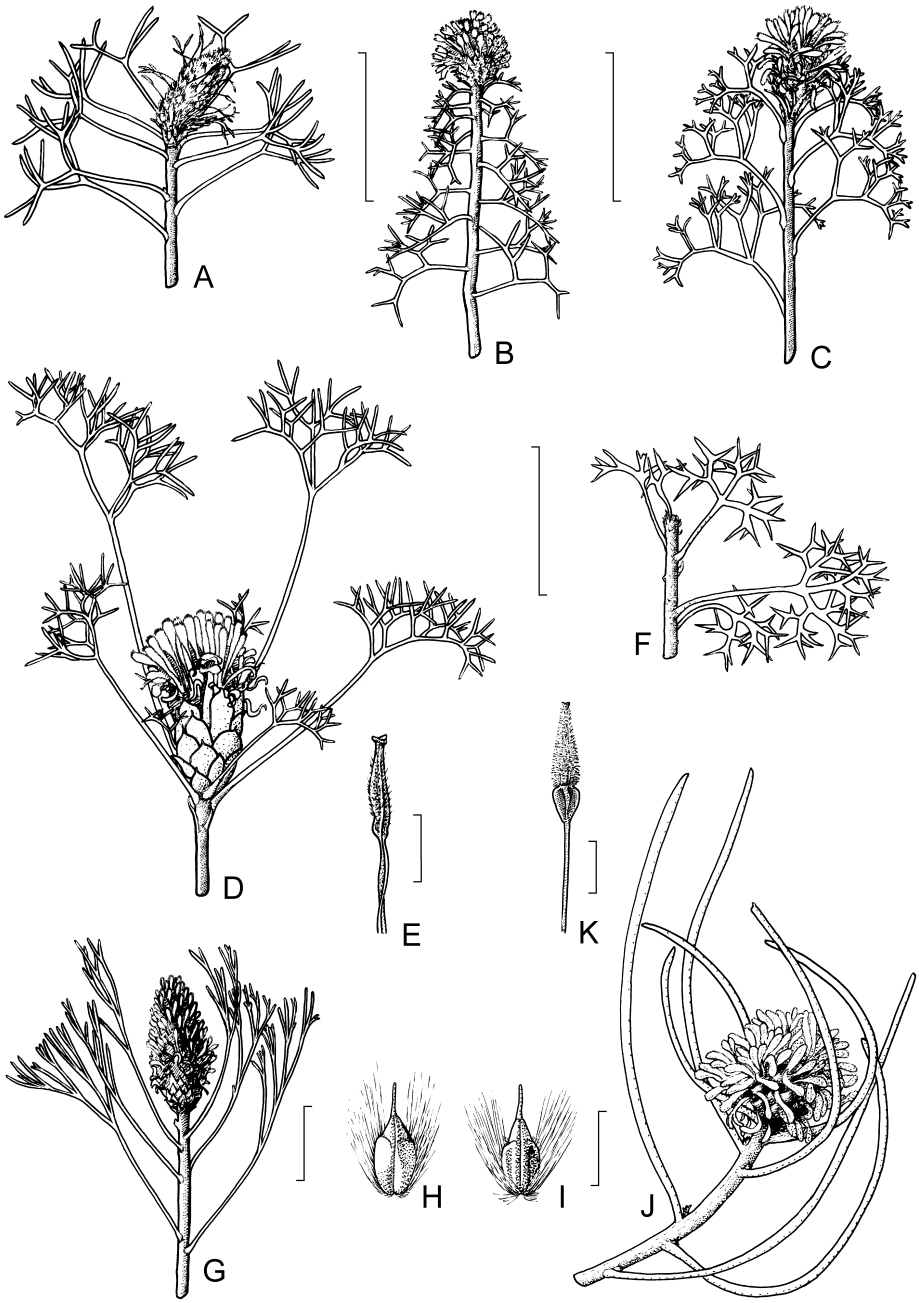



**Figure 83**. *Petrophile*. **A**, *P. conifera*, flowering branchlet (D.Foreman 627, MEL). **B**, *P. drummondii*, flowering branchlet (D.Foreman 506, MEL). **C**, *P. rigida*, flowering branchlet (Upper King R., W.A., W.Nicholls, MEL). **D–E**, *P. circinata*. **D**, flowering branchlet; **E**, pollen presenter (**D–E**, B.Smith 530, MEL). **F**, *P. multisecta*, leaves (1 km N of Flour Cask Bay, Kangaroo Is., S.A., D.Kraehenbuel, MEL). **G–I**, *P. fastigiata*. **G**, flowering branchlet; **H**, adaxial view of nut; **I**, abaxial view of nut (**G–I**, M.Corrick 9576, MEL). **J–K**, *P. teretifolia*. **J**, flowering branchlet; **K**, pollen presenter (**J–K**, A.Ashby 2741, MEL). Scale bar: **A–D**, **F** = 4 cm; **E**, **K** = 2 mm; **G**, **J** = 2 cm; **H**, **I** = 5 mm. Drawn by P.Cooper.

### 14. Petrophile helicophylla Foreman, *Muelleria* 7: 301 (1990)

T: 50 km N of South Coast Hwy, on Old Ravensthorpe Rd, W.A., 23 Nov. 1985, *D.B.Foreman 1195*; holo: MEL; iso: AD, CANB, MEL, NSW, PERTH.

Illustration: D.B.Foreman, *op. cit.* 302, fig. 1.

Prostrate, spreading shrub to c. 30 cm tall. Branchlets and leaves glabrous. Leaves 15–30 cm long, terete, acute, spirally twisted, smooth. Inflorescence terminal, sessile or pedunculate, to 25–30 mm long; peduncle 6–12 (–18) mm long; involucral bracts few, subulate, glabrous; cone scales ±circular to broadly ovate, glabrous; apices acute. Flowers c. 35 mm long, white, creamy white, pale cream-pink to pale pink, villous. Pollen presenter c. 6–8 mm long, turbinate below the brush; brush c. 4.5 mm long, yellow, villous. Cones ±globose to ellipsoidal, 15–25 mm long; peduncle mostly to c. 12 mm long, occasionally longer. Nuts c. 2–2.8 mm long. Fig. 28.

Scattered in the sandy heathlands north-west of Ravensthorpe and north-east of Jerramungup, W.A.; grows in low heath in sandy clay, near salt pans; also in heath in white sand and laterite, in low scrub in sand and in tall, open woodland in well-drained, deep white sand. Flowers Oct.–Feb. Map 144.

W.A.: c. 22.5 km W of Phillips R., *A.S.George 7312* (MEL, PERTH); c. 53 km E of Pingrup, *A.S.George 7328* (PERTH); 15 km N of Ravensthorpe–Ongerup road, on Koornong Rd, *N.S.Lander 1092* (PERTH); 15 km NNE of Jerrammungup, *K.Newbey 4604* (MEL, PERTH); c. 17.5 km SE of L. King crossroads on Ravensthorpe Rd, *A.S.George 10498* (PERTH).

### 15. Petrophile teretifolia R.Br., *Trans. Linn. Soc. London* 10: 68 (1810)

*Protea teretifolia* (R.Br.) Poir. *in* J.B.A.P. de M. de Lamarck, *Encycl.*, Suppl. 4: 559 (1816), *nom. inval.* T: Lucky Bay, New Holland [W.A.], Jan. 1802, *R.Brown s.n.*; lecto: BM; isolecto: BM, ?NSW; syn: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 478 (1995).

*Petrophile crassifolia* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 5 (1830). T: ora occidentali-meridionalis, King George's Sound [W.A.], 1828–29 [1829], *W.Baxter s.n.*; syn: BM.

Erect or spreading shrub 0.6–2 m tall. Branchlets and leaves glabrous. Leaves 4–20 cm long, simple, terete, blunt to shortly acute, smooth. Inflorescence globose to ovoid, terminal or axillary, sessile, or shortly pedunculate, c. 15 mm long; peduncle 2–3 mm long; involucral bracts few; outer bracts subulate to lanceolate; inner bracts becoming broader; cone scales broad, ±circular, ±acuminate, glabrous except at base, or sometimes shortly ciliate. Flowers 17–25 mm long, pink to mauve, turning whitish, villous. Pollen presenter c. 4.5 mm long, turbinate below the brush; brush c. 3 mm long, yellow, densely tomentose-villous. Cones ±globose, ovoid to ±elliptic, 15–25 mm long; peduncle (if present) 2–3 mm long. Nuts c. 3 mm long. Fig. 83J–K.

Common from near the Stirling Range to Israelite Bay, W.A.; grows on granite outcrops, and in sandplain scrub and heath in white to greyish sand, low shrubland in yellow to white sand and laterite, shrubland in medium brown deep sand or fine sandy silt. Flowers Sept.–Jan. Map 145.

W.A.: near foot of Mt Ragged, SW of the mountain, on track to Balladonia, *Hj.Eichler 20410* (AD); Chillinup Rd, c. 10 km S of Stirling Range Natl Park, *D.B.Foreman 1454* (AD, CANB, MEL, NSW, PERTH); Coramup Hill area, c. 30 km NE of Esperance, *P.S.Short 2333 & L.Haegi* (AD, MEL, PERTH); 22.5 km E of Mt Ragged Rd junction, on road to Israelite Bay, *D.B.Foreman 1314* (CANB, MEL, NSW, PERTH); S of Ongerup, *A.M.Ashby 2741* (AD).

### 16. Petrophile stricta C.A.Gardner ex Foreman, *Muelleria* 7: 307 (1990)

T: c. 40 km N of Hyden on Mt Walker South Rd, W.A., 22 Nov. 1985, *D.B.Foreman 1164*; holo: MEL; iso: NSW, PERTH.

Illustration: D.B.Foreman, *op. cit.* 308, fig. 5.

Erect, spreading shrub 0.6–1.6 m tall. Branchlets and leaves glabrous. Leaves simple, terete, shortly pungent, 4.5–13.5 cm long. Inflorescence ovoid, terminal, pedunculate, to c. 20 mm long; peduncle 6–12 mm long; involucral bracts linear, deciduous; cone scales broad, velvety; tips acuminate, glabrous. Flowers c. 10–12 mm long, pink to cream, villous. Pollen

presenter fusiform, c. 5 mm long, covered with short, stiff hairs. Cones ovoid to narrowly ovoid, 20–47 mm long; peduncle to c. 12 mm long. Nuts c. 4 mm long.

Found mainly in drier parts of inland south-western W.A.; grows in mixed sclerophyll scrub in sandy soil, in shrubland in yellow sand over laterite and in open scrub in well-drained, deep, yellow sand. Flowers Oct.–Dec. Map 146.

W.A.: Mt Holland Rd, S of Southern Cross, *W.E.Blackall 1253* (PERTH); c. 40 km N of Hyden, on Mt. Walker South Rd, *D.B.Foreman 1163* (CANB, MEL, PERTH, TNS); c. 22 km W of Boorabbin, *A.S.George 6038* (PERTH); 130 km WSW of Kalgoorlie, *D.J.E.Whibley 4692* (PERTH).

### 17. Petrophile longifolia R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 5 (1830)

T: ora occid.-merid., King George's Sound [W.A.], 1828-9 [1829], *W.Baxter s.n.*; syn: BM.

*Petrophile longifolia* var. *lorea* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 5 (1830). T: ora occid.-merid., King George's Sound [W.A.], 1828–29 [1829], *W.Baxter s.n.*; syn: BM, NSW.

*Petrophile longifolia* var. *caulescens* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 5 (1830). T: ora occid.-merid., King George's Sound [W.A.], 1828–29 [1829], *W.Baxter s.n.*; syn: BM.

*Petrophile longifolia* var. *tenuifolia* Benth., *Fl. Austral.* 5: 322 (1870). T: Kalgan R., W.A., *A.F.Oldfield 420*; syn: K.

Prostrate shrub to 50 cm tall. Branchlets glabrous. Leaves simple, terete, blunt or acute, to 30 cm long, glabrous. Inflorescence terminal, solitary, sessile, ovoid-conical, 2–2.5 (–3) cm long; involucral bracts rigid, linear-lanceolate, acuminate, glabrous; cone scales broadly ovate to broadly rhomboid, ±glabrous. Flowers to c. 25 mm long, yellow to cream, sweet-smelling, hirsute. Pollen presenter c. 4 mm long overall, ±turbinate below the brush; brush c. 2 mm long, densely hirsute. Cones ovoid, 10–25 mm long, occasionally longer. Nuts c. 2–3.5 mm long . Figs 29, 94H.

Most common in the Cranbrook, Mt Barker and Stirling Range areas, but extending eastwards towards Bremer Bay and the Fitzgerald River Natl Park, W.A.; grows in open Jarrah woodland or heath, in sand, gravelly sand, gravel, sandy loam, wet clay and sandplain. Flowers July–Mar. Map 147.

W.A.: between Unicup L. and Kulunilup L., *A.S.George 15034* (PERTH); 10 km W of Bremer Bay, on main road, *J.W.Green 4819* (PERTH); on road into Bluff Knoll, Stirling Ra. Natl Park, *R.Filson 8995* (MEL); c. 10 km S of South Bluff, Stirling Ra., *R.J.Hnatiuk 761436* (PERTH); 60 km NE of Albany, on road to Jeramungup, *D.J.E.Whibley 5228* (AD).

### 18. Petrophile acicularis R.Br., *Trans. Linn. Soc. London* 10: 69 (1810)

*Protea acicularis* (R.Br.) Poir. *in* J.B.A.P. de M. de Lamarck, *Encycl.*, Suppl. 4: 559 (1816), *nom. inval.* T: Lewin's Land, New Holland [W.A.], Dec. 1801, *R.Brown s.n.*; lecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 474 (1995); King George Sound [W.A.], Dec. 1801, *R.Brown (Britten 3242)*; syn: BM.

*Petrophile filifolia* R.Br., *Trans. Linn. Soc. London* 10: 69 (1810). T: in Novae Hollandiae ora australi, Lewin's Land [W.A.], Dec. 1801, *R.Brown (Britten 3243)*; syn: BM.

Low tufted shrub to c. 80 cm tall. Branchlets and leaves glabrous. Leaves slender, terete, simple, 5–18 cm long, obtuse or with a short, straight or sometimes curved tip. Inflorescence ±ovoid, terminal, solitary, sessile, c. 15 mm long; involucral bracts usually numerous, rigid, subulate, glabrous; cone scales prominently striate, ±acuminate, broadly ovate to ovate-lanceolate, glabrous. Flowers c. 10 mm long, cream, densely hirsute. Pollen presenter c. 3.5 mm long overall, turbinate below the brush; brush c. 1.5–2 mm long, with ±distinct, spreading hairs. Cones ±globose, 15–20 mm long. Nuts c. 2.5 mm long.

Restricted to a relatively small area around Albany (King George Sound) and extending westwards to around Denmark and Bow River [? Bow Bridge], W.A.; usually grows in sand. Flowers Sept.–Oct. Map 148.

W.A.: King George Sound, *B.Goadby 2377* (PERTH); Bow R. [? Bow Bridge], Jan. 1913, *S.W.Jackson* (PERTH); Stirling Terrace, King George Sound, *L.Preiss 626* (PERTH); c. 3.2 km E of King R., on Albany–Mt Manypeaks road, *R.Melville 4406 & R.D.Royce* (MEL).

### **19. Petrophile media** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 5 (1830)

*Petrophile media* var. *typica* Domin, *Vestn. Král. Ceské Spolecn. Nauk. Tr. Mat.-Prír.* 1921–22(2): 2 (1923), *nom. illeg.* T: ora occid.-merid., King George's Sound [W.A.], 1828–9 [1829], *W.Baxter s.n.*; syn: BM.

*Petrophile juncifolia* Lindl., *Sketch Veg. Swan R.* xxxv (1840); *P. media* var. *juncifolia* (Lindl.) Benth., *Fl. Austral.* 5: 323 (1870). T: no locality or coll. cited; syn: CGE in Herb. J.Lindley, K (photo).

Low, spreading to erect undershrub to 80 cm tall. Branchlets and leaves glabrous. Leaves simple, terete, to 30 cm long, acute, or with a short, recurved point, smooth. Inflorescence ovoid, terminal, solitary, sessile, c. 25 mm long; involucral bracts usually numerous, linear-subulate to lanceolate; cone scales ovate-lanceolate, acuminate, ±reflexed, glabrous. Flowers c. 15–20 mm long, cream or yellow, sweet-scented, velvety to villous. Pollen presenter c. 4 mm long overall, broadly turbinate below the brush; brush c. 3 mm long, hirsute. Cones usually ovoid, 10–25 mm long. Nuts c. 2–3 mm long.

Occurs in the Darling Range, south of Perth, in adjacent areas of the coastal plain to around the Stirling Range and Mt Barker and eastwards towards Ravensthorpe, W.A.; grows in low shrubland in sandy gravel and light brown sand, in heath and low woodland in sand or clay flats, and in mallee scrub on sandy flats. Flowers Aug.–Feb. Map 149.

W.A.: c. 55 km S of Williams, *R.Melville 4357 & R.D.Royce* (MEL); 15 km along Koornong road, from South Coast Hwy, about 42 km W of Ravensthorpe, *D.B.Foreman 1334* (CANB, MEL, PERTH); c. 41 km SE of Ongerup, *B.G.Briggs 480* (NSW); Porongurup, Nov. 1909, *J.H.Maiden* (NSW); Cannington swamp, *N.T.Burbidge 1930* (CANB).

### **20. Petrophile brevifolia** Lindl., *Sketch Veg. Swan R.* xxxv (1840)

*Petrophile media* var. *brevifolia* (Lindl.) Domin, *Vestn. Král. Ceské Spolecn. Nauk. Tr. Mat.-Prír.* 1921–22(2): 2 (1923). T: no locality or coll. cited; syn: CGE in Herb. J.Lindley.

Low multistemmed, spreading to erect shrub to 2 m tall. Branchlets and leaves glabrous. Leaves simple, terete, straight, slightly curved or recurved, 1–5 (–10) cm long, terminating in a pungent point c. 2 mm long. Inflorescence globose, terminal, sessile, 10–15 mm diam.; involucral bracts numerous, curled at apex, linear-subulate; cone scales ovate to narrowly ovate, acute or acuminate, imbricate, glabrous. Flowers 12–20 mm long, yellow or cream to white, villous. Pollen presenter c. 3–5 mm long, broadly turbinate, truncate below the brush, glabrous; brush c. 2–3 mm long, narrowly cylindrical, short and spreading, hirsute, with a glabrous tip, c. 0.5–1 mm long. Cones globose to ovoid, 10–20 mm long. Nuts c. 3 mm long. Fig. 94A.

Extending from Kalbarri Natl Park to near Ongerup, W.A.; common in shrubland, heathland and *Eucalyptus gomphocephala* (Tuart) woodland; grows in sand and laterite. Flowers Jun.–Dec. Map 150.

W.A.: Tutanning Wildlife Sanctuary, *D.B.Foreman 1089* (AD, CANB, MEL, NSW, PERTH); NW outskirts of Wongan Hills, between Piawaning Rd and railway line, *M.G.Corrick 9276* (MEL); 11 km NW of Jitarning, *D.B.Foreman 1122* (CANB, MEL, PERTH); c. 3.2 km E of Nyabing, *K.Newbey 983* (PERTH); 30.9 km W of L. Grace, on road to Dumbleyung, *J.W.Green 4415* (PERTH).

When infused in hot water, flowers are said to give off a brillant yellow colour.

### **21. Petrophile megalostegia** F.Muell., *Fragm.* 10: 61 (1876)

T: in Australia occidentali extratropica [W.A.], *J.Drummond s.n.*; syn: not located at K or MEL.

Erect shrub 0.3–1 m tall. Branchlets and leaves glabrous. Leaves simple, terete or flattened, straight or curved into an open S-shape, 2.5–8.5 cm long, terminating in a 1.5 mm long pungent point. Inflorescence ±globose, terminal, sessile; involucral bracts glabrous, completely surrounding inflorescence, broad, ovate to ±elliptic, acuminate to acute; margin tattered; cone scales narrowly obovate to oblong-ovate to elliptic, acute to acuminate, glabrous; margin irregular, pale brown. Flowers c. 30 mm long, yellow, cream or creamy yellow, fragrant, sericeous. Pollen presenter, c. 4.5 mm long overall, clavate-turbinate below the brush; brush c. 2 mm long, dark orange, covered with short, distinct, spreading, hairs. Cones ovoid, c. 15 mm long. Nuts c. 3.5 mm long.

Occurs from Mullewa to Eneabba and south to around Watheroo, W.A.; grows in low closed heath in deep sand and clay loam, in sand-heaths, in low open heath in shallow, grey sand over laterite and in shrubland in laterite. Flowers Aug.–Oct. Map 151.

W.A.: Carnamah Rd, 10 km E of Eneabba, *D.B.Foreman 512* (K, MEL, NSW, PERTH); 3 km N of Arrowsmith R., *M.G.Corrick 8107* (MEL, PERTH); 9 km NE of Walkaway, on road to Ellendale Pool, *B.J.Conn 2062* (MEL, MO, PERTH).

## 22. Petrophile aspera C.A.Gardner ex Foreman, *Muelleria* 7: 304 (1990)

T: 47 km E of Dumbleyung, W.A., 27 Nov. 1978, *A.S.George 15267*; holo: PERTH; iso: CANB, MEL, NSW.

Illustration: D.B.Foreman, *op. cit.* 305, fig. 3.

Low shrub 0.2–1.3 m tall. Branchlets and leaves glabrous. Leaves simple, terete, shortly acute, often curled at apex or slightly twisted over entire length, 15–30 cm long, scabrous. Inflorescence ovoid, terminal, sessile, to 30 mm long; involucral bracts linear-lanceolate; cone scales broad, ±circular to broadly rhomboid, acuminate, with apex sometimes reflexed, glabrous. Flowers c. 20 mm long, pale pink, creamy white, white, or pale yellow, with a sweetish scent, villous. Pollen presenter c. 5 mm long overall, turbinate below the brush; brush 3–3.5 mm long, densely tomentose-villous. Cones ±ellipsoidal, to 25 mm long. Nuts c. 2.5 mm long.

Scattered over an area from between Narrogin and Lake Grace to just north of the Stirling Range, W.A.; grows in low open woodland with heath and in low open shrubland of Proteaceae-Myrtaceae species in sandy laterite and on sandplains. Flowers Aug.–Nov. Map 152.

W.A.: 13.5 km N of Tarin Rock, along road to Kulin, *R.W.Purdie 5342* (CBG); 16 km E of Kukerin, *J.S.Beard 2143* (PERTH); 32 km W of L. Grace, *W.E.Blackall 1329* (PERTH); Salt River Rd, 17 km W of its junction with Chester Pass Rd, *M.G.Corrick 9677* (MEL).

## 23. Petrophile ericifolia R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 5 (1830)

T: south-west coast of New Holland [King George Sound, W.A.], 1828–29 [1829], *W.Baxter s.n.*; lecto: BM; isolecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 475 (1995).

*Petrophile ericifolia* f. *subglabra* Domin, *Vestn. Král. Ceské Spolecn. Nauk. Tr. Mat.-Prír.* 1921–22(2): 4 (1923). T: Slab Hut Creek to Cranbrook, *A.A.Dorrien-Smith s.n.*; *n.v.*, not found at K.

Shrub to 1.5 m tall. Branchlets curly-hairy and glabrescent, hoary or glabrous. Leaves simple, terete, ±scabrous, to 12 mm long, acute or obtuse, appressed or spreading, glabrous or glabrescent. Inflorescence terminal, sessile, globose to ovoid in bud, 10–20 mm diam.; involucral bracts numerous, ±persistent, glutinous, imbricate or not, obovate to ovate, acuminate to acute, glabrous; cone scales narrowly ovate to ovate, densely villous at base. Flowers 10–20 mm long, yellow, villous or pilose. Pollen presenter c. 4 mm long, fusiform to narrowly attenuate, shortly or sparsely hairy. Cones ovoid, to 20 mm diam. Nuts to 4 mm long.

Two subspecies are recognised here.

| | |
|---|---|
| Branchlets minutely hoary to glabrous; leaves to 12 mm long, ±glabrous; inflorescence 15–20 mm diam.; flowers viscid, pilose, to c. 20 mm long | **23a.** subsp. **ericifolia** |
| Branchlets with a medium to sparse covering of short, curly, greyish hairs, glabrescent; leaves to 6 mm long, ±hairy; inflorescence c. 10 mm diam.; flowers not viscid, villous, 13–16 mm long | **23b.** subsp. **subpubescens** |

### 23a. Petrophile ericifolia R.Br. subsp. ericifolia

Branchlets minutely hoary to glabrous. Leaves appressed or spreading, to 12 mm long, glabrous (a few long, fine hairs may be present when immature). Inflorescence ±ovoid, 15–20 mm diam.; involucral bracts ovate, acuminate; cone scales narrowly ovate, with a rather elongated, deciduous, acute tip. Flowers to c. 20 mm long, viscid, pilose. Pollen presenter fusiform, to c. 4.5 mm long. Cones ovoid, to c. 25 mm diam.

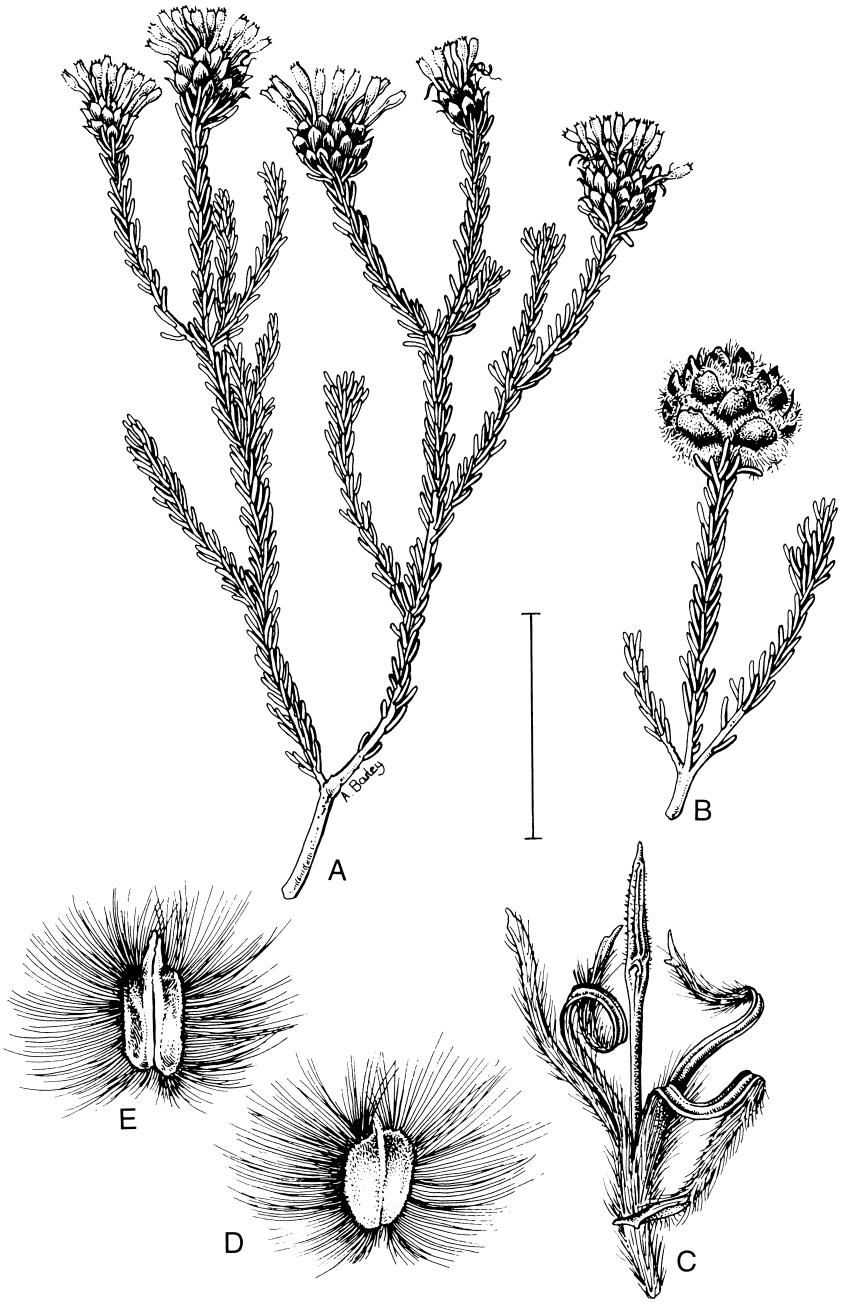



**Figure 84**. *Petrophile ericifolia* subsp. *subpubescens*. **A**, flowering branchlet; **B**, fruiting branchlet; **C**, flower; **D**, nut showing abaxial surface; **E**, nut showing adaxial surface (**A–E**, Tammin, on rly and Great Eastern Hwy c. 160 km E of Perth, W.A., J.Cleland s.n., MEL). Scale bar: **A**, **B** = 3 cm; **C** = 5 mm; **D**, **E** = 1 cm. Drawn by A.Barley.

Extending from the Fitzgerald River Natl Park to the Stirling Range and Lake Wagin and in the vicinity of Lake Grace, W.A.; also in the Southern Cross–Coolgardie area; grows in heathland in deep grey-yellow, yellow and white sand, and in low scrub in well-drained gravelly sand. Flowers Aug.–Nov. Map 153.

W.A.: c. 16 km E of Southern Cross, *J.S.Beard 5182* (PERTH); Coolgardie, 1894, *J.Cronin* (MEL); 6.9 km E of rabbit-proof fence on the Hyden–L. Cronin road, *R.J.Chinnock 3280* (AD, AK, CANB); 33 km W of L. Grace, *H.Demarz D7860* (PERTH); 10 km S of South Bluff [Stirling Ra.], *R.J.Hnatiuk 761393* (PERTH).

### **23b. Petrophile ericifolia** subsp. **subpubescens** (Domin) Foreman, *Fl. Australia* 16: 475 (1995)

*Petrophile ericifolia* f. *subpubescens* Domin, *Vestn. Král. Ceské Spolecn. Nauk. Tr. Mat.-Prír.* 1921–22(2): 4 (1923). T: Avon district, W.A., July 1901, *E.Pritzel 476*; syn: AD, BM, NSW, PERTH.

Branchlets with a medium to sparse covering of short, curly, greyish hairs, glabrescent. Leaves appressed, 3–6 mm long, with a medium to sparse covering of short, straight, ascending hairs, glabrescent. Inflorescence globose or ovoid in bud, ±cup-shaped after anthesis, c. 10 mm diam.; involucral bracts ±obovate, acuminate to acute; cone scales ovate. Flowers 13–16 mm long, villous. Pollen presenter c. 4 mm long overall, ±fusiform to narrowly attenuated beneath the brush. Cones ±ovoid, sometimes slightly flattened on top, c. 15 mm diam. Fig. 84.

Most collections are from between Northam and Kellerberrin, with two more northerly collections from near Watheroo and Piawaning, W.A.; grows in low shrubland in light brown sand and on sandplain. Flowers Aug.–Oct. Map 154.

W.A.: Tammin, *C.A.Gardner 524* (PERTH); Meckering, *O.H.Sargent 1349* (MEL); Kellerberrin, *R.B.Leake s.n.* (PERTH); Youndegin, 1892, *A.Eaton* (MEL 1535607); near Watheroo, 10 Nov. 1906, *A.Morrison* (BRI).

One collection, *D.B.Foreman 696* (MEL), is slightly atypical in having nearly glabrous branchlets with the hairs which persist tending to be straight rather than curly, and the leaves tending to be slightly more recurved than usual. In other respects it appears to match typical *P. ericifolia* subsp. *subpubescens* quite well, especially in its involucral bracts, cone scales, flowers and fruits.

### **24. Petrophile arcuata** Foreman, *Fl. Australia* 16: 474 (1995)

T: 55 miles [c. 88 km] E of Southern Cross, towards Coolgardie, W.A., 9 Sept. 1968, *M.E.Phillips CBG 02766*; holo: CBG; iso: AD, BRI.

Spreading shrub to c. 1.2 m tall. Branchlets glabrous or with a few sparse, short, curly hairs. Leaves simple, terete, 10–15 mm long, acute, spreading, slightly curved, held away from branchlets, glabrous, sparsely and very minutely scabrous. Inflorescence ovoid to globose, terminal, sessile, c. 12 mm diam.; involucral bracts few, ovate to oblong, acute, ±glutinous, glabrous; cone scales ovate, acute becoming obtuse, densely villous at base. Flowers c. 12 mm long, deep creamy yellow to yellow, villous. Pollen presenter c. 4 mm long overall, attenuate below the brush; brush c. 3 mm long, yellow, with short, reflexed hairs. Cones ±globose, 10–15 mm diam. Nuts c. 3 mm long. Fig. 85.

Occurs along the Great Eastern Hwy between Southern Cross and Coolgardie, with many collections from near Boorabin; also extending south to Peak Charles, W.A.; grows in open scrub in deep yellow sand, in dense scrub and low scrubby bush on sandplain; also in very open shrub mallee over dense scrub in orange-yellow sand over yellowish brown sandy-clay. Flowers Sept.–Oct. Map 155.

W.A.: Kumarl–L. King road, c. 64 km W of Kumarl, *R.Filson 9340* (MEL); Frank Hann Natl Park, *D.Monk 365* (PERTH); N of Bullabulling, *J.S.Beard 3343* (PERTH).

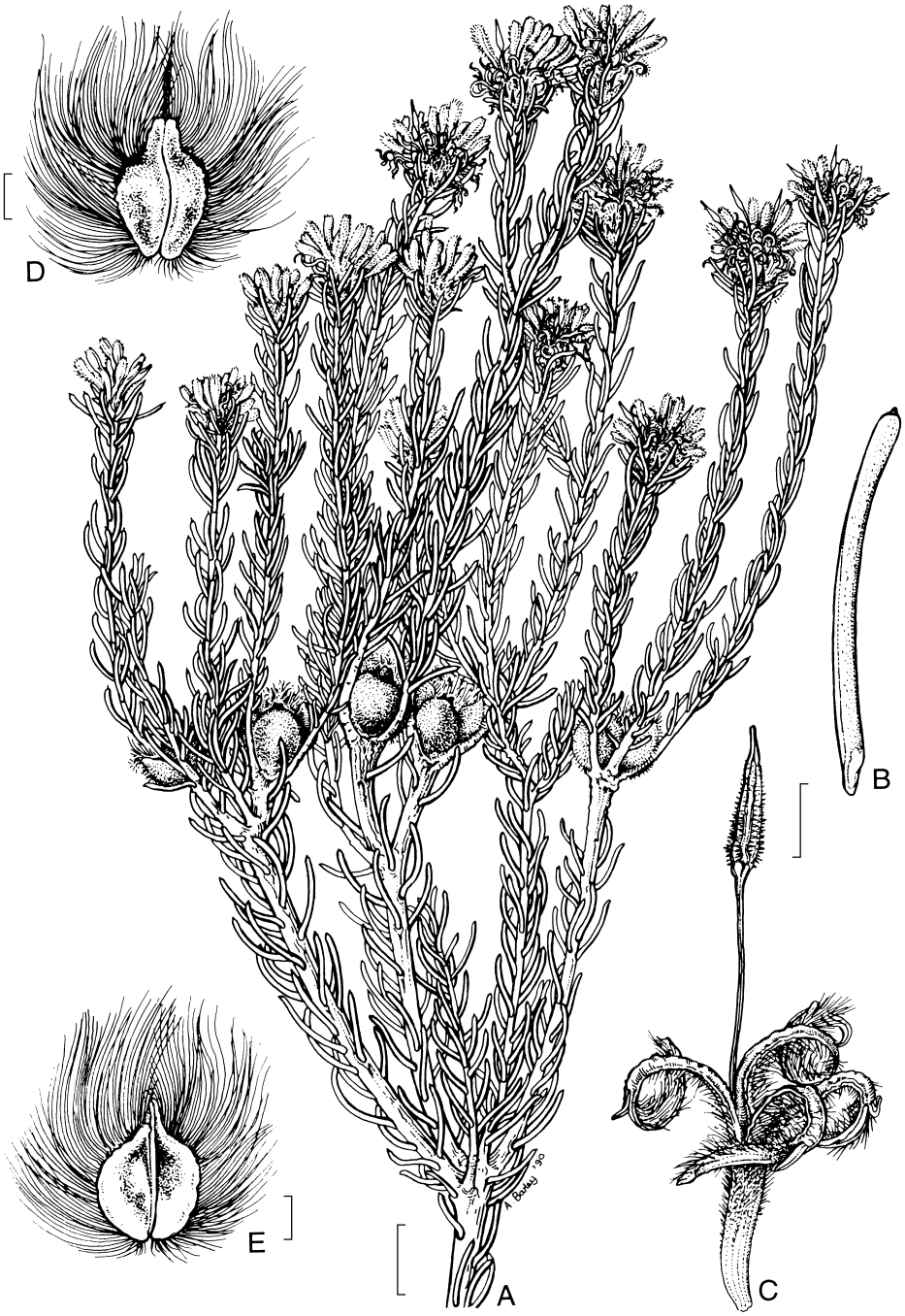



**Figure 85**. *Petrophile arcuata*. **A**, flowering and fruiting branchlet; **B**, leaf; **C**, flower; **D**, nut showing adaxial surface; **E**, nut showing abaxial surface (**A–E**, Coolgardie–Southern Cross Rd, c. 6.4 km W of Gilgai, R.Filson s.n., MEL). Scale bars: **A** = 1 cm; **B**, **C** = 2 mm; **D**, **E** = 1 mm. Drawn by A.Barley.


**Figure 86**. *Petrophile merrallii*. **A**, flowering and fruiting branchlet; **B**, leaf; **C**, flower; **D**, nut showing adaxial surface; **E**, nut showing abaxial surface (**A–E**, R.Chinnock 3280, AD). Scale bars: **A** = 2 cm; **B–E** = 5 mm. Drawn by A.Barley.

### **25. Petrophile merrallii** Foreman, *Fl. Australia* 16: 476 (1995)

T: 12 miles [c. 19 km] E of Southern Cross, at Summer Tank, W.A., 9 Sept. 1968, *M.E.Phillips CBG 028011*; holo: CBG; iso: NSW.

Erect shrub to c. 1.1 m tall. Branchlets and leaves with short, curly hairs, glabrescent. Leaves spreading, simple, terete, 4–14 mm long, obtuse or minutely acutely pointed, straight or slightly curved, very scabrous. Inflorescence ovoid to globose, terminal, sessile, to c. 16 mm diam.; involucral bracts numerous, imbricate, ovate, acute to acuminate, glutinous; margins fringed with long, straight hairs; cone scales ovate-acuminate, densely villous on outer surface of base; tips deciduous, glabrous. Flowers c. 15 mm long, yellow, pilose. Pollen presenter ±fusiform, 4.5 mm long overall; brush c. 3–4 mm long, with short, ±erect hairs; tip glabrous. Cones ovoid to globose, to 20 mm diam. Nuts c. 3 mm long. Fig. 86.

Found near Southern Cross and Muntadgin and south to localities between Pingrup and Lake Grace, W.A.; grows in heaths and mallee shrubland, mostly in sandy soil. Flowers Aug.–Oct. Map 156.

W.A.: 4 km N of Muntadgin, on Merredin Rd, *N.G.Marchant 70/308* (PERTH); 6 km SW of L. Cronin, *K.Newbey 6205* (PERTH); 20 km E of Southern Cross, *M.G.Corrick 9176* (HO, MEL); Southern Cross, 1890, *E.Merrall* (MEL).

### **26. Petrophile imbricata** Foreman, *Fl. Australia* 16: 475 (1995)

T: Boyagin Nature Reserve, NW of Pingelly, W.A., 18 Nov. 1985, *D.B.Foreman 1074*; holo: MEL; iso: PERTH.

Shrub 1–2 m tall. Branchlets hoary. Leaves simple, terete, to c. 15 mm long, minutely scabrous, obtuse, with a very short, acute to blunt point, sometimes slightly reflexed, usually appressed, imbricate, covered with fine, short, straight hairs, glabrescent. Inflorescence ±ovoid, terminal, sessile, to c. 18 mm diam.; involucral bracts numerous, prominent, imbricate, narrowly ovate, acuminate, slightly but not noticeably glutinous, fringed with fine, long, white hairs; tips often reflexed, drying dark brown or black; cone scales linear to lanceolate; base villous. Flowers to c. 20 mm long, cream, villous. Pollen presenter c. 6 mm long overall, slightly swollen or truncate below the brush; brush yellow, shortly hairy. Cones ovoid or slightly cup-shaped due to persistence of involucral bracts, to c. 18 mm diam. Nuts c. 4 mm long. Fig. 87.

Occurs mostly in the vicinity of Dryandra State Forest, Boddington, the Boyagin Nature Reserve and near Katanning, W.A.; grows in open woodland and low forest in laterite, in dense scrub on sandplain and in proteaceous heath in Jarrah forest. Flowers Aug.–Sept. Map 157.

W.A.: c. 3 km E of Katanning, *N.T.Burbidge 2415* (CANB); 2–3 km SE of Dryandra, towards Narrogin, *D.B.Foreman 1101* (CANB, MEL, PERTH); on NW slope of Mt Saddleback, 17 km S of Boddington, *D.Halford 808135* (CANB, PERTH); sources of the Blackwood R., 1888, *A.Cronin* (MEL).

### **27. Petrophile cyathiforma** Foreman, *Fl. Australia* 16: 474 (1995)

T: Hyden, W.A., 8 Sept. 1966, *M.Barrow 84*; holo: PERTH; iso: CANB.

Shrub 30–65 cm tall. Branchlets covered with short, straight hairs, glabrescent. Leaves simple, terete, spreading, 10–15 mm long, pungent, sometimes slightly recurved, minutely scabrous to almost smooth and glabrous. Inflorescence cup-shaped, terminal, sessile, to c. 15 mm diam.; involucral bracts imbricate, narrowly ovate, acuminate, persistent, glutinous, mostly cohering, ciliate to fimbriate; cone scales narrowly ovate, densely villous outside; tips glabrous. Flowers c. 20 mm long, bright yellow, pilose, glabrous towards tips. Pollen presenter with short, erect hairs, fusiform, 5–6 mm long, yellow. Cones hemispherical due to persistence of involucral bracts, 15–20 mm diam. Nuts to c. 3.5 mm long. Fig. 88.

Extending from near Corrigin to the Fitzgerald River Natl Park, W.A.; grows in mallee and open dwarf scrub with low heath and sedges in white sand, in mallee heath in grey clayey sand and on sandplain. Flowers Sept.–Dec. Map 158.

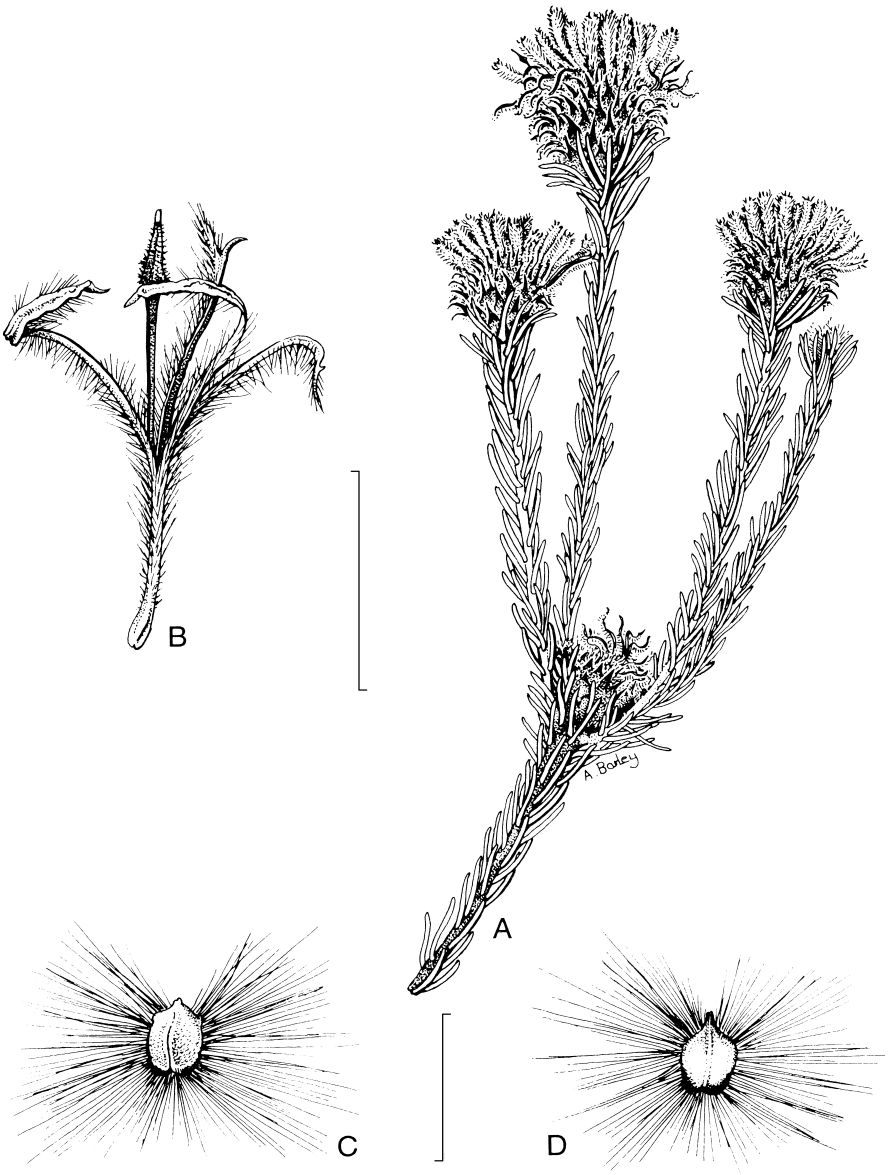



**Figure 87**. *Petrophile imbricata*. **A**, flowering and fruiting branchlet; **B**, flower; **C**, nut showing adaxial surface; **D**, nut showing abaxial surface (**A–D**, D.Halford 808135, BRI). Scale bars: **A** = 3 cm; **B** = 1 cm; **C**, **D** = 5 mm. Drawn by A.Barley.

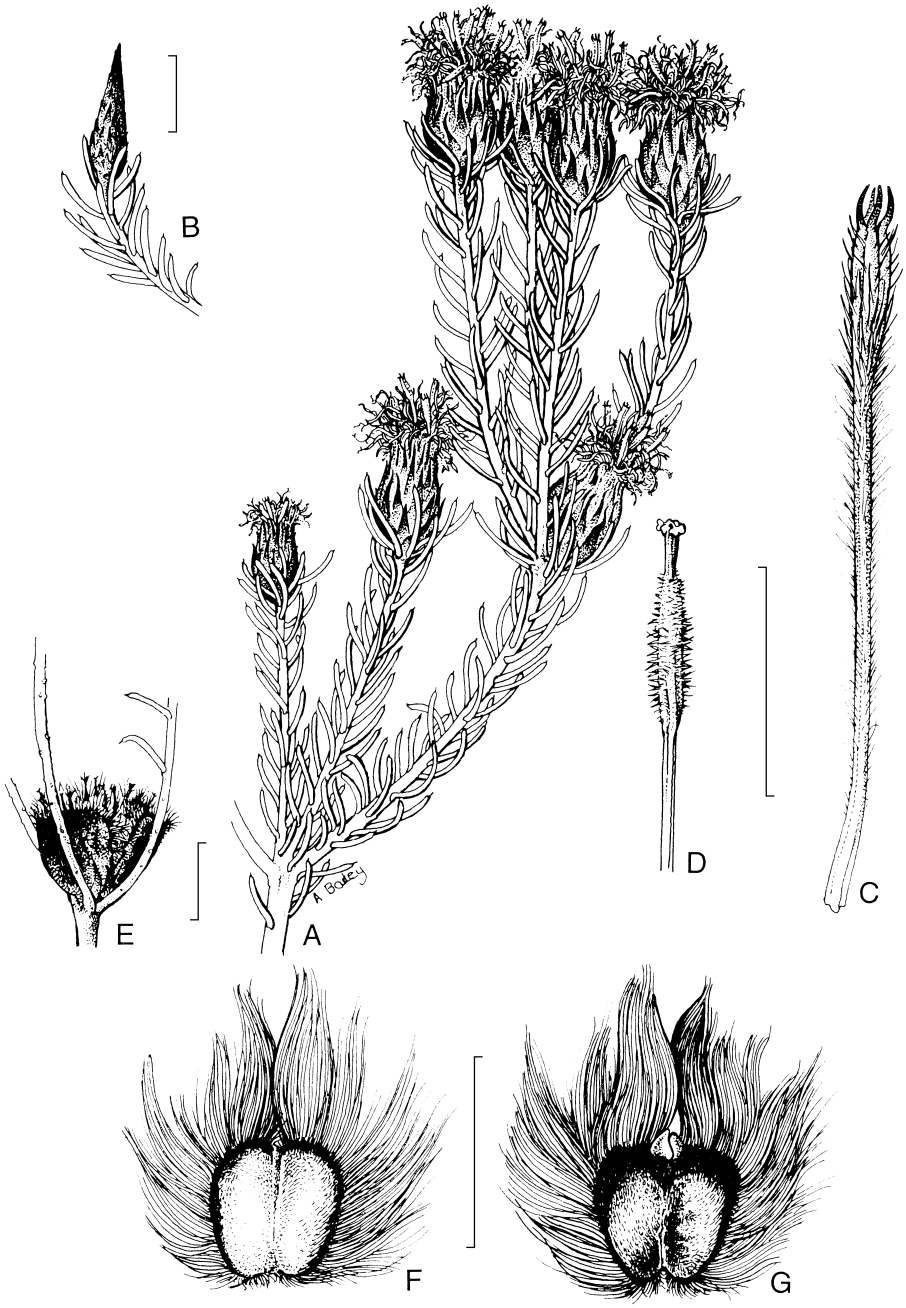



**Figure 88**. *Petrophile cyathiforma*. **A**, flowering branchlet (Lullfitz 5554, MEL); **B**, branchlet with young inflorescence (M.Burgman MAB 2910 & C.Layman, PERTH); **C**, flower; **D**, pollen presenter (**C–D**, Lullfitz 5554, MEL); **E**, fruiting branchlet; **F**, nut showing abaxial surface; **G**, nut showing adaxial surface (**E–G**, E.Nelson ANU 16722 CANB). Scale bars: **A–C**, **E** = 1 cm; **D** = 6 mm; **F**, **G** = 5 mm. Drawn by A.Barley.

W.A.: 22.75 km SE of Muckinwobert Rock, *M.A.Burgman & C.Layman MAB 2910* (PERTH); c. 26 km N of Ravensthorpe, *A.S.George 308* (KPBG, PERTH); near Dempster Inlet, Fitzgerald River Reserve, 20 km from coast, *E.C.Nelson ANU 16722* (CANB); Corrigin, near airstrip, *C.E.Woolcock P31* (MEL).

### 28. Petrophile scabriuscula Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 495 (1845)

*Petrophile ericifolia* var. *scabriuscula* (Meisn.) Benth., *Fl. Austral.* 5: 331 (1870). T: Swan River [W.A.], *J.Drummond 557*; syn: K, MEL.

Dense, spiny shrub to 1.2 m tall. Branchlets grey-pubescent, glabrescent. Leaves simple, terete, mostly 6–14 mm long, ±appressed, scabrous, pungent, covered with fine hairs, glabrescent. Inflorescence ovoid, to c. 20 mm diam., terminal, sessile; involucral bracts numerous, imbricate, acuminate to acute, slightly glutinous, villous to sparsely hairy, fringed with hairs; cone scales narrowly ovate, becoming broadly ovate, villous at base. Flowers 8–14 mm long, yellow to yellow-cream, villous. Pollen presenter ±fusiform, with short, ±erect hairs; brush merging with an attenuated basal part, c. 3–3.5 mm long, yellow. Cones ±globose to ovoid, 10–20 mm diam. Nuts c. 4–5 mm long.

Occurs from south of Moora to Kalbarri Natl Park, W.A.; grows in low open heath in white sand and with *Leucopogon* and *Calothamnus* in pale grey-brown sand; also in shrubland, *Banksia* heathland in sandy soils, and on sandplain. Flowers May–Oct. Map 159.

W.A.: 25 km S of Eneabba, *R.J.Cranfield 262* (PERTH); 160 km from Perth, towards Moora, along Geraldton Hwy, *E.M.Canning CBG 027385* (CBG, MEL); 27 mile [c. 43 km] post, on Dongarra-Eneabba road, *H.Demarz 948* (PERTH); Minginew, *F.L.E.Diels & E.Pritzel 427* (PERTH); Kalbarri Natl Park, along road to Murchinson Gorge, 2 km from junction with main Kalbarri road, *M.G.Corrick 8193* (MEL, NSW).

### 29. Petrophile recurva Foreman, *Fl. Australia* 16: 477 (1995)

T: c. 17 miles [c. 27 km] from Moora, towards Jurien Bay, W.A., 23 Sept. 1962, *M.E.Phillips CBG 005328*; holo: CBG; iso: MEL, NSW.

Erect, much-branched shrub to c. 2 m tall. Branchlets tomentose, glabrescent. Leaves simple, terete, 7–13 mm long, appressed, pungent, hirsute, minutely scabrous to almost smooth, glabrescent; apex usually recurved. Inflorescence ±globular, terminal, sessile, 10–15 mm diam.; involucral bracts numerous, narrowly ovate, acuminate, sometimes persisting, glutinous, sparsely hairy; cone scales narrowly elliptic, densely villous; tip glabrous. Flowers c. 11 mm long, pale yellow to cream, pilose to tomentose. Pollen presenter ±fusiform to slightly attenuate at base, c. 3 mm long, yellow or orange-yellow, shortly and sparsely hairy. Cones ±globose to ovoid, c. 10–15 mm diam. Nuts c. 3.5 mm long. Fig. 89.

Occurs from east of Jurien Bay to Moora and to the north of Gingin, W.A.; grows in bushland in yellow sand, in low open heath, in shrubland in grey to white sand with high gravel content and in sandy heath with *Eucalyptus todtiana*. Flowers Aug.–Oct. Map 160.

W.A.: c. 9 km N of Cataby Ck, *R.J.Hnatiuk* 760094 (PERTH); Mogumber–Regans Ford road, c. 19 km W of Mogumber, *R.Filson 8415* (MEL); Marchagee Track, 15–20 km E of Brand Hwy, *D.B.Foreman 469* (CANB, MEL, NSW, PERTH); c. 22 km from Gingin, *M.E.Phillips CBG 030717* (CBG, NSW).

### 30. Petrophile wonganensis Foreman, *Fl. Australia* 16: 479 (1995)

T: 10 km E of Wongan Hills on road to Manmanning, W.A., 30 Sept. 1984, *J.H.Ross 2838*; holo: MEL; iso: CBG, PERTH.

Dense shrub 0.4–1.5 m tall, to 2 m across. Branchlets and leaves covered with short, curly, whitish hairs, glabrescent. Leaves simple, terete, 5–9 mm long, blunt, minutely scabrous. Inflorescence ±globose, sessile, terminal, to c. 15 mm diam. Involucral bracts ±ovate or elliptic, acuminate, deciduous, glabrous at base, fringed with pale, ferruginous hairs near apex; cone scales elliptic to broadly elliptic, slightly glutinous, acute, becoming retuse, tomentose or woolly. Flowers 14–15 mm long, yellow, villous. Pollen presenter c. 4 mm long, covered with short, slightly reflexed hairs; brush c. 3 mm long; basal portion attenuate. Cones ±globose, c. 15–20 mm diam. Nuts c. 4–5 mm long. Fig. 90.

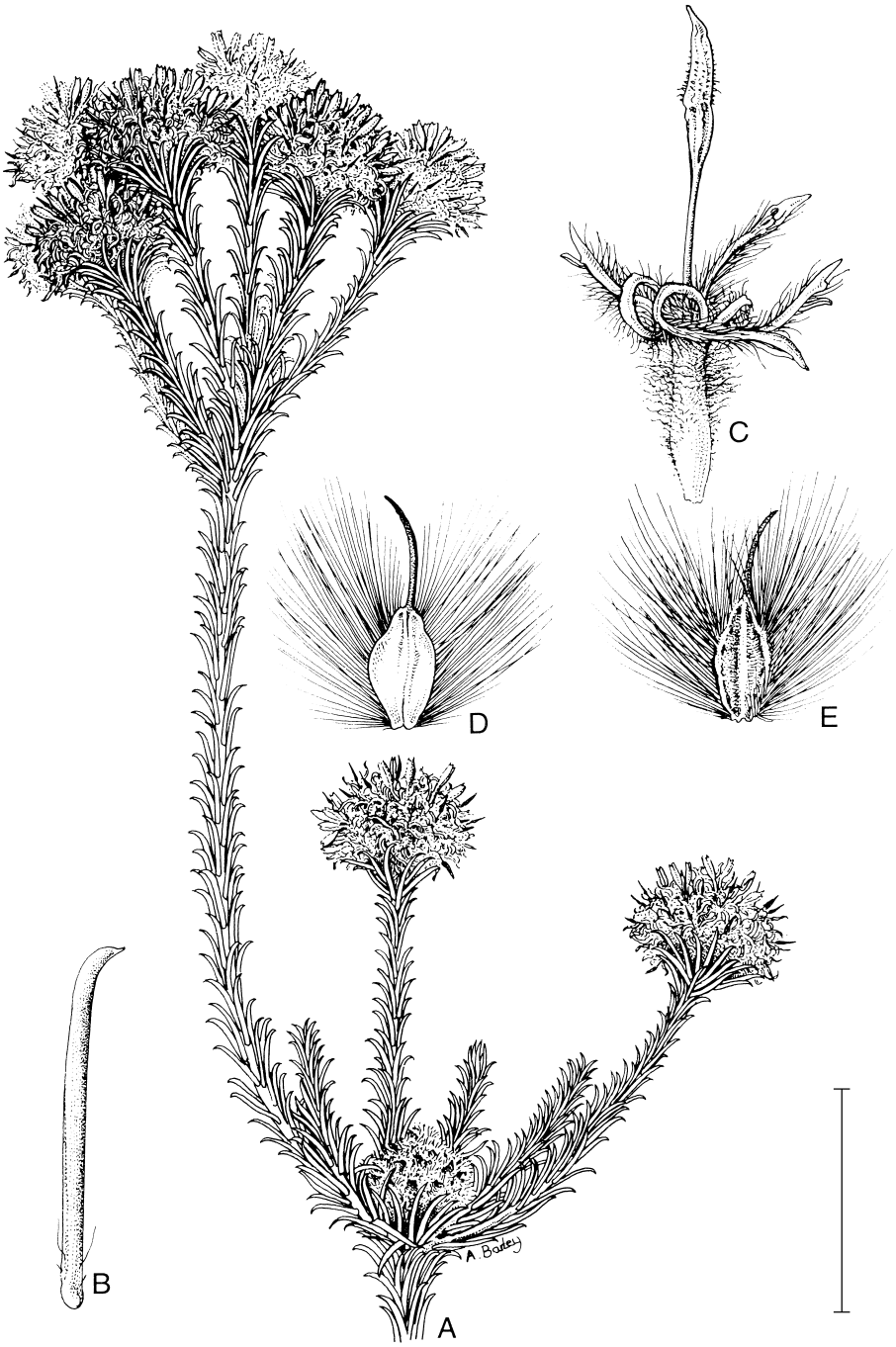



**Figure 89**. *Petrophile recurva*. **A**, flowering and fruiting branchlet; **B**, leaf; **C**, flower; **D**, nut showing abaxial surface; **E**, nut showing adaxial surface (**A–E**, R.Smith 66/209, MEL). Scale bar: **A** = 3 cm; **B–E** = 5 mm. Drawn by A.Barley.

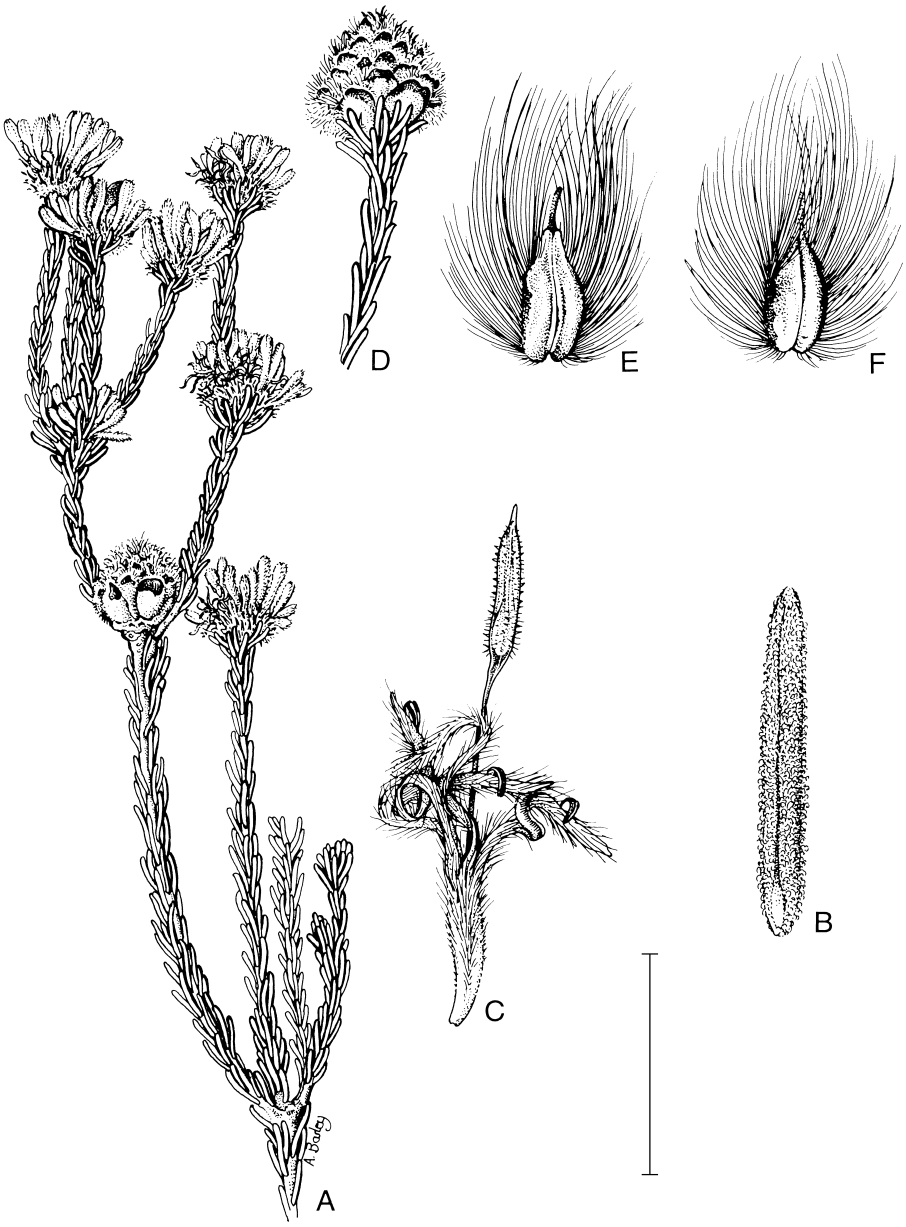



**Figure 90**. *Petrophile wonganensis*. **A**, flowering and fruiting branchlet; **B**, leaf; **C**, flower; **D**, fruiting branchlet; **E**, nut showing adaxial surface; **F**, nut showing abaxial surface (**A–F**, B.Smith 1352, MEL). Scale bar: **A**, **D** = 3 cm; **B**, **E**, **F** = 5 mm; **C** = 6 mm. Drawn by A.Barley.

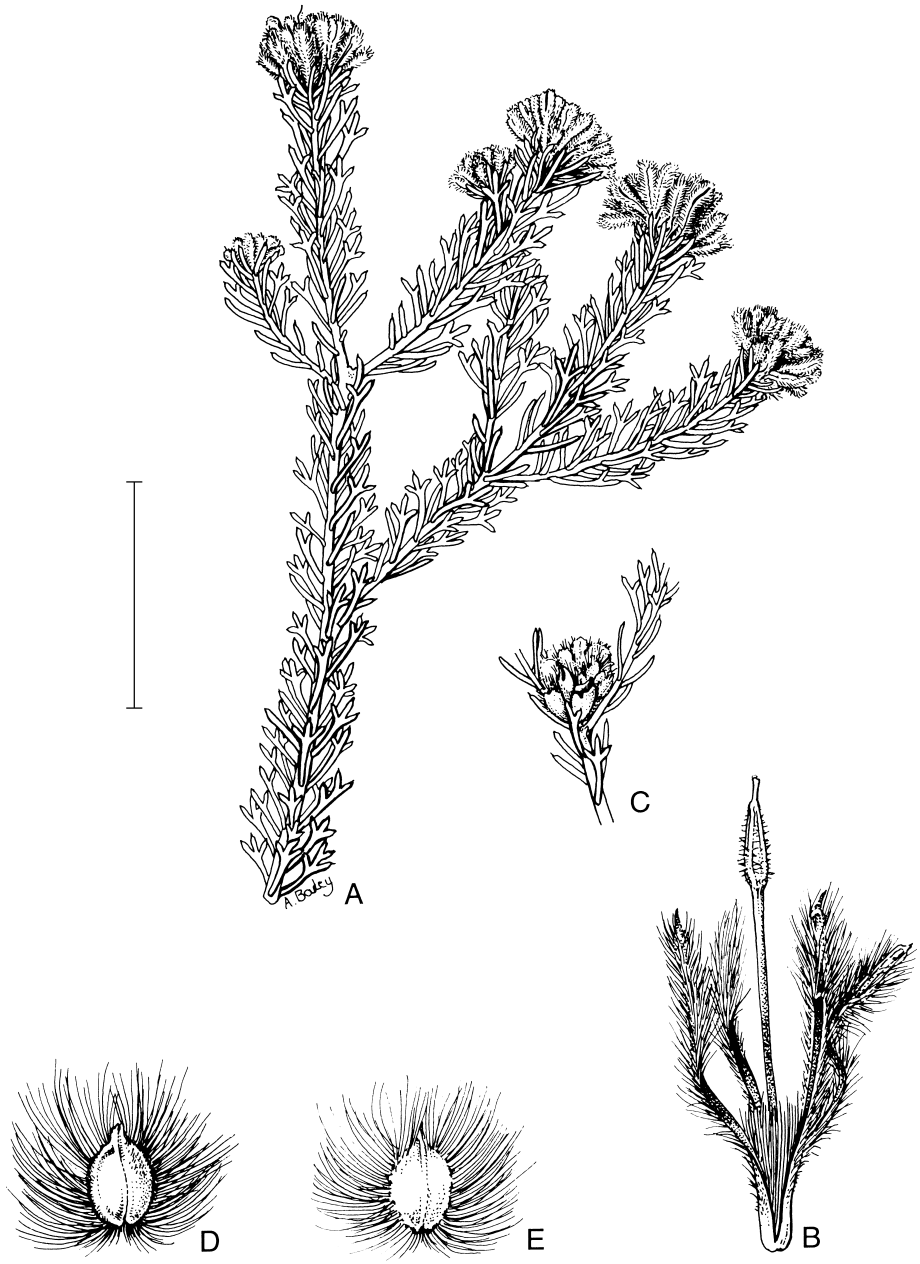



**Figure 91**. *Petrophile misturata*. **A**, flowering branchlet; **B**, flower; **C**, fruiting cone; **D**, nut showing adaxial surface; **E**, nut showing abaxial surface (**A–E**, W.Blackall 3264, PERTH). Scale bar: **A**, **C** = 3 cm; **B**, **D**, **E** = 1 cm. Drawn by A.Barley.

Occurs mostly in the vicinity of Wongan Hills, but extends east to Cowcowing, W.A.; grows in shrubland, in heath in sandy soil; also in deep white sand and yellow sandy loam. Flowers Aug.–Jan. Map 161.

W.A.: 3 km NW of Wongan Hills, between road to Piawaning and railway line, *J.Taylor 2165 & P.Ollerenshaw* (CBG, MEL, PERTH), 3 km N of Wongan Hills, *M.E.Philips CBG 035620* (CBG, NSW); 1.5 km S of Ballidu, *A.S.George 100* (PERTH).

### **31. Petrophile chrysantha** Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 68 (1855)

T: between Moore and Murchison Rivers [W.A.], *J.Drummond 6: 165*; syn: MEL.

Erect shrub to c. 1 m tall. Branchlets and leaves tomentose-pubescent, glabrescent; hairs long, fine, scattered. Leaves crowded along branchlets, 5–20 mm long overall; petiole 1–4 mm long; lamina pinnate, terete, minutely scabrous, pungent; pinnae 1–10 mm long. Inflorescence ovoid, terminal, sessile, c. 10 mm long; involucral bracts broad, imbricate, ±obtuse or with a small tip, sparsely hairy; margin ciliate; cone scales similar with inner ones becoming narrower and more hairy on outer surface. Flowers to c. 14 mm long, cream to dark yellow, densely hairy. Pollen presenter fusiform, c. 3 mm long, yellow, ±glabrous, or with a few reflexed hairs. Cones ±globose to ovoid, c. 10 mm diam. Nuts c. 4 mm long overall, winged. Fig. 94B–C.

Occurs from near Regans Ford to around Eneabba and extends eastwards to Marchagee, W.A.; grows in shrubland and woodland in white, yellow and grey sand which is often gravelly. Flowers June–Oct. Map 162.

W.A.: Marchagee Track, 4 km E of Brand Hwy, *D.B.Foreman 454* (CANB, MEL, PERTH); c. 27 km NW of Badgingarra, *A.S.George 6758* (MEL, PERTH); 7 km SSE of Eneabba, *E.A.Griffin 994* (PERTH).

### **32. Petrophile misturata** Foreman, *Fl. Australia* 16: 476 (1995)

T: 1 mile [c. 1.6 km] E of Quairading, W.A., 22 Oct. 1964, *K.Newbey 1577*; holo: PERTH.

Shrub to c. 1 m tall. Branchlets and leaves tomentose. Leaves simple to pinnate, terete, 8–16 mm long, spreading, pungent, minutely scabrous. Inflorescence globose, terminal, solitary, sessile, c. 10 mm diam.; involucral bracts few, subulate, deciduous, tomentose to villous on both surfaces, glabrescent outside; cone scales ovate-acuminate, villous outside. Flowers c. 10 mm long, dull yellow, villous. Pollen presenter fusiform, c. 3.5 mm long, with sparse, short, erect hairs. Cones globose, c. 12 mm diam. Nuts c. 3.5 mm long. Fig. 91.

Mostly collected from or near Quairading; also recorded near Tammin and between Hines Hill and Bruce Rock, W.A.; grows in sand. Flowers Sept.–Oct. Map 163.

W.A.: Quairading, *K.Waters 119 & 139* (PERTH); *loc. id.*, *W.E.Blackall 3264* (PERTH); between Hines Hill and Bruce Rock, *W.E.Blackall s.n.* (PERTH); near Tammin, *E.Pritzel 761* (PERTH).

### **33. Petrophile trifurcata** Foreman, *Fl. Australia* 16: 479 (1995)

T: Reserve 16418, Wongan Hills, W.A., 9 Sept. 1983, *P.Roberts 172*; holo: PERTH; iso: MEL.

Shrub to 65 cm tall. Branchlets tomentose, glabrescent. Leaves mostly divided into 3 short lobes towards tip, sometimes simple, terete, 10–16 mm long, acute or pungent, very minutely scabrous or ±glabrous; lobes to c. 6 mm long. Inflorescence globose, terminal, sessile, c. 8–10 mm diam.; involucral bracts ovate, acuminate, glabrous outside, fringed with hairs, tomentose inside; cone scales ±obovate, acuminate, villous outside; tip and inner surface glabrous. Flowers c. 10 mm long, yellow, hirsute. Pollen presenter ±fusiform, c. 3 mm long, with short, erect or slightly reflexed hairs; brush hardly differentiated from a short, attenuate, basal part. Cones globose, c. 12 mm diam. Nuts c. 3 mm long. Fig. 92.

Known only from ttwo somewhat isolated collections from near Wongan Hills and between Watheroo and Coorow, W.A.; grows in sand. Flowers Sept. Map 164.

W.A.: between Watheroo and Coorow, *W.E.Blackall 2574* (PERTH).

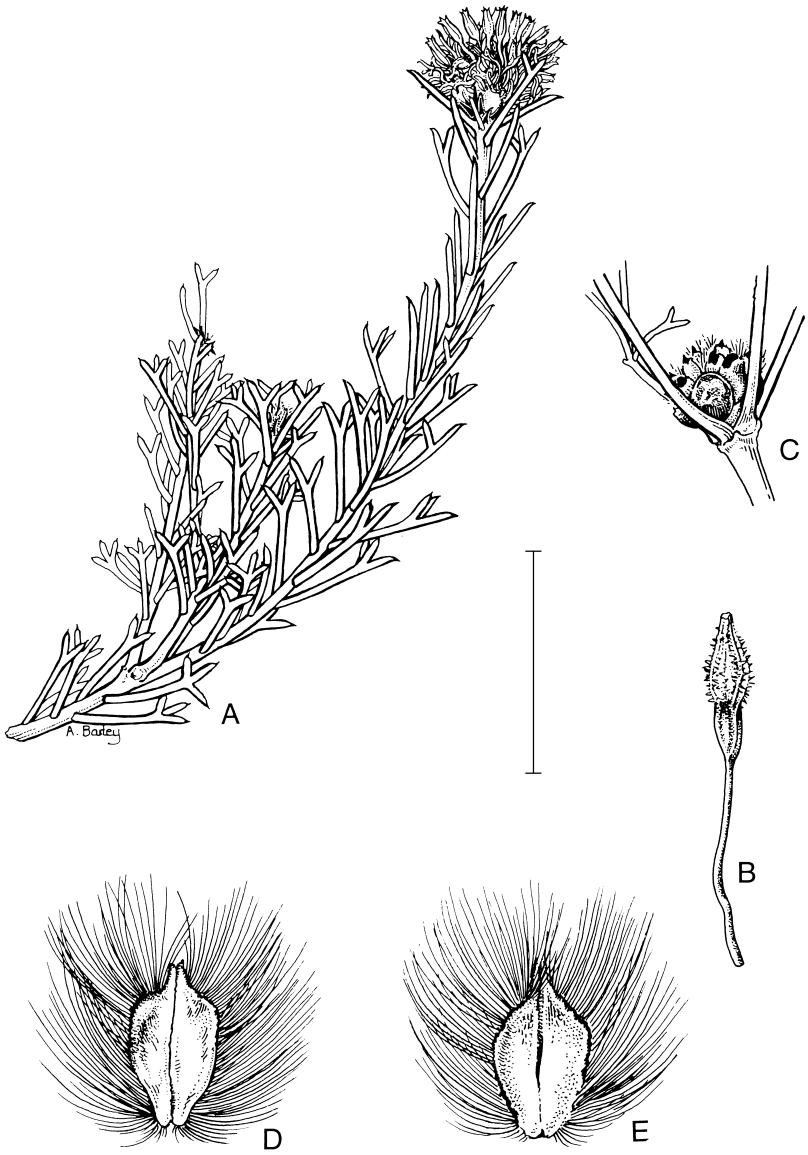



**Figure 92**. *Petrophile trifurcata*. **A**, flowering branchlet; **B**, style; **C**, fruiting branchlet; **D**, nut showing adaxial surface; **E**, nut showing abaxial surface (**A–E**, P.Roberts 172, MEL, PERTH). Scale bar: **A**, **C** = 3 cm; **B**, **D**, **E** = 5 mm. Drawn by A.Barley.

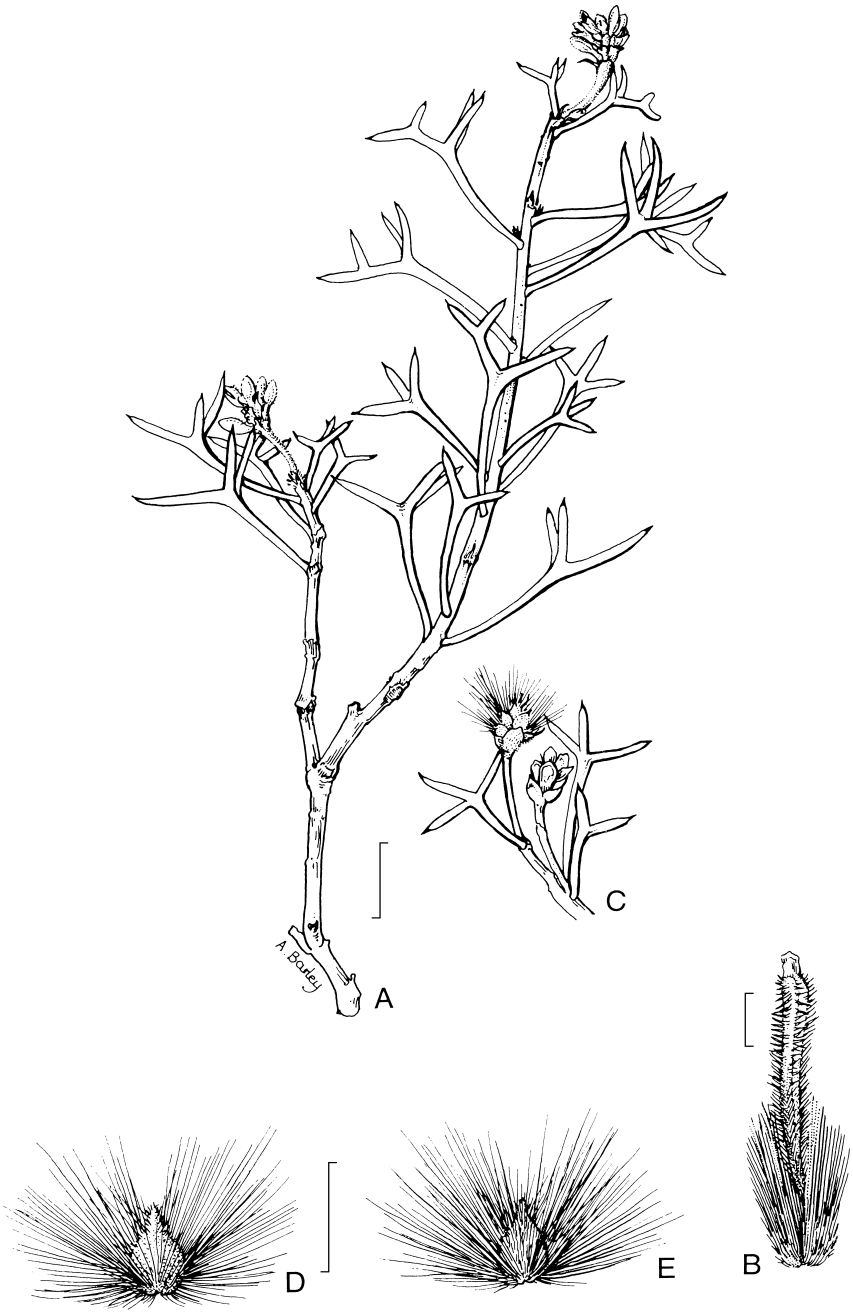



**Figure 93**. *Petrophile pauciflora*. **A**, flowering branchlet; **B**, pistil (**A–B**, N.Speck 701, CANB); **C**, fruiting branchlet; **D**, nut showing abaxial surface; **E**, nut showing adaxial surface (**C–E**, A.George 14242, PERTH). Scale bars: **A**, **C** = 1 cm; **B** = 1 mm; **D**, **E** = 5 mm. Drawn by A.Barley.

### **34. Petrophile pauciflora** Foreman, *Fl. Australia* 16: 476 (1995)

T: 3 km NW of Bimbijy Stn, W.A., 19 Apr. 1976, *A.S.George 14242*; holo: PERTH.

Shrub to c. 1 m tall. Branchlets and leaves tomentose, glabrescent. Leaves erect, sparse, terete, usually 3-forked, but middle segment sometimes divided again, 15–35 mm long, pungent. Inflorescence globose, few-flowered, towards end of branchlets, pedunculate, c. 8 mm diam.; peduncle to c. 6 mm long; involucral bracts ovate, acute to acuminate, glabrous outside, tomentose inside at least in upper half; cone scales ovate, acute, tomentose outside, glabrous inside. Flowers c. 7 mm long; colour not known (probably yellow), tomentose. Pollen presenter ±straight, c. 4.5 mm long, with dense, short, reflexed hairs. Cones ovoid to globose, 6–8 mm long; peduncles 10–16 mm long. Nuts 2–3 mm long. Fig. 93.

Presently known only from north-west of Bimbijy Station and south of Mileura, W.A.; grows in low and very open heath on decaying and dissected granite breakaway. Flowers Sept. Map 165.

W.A.: 69 km S of Mileura, *N.H.Speck 701* (CANB, PERTH; label gives direction as SE).

### **35. Petrophile phylicoides** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 6 (1830)

T: south-west coast of New Holland [Lucky Bay, W.A.], 1823, *W.Baxter 120*; lecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 476 (1995); inland from King George Sound [W.A.], 1829, *W.Baxter s.n.*; syn: BM.

*Petrophile ericifolia* var. *glabriflora* Benth., *Fl. Austral.* 5: 331 (1870); *P. glabriflora* (Benth.) Domin, *Vestn. Král. Ceské Spolecn. Nauk. Tr. Mat.-Prír.* 1921–22(2): 3 (1923). T: sandy plains, Cranbrook to Warrungup, W.A., *A.A.Dorrien-Smith s.n.*; syn: K (photo); Stirling Range, W.A., *F.Mueller s.n.*; syn: MEL.

Shrub to 1.5 m tall. Branchlets ±hoary, glabrescent. Leaves simple, terete, 6–15 mm long, acute, smooth, mostly curving upwards, ±pilose, glabrescent. Inflorescence ±globose, terminal, sessile, c. 10 mm diam.; involucral bracts subulate, deciduous, shortly hairy; cone scales ovate to broadly ovate, acute, tomentose at base, glabrous at tip. Flowers c. 12 mm long, yellow, glabrous. Pollen presenter narrowly ovoid, c. 4.5 mm long, orange, shortly and sparsely hairy. Cones globose, to c. 28 mm diam. Nuts c. 3 mm long, c. 5 mm wide.

Scattered over a wide area from the Stirling Range to Israelite Bay and north to near Tarin Rock and Newdegate, W.A.; grows in shrubland and heath, often associated with mallees, in sand, gravelly sand and laterite. Flowers Sept.–Dec., rarely to Mar. Map 166.

W.A.: 22.5 km E of Mt Ragged Rd junction, on road to Israelite Bay, *D.B.Foreman 1315* (MEL, PERTH); c. 29 km W of Newdegate, *K.Newbey 1836* (PERTH); 14 km N of Tarin Rock, along road to Kulin, *R.W.Purdie 5338* (CBG); Stirling Range Natl Park, *R.D.Royce 8079* (PERTH).

### **36. Petrophile biternata** Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 69 (1855)

T: between Moore and Murchison Rivers [W.A.], *J.Drummond 6: 168*; syn: MEL.

Shrub to 1.2 m tall. Branchlets minutely tomentose to glabrous. Leaves biternate or pinnate, to c. 6.5 cm long overall; petiole 12–28 mm long; lamina flattened, striate, thick, rigid, pungent, glabrous; lower pinnae sometimes 2–3-lobed, 10–36 mm long. Inflorescence ovoid to globose, terminal, solitary, sessile, 20–25 mm long; involucral bracts short, broad, viscid, glabrous; outer cone scales viscid, ±glabrous; inner scales broad, acuminate, rigid, woolly at base, glabrous at tips. Flowers c. 10 mm long, yellow or creamy yellow, viscid, glabrous. Pollen presenter ridged, fusiform, 3.5–4.5 mm long, yellow, covered with short, erect hairs. Cones ±ovoid, c. 25 mm long. Nuts 4–5 mm long.

Scattered in the Moora–Watheroo and Murchison River areas and just south of New Norcia, W.A.; grows in shrubland in laterite, grey sand and gravel, in quartzite soil and in sand heath. Flowers Aug.–Oct. Map 167.

W.A.: Rose Thompson Rd, 18 km S of Eneabba–Carnamah road, *D.B.Foreman 558* (MEL, PERTH); c. 55 km E of Jurien Bay, on road to Marchagee, *J.S.Beard 7873* (NSW, PERTH); between Moora and Coorow; c. 120 km N of Perth on Great Northern Hwy, S of New Norcia, *A.S.George 11701* (MEL); Brand Hwy, 11–14 km N of Eneabba, *D.B.Foreman 506* (MEL).

**37. Petrophile plumosa** Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 69 (1855)

T: Moore River [W.A.], *J.Drummond 6: 164*; syn: MEL.

Shrub to 1.3 m tall. Branchlets hoary, hirsute to minutely pubescent. Leaves entire or with 2–3 short lobes, 13–32 mm long overall; petiole 6–20 mm long; lamina linear-spathulate, flattened, rigid, pungent, plumose, slightly scabrous, glabrescent; pinnae 2–6 mm long. Inflorescence ±globose, terminal, solitary, sessile, 20–25 mm long; involucral bracts ovate-oblong, villous at base, glabrous at tip; margins ciliate; cone scales ovate-oblong, narrow, villous; outer scales sometimes ±glabrous; margins ciliate. Flowers c. 2.5 mm long, pale yellow, densely villous. Pollen presenter narrowly fusiform, 3–3.5 mm long, yellow, with sparse, short, reflexed hairs. Cones ±ovoid, c. 25 mm long. Nuts c. 4 mm long, winged. Figs 50, 94D.

Scattered in the Moore River area, W.A.; grows in shrubland on sandplain, on gravelly hills and in sandy gravel. Flowers July–Nov. Map 168.

W.A.: between Mogumber and Gillingarra, c. 130 km N of Perth and W of Gillingarra, Nov. 1903, *W.V.Fitzgerald* (PERTH); Gillingarra, Moore R., 18 Aug. 1904, *A.Morrison* (CANB); Moore R., Oct. 1901, *E.Pritzel* (AD); Mogumber, July 1936, *C.A.Gardner* (PERTH).

**38. Petrophile carduacea** Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 274 (1856)

T: in Nova Hollandia occidentali interiori [W.A.], *J.Drummond 4: 262*; syn: MEL.

Shrub to 1.3 m tall. Branchlets tomentose-pubescent or villous, with spreading hairs extending onto juvenile foliage, glabrescent. Leaves deeply toothed, 5–12 cm long, 1–5 cm wide, flattened, pungent, glabrous; teeth broadly triangular; lowest pair sometimes stipule-like; margin undulate. Inflorescence ±globose, axillary, pedunculate, c. 10 mm diam.; peduncle 10–15 mm long; involucral bracts few, triangular, acute, persisting, glabrous; cone scales broad, obtuse, glabrous. Flowers c. 8 mm long, yellow, silky-villous. Pollen presenter fusiform, c. 2 mm long, yellow, with sparse, reflexed hairs. Cones ovoid to oblong-ovoid, 20–35 mm long; peduncle to c. 10 mm long. Nuts c. 5 mm long, flattened, winged. Fig. 94 I.

Confined to the Stirling Range and nearby areas, W.A.; grows in scrub and heath; in gravelly soil and on sandplain. Flowers Sept.–Oct. Map 169.

W.A.: Red Gum Springs, Stirling Range Natl Park, 21 Sept. 1985, *W.Huggins* (MEL); c. 11 km E of Mt Manypeaks trig., *A.Salkin 68/7* (MUCV); foot of Stirling Ra., Oct. 1867, *F.Mueller* (MEL); along road towards Toolbrunup, *A.M.Ashby 553* (AD).

**39. Petrophile diversifolia** R.Br., *Trans. Linn. Soc. London* 10: 70 (1810)

*Protea diversifolia* (R.Br.) Poir. *in* J.B.A.P. de M. de Lamarck, *Encycl*., Suppl. 4: 559 (1816), *nom. inval.* T: Lewin's Land, New Holland [W.A.], Dec. 1801, *R.Brown (Britten 3237)*; lecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 475 (1995); syn: BM, MEL.

Shrub to 3 m tall, often single-stemmed. Branchlets pubescent or villous, glabrescent. Juvenile leaves often reddish, soft and fern-like, villous. Adult leaves pinnate, bipinnate, or tripinnatifid, 3–11 cm long overall, glabrous; petiole 6–26 mm long; midrib well-defined, flattened, pungent; pinnae very variable. Inflorescence ovoid, terminal or axillary, pedunculate, c. 2 mm long; peduncle 10–20 mm long; involucral bracts ovate, glabrous; cone scales deciduous, villous at base; tips acute, glabrous. Flowers c. 10–12 mm long, creamy white or white, rarely pinkish, densely villous. Pollen presenter fusiform, c. 3 mm long, yellow, ±glabrous. Cones ovoid to ±globose, to c. 30 mm long; peduncle c. 20 mm long. Nuts 5–6 mm long, winged. Fig. 94E–G.

Extending from the Blackwood River to the Stirling Range and near Bremer Bay, W.A.; grows in scrub in sand, sandy peat and pale grey sandy soil with abundant yellow bauxite grains; also in stunted Jarrah-Marri forest, in shrubland in grey sandy soil and in Jarrah woodland/forest in laterite; soils sometimes poorly drained. Flowers Sept.–Dec. Map 170.

W.A.: on road to Mt Lindesay, c. 22 km N of Denmark, *D.B.Foreman 1482* (AD, CANB, MEL, NSW, PERTH); Cane Break Rd, 5–7 km SW of Brockman Hwy, *D.B.Foreman 1522* (CANB, MEL, PERTH).

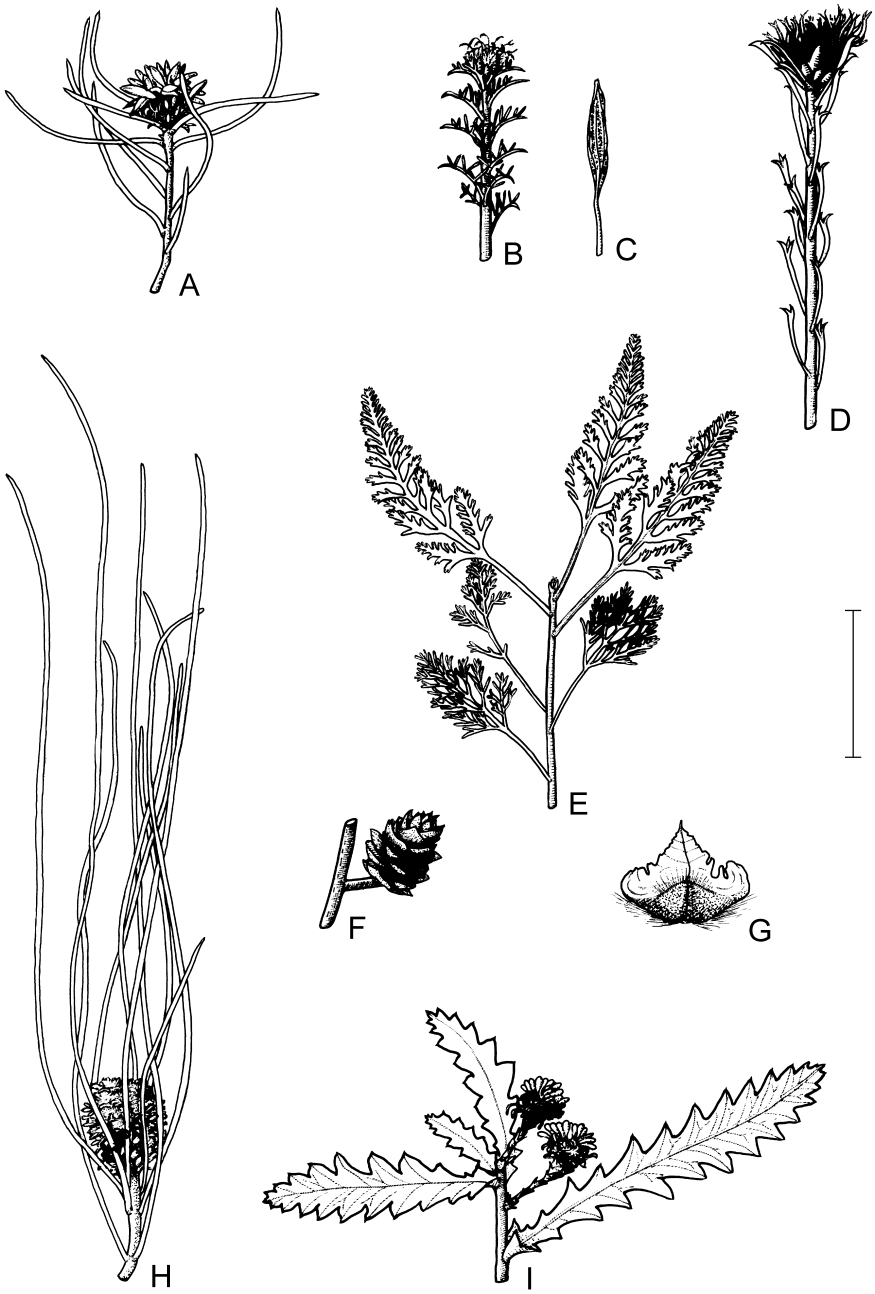



**Figure 94**. *Petrophile*. **A**, *P. brevifolia*, flowering branchlet (D.Foreman 530, MEL). **B–C**, *P. chrysantha*. **B**, flowering branchlet; **C**, pollen presenter (**B–C**, D.Foreman 521, MEL). **D**, *P. plumosa*, flowering branchlet (W.Blackall 2943, PERTH). **E–G**, *P. diversifolia*. **E**, leafy branchlet (A.George 14585, PERTH); **F**, fruiting branchlet; **G**, adaxial view of nut (**F–G**, D.Foreman 1515, MEL). **H**, *P. longifolia*, flowering branchlet (J.Preiss 625, MEL). **I**, *P. carduacea*, flowering branchlet (C.Woolcock P36, MEL). Scale bar: **A**, **B**, **D–F**, **H**, **I** = 4 cm; **C** = 5 mm; **G** = 1 cm. Drawn by P.Cooper.

**40. Petrophile glauca** Foreman, *Fl. Australia* 16: 475 (1995)

T: 17 km N of Fitzgerald townsite, W.A., 4 Oct. 1979, *N.G.Marchant 79/96*; holo: PERTH; iso: MEL, PERTH.

Erect or low-growing shrub to 1 m tall. Branchlets and leaves glabrous or with scattered, fine, spreading hairs. Leaves once or twice imparipinnate, 7–19.5 cm long; petiole 3–11 cm long; pinnae variable, usually to c. 25 mm long, glaucous, flattened, acute to pungent; midrib ±distinct. Inflorescence ±globular, sessile, terminal or axillary, c. 14 mm diam.; involucral bracts imbricate, triangular, acuminate, ±persistent, dark brown and glabrous outside, villous inside; cone scales acute, densely villous outside, glabrous inside; tip glabrous. Flowers c. 14 mm long, creamy yellow, yellow or creamy white, silky-villous. Pollen presenter fusiform, c. 2 mm long, yellow, with short, reflexed hairs. Cones ±ovoid to globose, c. 15 mm diam. Nuts c. 6 mm long, flattened, winged. Fig. 95.

Common between Wagin and Lake King to Frank Hann Natl Park, extending north to Corrigin and south to East Mt Barren, W.A.; grows in shrubland on laterite ridge, in open woodland on gravelly hilltop and in low sclerophyll scrub in sand; also in open shrubland and heath in laterite and in low open mallee in pale orange sand. Flowers Aug.–Nov., sometimes extending to Jan. Map 171.

W.A.: 11 km NW of Jitarning, *D.B.Foreman 1118* (CANB, MEL, PERTH); 9 km E of Dumbleyung, on Wagin–L. Grace road, *D.B.Foreman 745* (CANB, MEL, PERTH); L. King–Newdegate road, 16 km W of L. King, *R.Filson 9368* (MEL); Tarin Rock, *C.A.Gardner 14801* (PERTH); 1 km E of Mt Desmond summit, *B.Barnsley 450* (CBG, PERTH).

**41. Petrophile shuttleworthiana** Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 246 (1848)

T: locality not stated [Swan R. district, W.A.], *J.Drummond 2: 298*; syn: MEL.

Shrub to 2 m tall. Branchlets and leaves glabrous. Leaves pinnate or deeply trifid, 3.5–7 cm long overall; petiole flattened, 2–4.5 cm long; lamina rigid, flattened, faintly striated, pungent; pinnae 2–4 cm long, 2.5–10 mm wide, sometimes further divided. Inflorescence ±cylindrical or narrowly ovoid, terminal or axillary, sessile or shortly pedunculate, 2.5–6 cm long; apical part sometimes sterile; peduncle to c. 14 mm long; involucral bracts subulate, caducous; cone scales rather small and densely villous, becoming broad and glabrous with tip lanceolate and deciduous. Flowers 10–12 mm long, white, cream, creamy white or yellow, glabrous. Pollen presenter fusiform, 3–4 mm long, yellow, shortly and sparsely hairy. Cones narrowly ovoid, 3.5–6 cm long; peduncle c. 14 mm long. Nuts 5–6 mm long . Figs 52, 96G–I.

Extending from Moore River to Kalbarri and inland to near Wongan Hills and Watheroo, W.A.; grows in low scrub, in heath in sandy clay, in shrubland in clayey sand, sandy loam and laterite and in mallee shrubland in gravelly lateritic clay. Flowers Sept.–Oct. Map 172.

W.A.: corner of Badgingarra Rd and Mungedar Rd, *D.B.Foreman 403* (CANB, K, MEL, NSW, PERTH); Kokardine townsite, *M.G.Corrick 9272* (MEL); 11 km E of Kalbarri, on road to Ajana, *M.G.Corrick 8252* (MEL); 16 km from Perenjori, S along road to Caron, *R.W.Purdie 5278* (CBG); Western Titanium Leases, 8 km S of Eneabba, *E.A.Griffin 1347* (PERTH).

**42. Petrophile macrostachya** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830)

T: Swan R. [W.A.], 1827, *C.Fraser s.n.*; syn: K (photo).

Erect, compact, prickly shrub to 1 m tall. Branchlets grey, villous or tomentose, glabrescent. Leaves pinnate or often divided into 3 broad pinnae, these sometimes subdivided, 3–8 cm long overall; petiole ±terete, 2–5 cm long; lamina flattened, rigid, pungent, tomentose, glabrescent; pinnae to c. 3 cm long, 1.5–8 mm wide; veins conspicuous. Inflorescence oblong or cylindrical, terminal or axillary, sessile, 2–6 cm long; involucral bracts imbricate, ±ovate, deciduous, glabrous; margins minutely ciliate; cone scales becoming broad, densely villous at base; tips glabrous; margin fringed. Flowers c. 9 mm long, yellow to cream, glabrous. Pollen presenter fusiform, c. 3 mm long, yellow, shortly and sparsely hairy. Cones narrowly ovoid, almost cylindrical, to 6.5 cm long. Nuts c. 5 mm long. Fig. 96F.

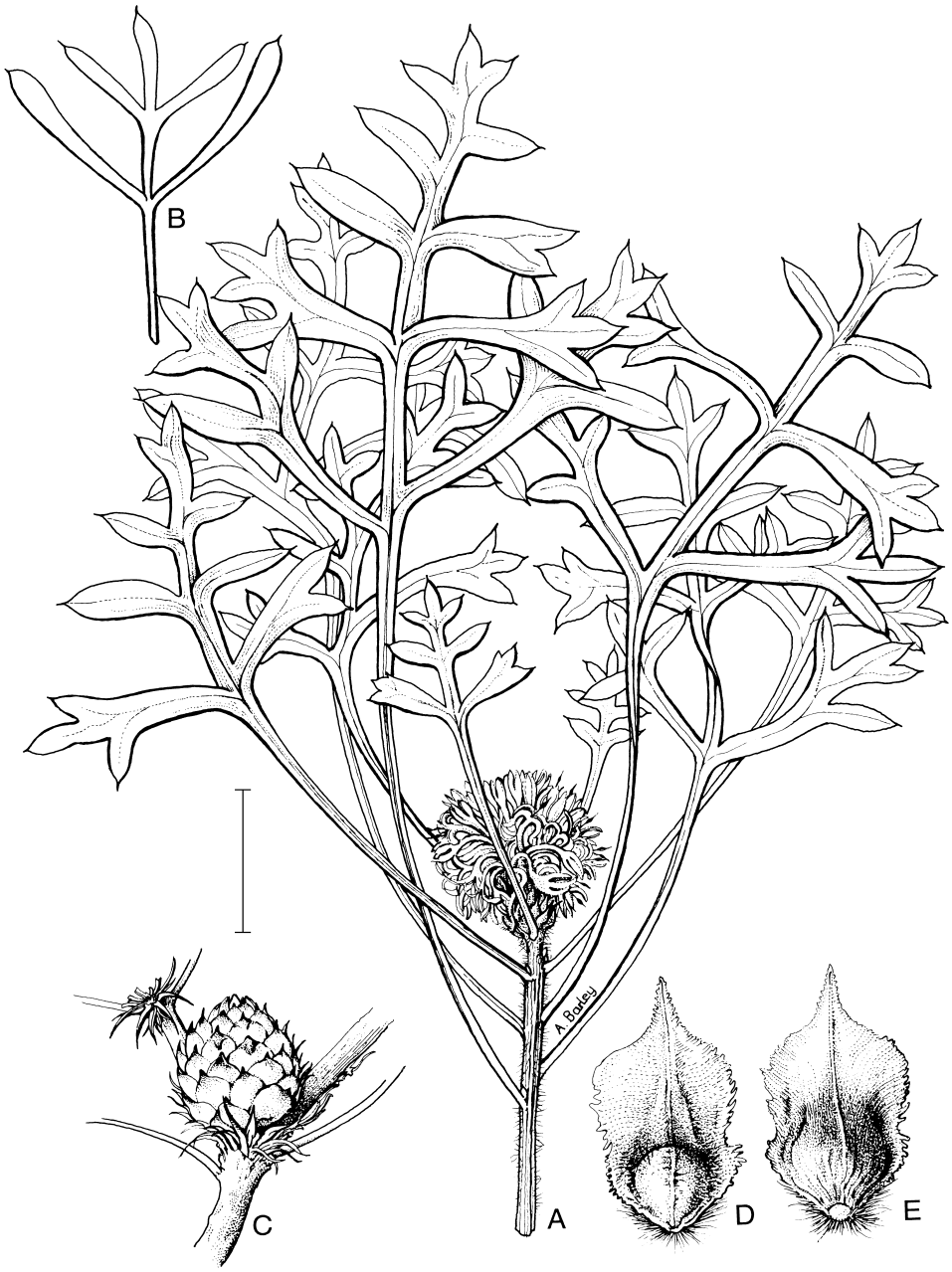



**Figure 95**. *Petrophile glauca*. **A**, flowering branchlet; **B**, leaf variation; **C**, fruiting branchlet; **D**, nut showing abaxial surface; **E**, nut showing adaxial surface (**A–E**, D.Foreman 745, MEL). Scale bar: **A–C** = 2 cm; **D**, **E** = 5 mm. Drawn by A.Barley.

Occurring from Kalbarri Natl Park to north of Gingin, W.A.; grows on sandplain, in low open heath in yellow or white sand, in heath in sand over limestone and in open shrubland in white sand; also in *Banksia* scrub in grey-brown sand and in Jarrah woodland in white sand. Flowers July–Nov. Map 173.

W.A.: Kalbarri Natl Park, 6 km NE of Kalbarri, on Ajuna–Kalbarri road, *D.B.Foreman 622* (CANB, MEL, PERTH); Cowalla road, 15 km N of Gingin to Wanneroo–Lancelin road, *D.B.Foreman 382* (CANB, MEL, NSW, PERTH); Three Springs–Eneabba road, c. 11 km SW of Eneabba, *R.V.Smith 66/230* (MEL).

### 43. Petrophile incurvata W.Fitzg., *J. Bot.* 50: 22 (1912)

T: Watheroo rabbit fence, W.A., Sept. 1905, *M.Koch 1522*; syn: MEL, NSW, PERTH.

*Petrophile semifurcata* var. *planifolia* F.Muell., *Fragm.* 10: 47 (1876). T: near Mt Churchman [W.A.], *J.Young s.n.*; syn: MEL.

Much-branched shrub to 1.2 m tall. Branchlets tomentose when young, glabrescent. Leaves rigid, flattened, entire or with with 2–5 short, pungent lobes, incurved, c. 7–12 cm long overall, glabrous. Inflorescence ±cylindrical or ovoid, terminal, sometimes 2 or 3 arising close together, sessile or shortly pedunculate, to c. 3.5 cm long; peduncle c. 10 mm long; involucral bracts deciduous, linear, acuminate; cone scales broad, rigid, overlapping, acuminate, becoming obtuse, velvety. Flowers c. 10–14 mm long, cream or yellowish white, silky-villous. Pollen presenter fusiform, c. 5 mm long, with short, stiff, ±erect hairs. Cones ovoid to cylindrical, 20–30 mm long; peduncle c. 6 mm long. Nuts c. 6 mm long. Fig. 96D–E.

Restricted to, but locally common on the eastern side of Lake Moore and south to Wubin, W.A.; grows in shrubland in pale brown, yellow and white sand. Flowers Oct. Map 174.

W.A.: Mt Churchman, *C.A.Gardner 13563* (PERTH); between Caron and Latham, *C.A.Gardner & W.E.Blackall 757a* (PERTH); c. 6 km S of Paynes Find Rd, *B.H.Smith 468* (AD, CBG, HO, MEL, PERTH); c. 18 km S of Kalannie, on road to Burakin, *D.B.Foreman 672* (MEL, PERTH).

### 44. Petrophile semifurcata F.Muell. ex Benth., *Fl. Austral.* 5: 335 (1870)

T: Murchison River, W.A., *A.F.Oldfield s.n.*; syn: K, MEL (2 sheets).

Erect, bushy shrub 0.3–1.5 m tall. Branchlets tomentose-pubescent. Leaves rigid, terete, pungent, 2- or 3-lobed, sometimes dividing again towards tip, 7–14.5 cm long, glabrous. Inflorescence ovoid, terminal, pedunculate, 2–4 cm long; peduncle 8–16 mm long; involucral bracts linear-triangular, deciduous; cone scales broad, obtuse, with an acute or acuminate point, densely tomentose to velvety. Flowers c. 14 mm long, whitish, lemon-yellow or cream, silky-villous. Pollen presenter slightly thickened, c. 6 mm long, with short, stiff hairs. Cones ovoid, 2.5–3.8 cm long; peduncle 10–20 mm long. Nuts to c. 10 mm long including a persistent tip. Fig. 96J–M.

Mostly found between Geraldton and Kalbarri, W.A.; grows in sand heaths, in open heath and in low heath with *Banksia* in yellow sand. Flowers Sept.–Nov. Map 175.

W.A.: W of Nerren Nerren, *J.S.Beard 7105* (PERTH); Kalbarri Natl Park, 12 km N of Murchison R., *R.J.Hnatiuk 760415* (PERTH); near Ajana, c. 112 km N of Geraldton, Sept. 1926, *C.A.Gardner & W.E.Blackall* (PERTH); North-west Coastal Hwy, 11 km N of Murchison R. Bridge, *R.Filson 8587* (MEL).

### 45. Petrophile linearis R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 6 (1830)

T: ora meridionali-occidentalis, ad rip. Swan River [W.A.], 1826, *C.Fraser s.n.*; syn: K (photo).

*Petrophile linearis* var. *microcephala* Domin, *Vestn. Král. Ceské Spolecn. Nauk. Tr. Mat.-Prír.* 1921–22(2): 2 (1923). T: Yallingup and Cape Naturaliste, W.A., *A.A.Dorrien-Smith s.n.*; syn: K (photo).

Erect shrub to 0.8 m tall. Branchlets glabrous, ±glaucous. Leaves narrowly obovate, 5–12 cm long overall, 1.5–10 mm wide, usually rather strongly curved, flattened, recurved at apex, obtuse or with a short, straight or curved point, thick, glabrous. Inflorescence terminal or axillary, solitary, sessile, ovoid to globular, to 25 mm long; involucral bracts numerous, linear-subulate, glabrous; cone scales broadly obovate, acuminate, glabrous towards apex, ±hirsute at base. Flowers to 3.5 cm long, grey-pink or mauve to almost white, densely

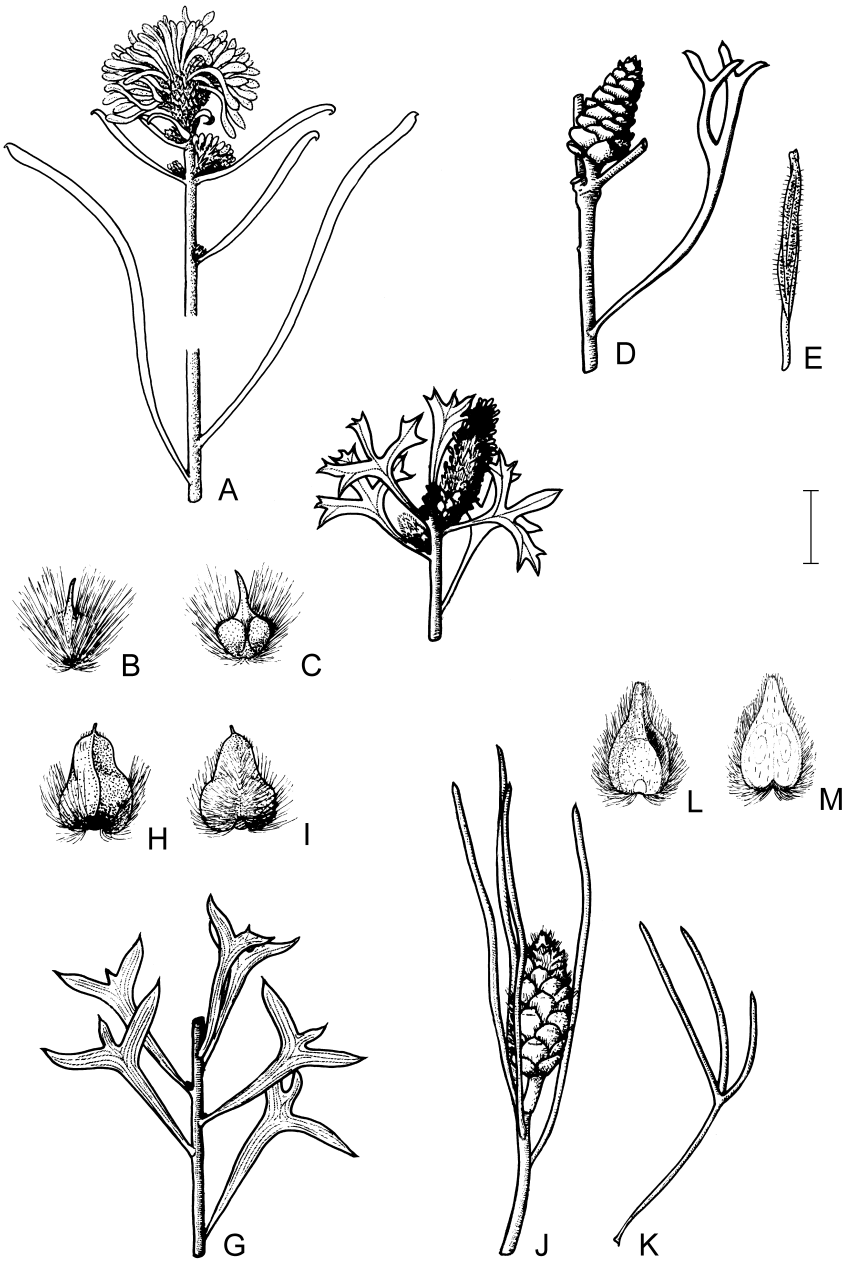



**Figure 96**. *Petrophile*. **A–C**, *P. linearis*. **A**, flowering branchlet; **B**, adaxial view of nut; **C**, abaxial view of nut (**A–C**, J.Ross 2967, MEL). **D–E**, *P. incurvata*. **D**, fruiting branchlet; **E**, pollen presenter (**D–E**, B.Smith 468, MEL). **F**, *P. macrostachya*, flowering branchlet (D.Foreman 622, MEL). **G–I**, *P. shuttleworthiana*. **G**, leaves; **H**, adaxial view of nut; **I**, abaxial view of nut (**G–I**, D.Foreman 403, MEL). **J–M**, *P. semifurcata*. **J**, fruiting branchlet (R.Filson 8587, MEL); **K**, leaf variant (D.Foreman 625, MEL); **L**, adaxial view of nut, tip broken; **M**, abaxial view of nut, tip broken (**L–M**, R.Filson 8587, MEL). Scale bar: **A**, **D**, **F**, **G**, **J**, **K** = 2 cm; **B**, **C**, **H**, **I**, **L**, **M** = 5 mm; **E** = 2 mm. Drawn by P.Cooper.

villous. Pollen presenter 4–5 mm long overall, narrowly turbinate below brush; brush ridged, c. 3 mm long, with short, spreading hairs. Cones ovoid, c. 25 mm long. Nuts c. 3 mm long. Figs 53, 96A–C.

Common on the coastal plain and Darling Range from Jurien Bay/Eneabba to Yallingup, W.A.; grows in open *Banksia* or Jarrah woodland and in low open heath, on sandplains and in laterite. Flowers Aug.–Nov. Map 176.

W.A.: Carnamah Rd, 26 km E of Eneabba, *D.B.Foreman 528* (CANB, MEL, NSW, PERTH); Yanchep Natl Park, *A.M.James 9* (PERTH); 6 km E of Busselton, on Vasse Hwy to Nannup, *J.H.Ross 2967* (HO, MEL, PERTH); lower Helena Valley, *J.Seabrook 277* (PERTH); between Badgingarra and Jurien Bay, *D.J.Whibley 3192* (AD).

This species has been reported to sprout from a lignotuber after fire.

### 46. Petrophile anceps R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 5 (1830)

*Petrophile linearis* var. *anceps* (R.Br.) Benth., *Fl. Austral.* 5: 324 (1870). T: ora occid.-merid., King George's Sound [W.A.], 1829, *W.Baxter s.n.*; syn: BM.

Shrub to c. 60 cm tall. Branchlets and leaves glabrous. Leaves linear, flattened, with very narrow, winged margins, pungent, incurved or straight, to c. 11 cm long overall, 2–3 mm wide. Inflorescence ovoid, terminal, solitary or sometimes several clustered together, sessile, to c. 20 mm long; involucral bracts greyish white when dried, numerous, linear-subulate, glabrous; cone scales ovate, acuminate, glabrous; margin slightly ciliate. Flowers c. 15 mm long, yellow, villous. Pollen presenter 3–3.5 mm long overall, narrowly turbinate below the brush; brush c. 2.5 mm long, sparsely hirsute. Cones ovoid, c. 25 mm long. Nuts c. 2.5 mm long. Fig. 97F.

Restricted to the Stirling Range, W.A.; grows on scrubby ridges, shallow gravelly sand and open heath in coarse sandy loam; also in mallee scrub on sandstone. Flowers Sept.–Oct. Map 177.

W.A.: near Warrungup Farm turn-off, Stirling Ra., *A.M.Ashby 2661* (AD); Red Gum Pass Rd, Stirling Range Natl Park, 21 Sept. 1985, *W.Huggins* (MEL); Stirling Ra., Oct. 1867, *F.Mueller* (MEL); c. 16 km S of South Bluff, Stirling Ra., *R.J.Hnatiuk 761485* (PERTH).

### 47. Petrophile striata R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 6 (1830)

T: Swan River [W.A.], date unknown, *C.Fraser 2*; lecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 478 (1995); *C.Fraser 3*; syn: BM.

*Petrophile stylaris* Gand., *Bull. Soc. Bot. France* 66: 226 (1919). T: Kelmscott, Canning River, W.A., 24 Sept. 1898, *A.Morrison s.n.*; holo: LY, *fide* L.A.S.Johnson & D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 351 (1973).

*Petrophile dasyclada* Gand., *Bull. Soc. Bot. France* 66: 226 (1919). T: Woorooloo, W.A., Sept. 1907, *M.Koch s.n.*; holo: LY, *fide* L.A.S.Johnson & D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 350 (1973); iso: MEL.

Shrub 0.2–1 m tall, sometimes multi-stemmed and semi-prostrate. Branchlets and leaves with long, fine hairs, glabrescent. Leaves pinnate or bipinnate, 3.5–7.5 cm long overall; petiole 10–22 mm long; lamina flattened, pungent, striate; pinnae linear to broad, entire or lobed, to c. 10 mm long, 1–3 mm wide, with a distinct midrib. Inflorescence axillary, ovoid, sessile, solitary or often clustered in upper leaf axils, 10–15 mm diam.; involucral bracts numerous, imbricate, ovate, c. 6 mm long, glabrous; cone scales ovate to lanceolate, mostly villous outside. Flowers 15–20 mm long, yellowish white, yellow, creamy yellow or cream, silky-villous. Pollen presenter c. 3 mm long overall, clavate to turbinate, angled below the brush; brush c. 4 mm long, almost glabrous or with sparse, reflexed hairs. Cones ovoid, to c. 15 mm diam. Nuts 7–9 mm long. Fig. 97A.

Extends from Eneabba to Wagin, in the Darling Range and to nearby parts of the coastal plain, W.A.; grows in Jarrah woodland in laterite and in clay soils, in undulating shrubland in yellow to white sand with a high gravel content and on sandplain. Flowers Aug.–Dec. Map 178.

W.A.: Great Northern Hwy, 12 km S of Hay Flat, *M.G.Corrick 9291* (MEL); c. 30 km E of Kelmscott, on Brookton Hwy, *D.B.Foreman 1056* (MEL, PERTH); c. 16.5 km from Mogumber, along Moore River Rd, *R.W.Purdie 5065* (CBG, MEL).

New growth is typically bronze-red in colour.

### **48. Petrophile divaricata** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830)

T: Mt Gardener (?Gardner) [King George Sound, W.A.], 1823, *W.Baxter 309*; lecto: BM; isolecto: NSW, *fide* D.B.Foreman, *Fl. Australia* 16: 474 (1995); south-west coast of New Holland, 1828–29, *W.Baxter s.n.*; syn: BM.

*Petrophile intricata* Lindl., *Sketch Veg. Swan R.* xxxv (1840). T: Swan R. district [W.A.], 1839, *J.Drummond s.n.*; syn: CGE, in Herb. J.Lindley.

Shrub to 2 m tall. Branchlets and leaves with long, fine, spreading hairs, glabrescent. Leaves bipinnate, 4–11 cm long overall; petiole 2–5 cm long; lamina rigid, terete, pungent; pinnae 6–20 mm long. Inflorescence oblong to ovoid, terminal, subterminal, axillary, sessile, c. 25 mm long; involucral bracts broad, acuminate, deciduous, glabrous outside, silky inside; cone scales broad, villous with tips acuminate and ±glabrous. Flowers 20–25 mm long, yellow to pale creamy yellow, fragrant, shortly silky-villous. Pollen presenter ±ridged, fusiform, c. 2–2.5 mm long, pale yellow to yellow, with short, reflexed hairs. Cones cylindrical to ovoid, to 28 mm long. Nuts c. 8 mm long, with winged, ±ciliate margins.

Extending from near Eneabba to the Stirling Range and Albany district and eastwards to the Fitzgerald River Natl Park, W.A.; grows in Jarrah forest, in heath in well-drained pale yellow clayey sand, in open woodland in laterite, in open forest in gravelly soil and in shrubland in grey sand over laterite. Flowers Aug.–Dec. Map 179.

W.A.: 16 km S of Regans Ford, *K.Newbey 1371* (PERTH); near Middle Mt Barren, *C.A.Gardner 1869* (PERTH); Red Gum Pass, Stirling Ra., *C.E.Woolcock P34* (MEL); Dryandra State Forest, c. 5 km NW of Dryandra, *D.B.Foreman 1100* (CANB, MEL, PERTH); Tutanning Wildlife Sanctuary, Bee-Eater Rd, *D.B.Foreman 1084* (CANB, MEL, PERTH).

### **49. Petrophile serruriae** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830)

T: south-west coast of New Holland [King George Sound, W.A.], 1828–29 [1829], *W.Baxter s.n.*; lecto: BM; isolecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 477 (1995); Swan River [W.A.], date unknown, *C.Fraser s.n.*; syn: BM.

*Petrophile glanduligera* Lindl., *Sketch Veg. Swan R.* xxxv (1840). T: no locality or coll. cited; syn: CGE in Herb. J.Lindley (2 sheets).

*Petrophile axillaris* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 68 (1855). T: Moore R. and Murchison R. [W.A.], *J.Drummond 6: 166*; syn: MEL.

Erect or spreading shrub to c. 1.5 m tall. Branchlets and leaves silky-pubescent, or with long, fine, spreading hairs, glabrescent or not. Leaves crowded, bipinnate or tripinnate, 15–34 mm long overall; petiole 2–10 mm long; lamina terete, acute to pungent; lower pinnae branching again. Inflorescence ovoid, sessile or with peduncles to c. 5 mm long, in terminal clusters or in upper axils, c. 10 mm diam.; involucral bracts few, deciduous; cone scales villous on outer, basal surfaces, glabrous inside; tips acute to acuminate, glabrous. Flowers 13–16 mm long, yellow or greyish mauve to pink, silky- or ferruginous-villous. Pollen presenter ±ridged, fusiform, c. 4 mm long, orange-yellow, with short, reflexed hairs. Cones ovoid to globose, 10–12 mm long. Nuts 5–8 mm long . Figs 51, 97C–E.

Common in coastal limestone areas, extending from near Geraldton to near Albany, W.A.; grows in open *Eucalyptus* woodland in gravelly loam, in shrubland in laterite, in Jarrah woodland in white sand and in low open woodland in shallow yellow sand over limestone; also in scrub heath over coastal limestone and, sometimes, in peaty sand. Flowers July–Dec. Map 180.

W.A.: Warriup Rd, c. 10 km from South Coast Hwy, *D.B.Foreman 1433* (CANB, MEL, NSW, PERTH); Yanchep Natl Park, near eastern boundary, *D.B.Foreman 359* (MEL); Red Gum Pass, Stirling Ra., *A.R.Fairall 443* (PERTH); Toodyay Rd, near Goonaring Nature Reserve, *M.G.Corrick 9664* (MEL).

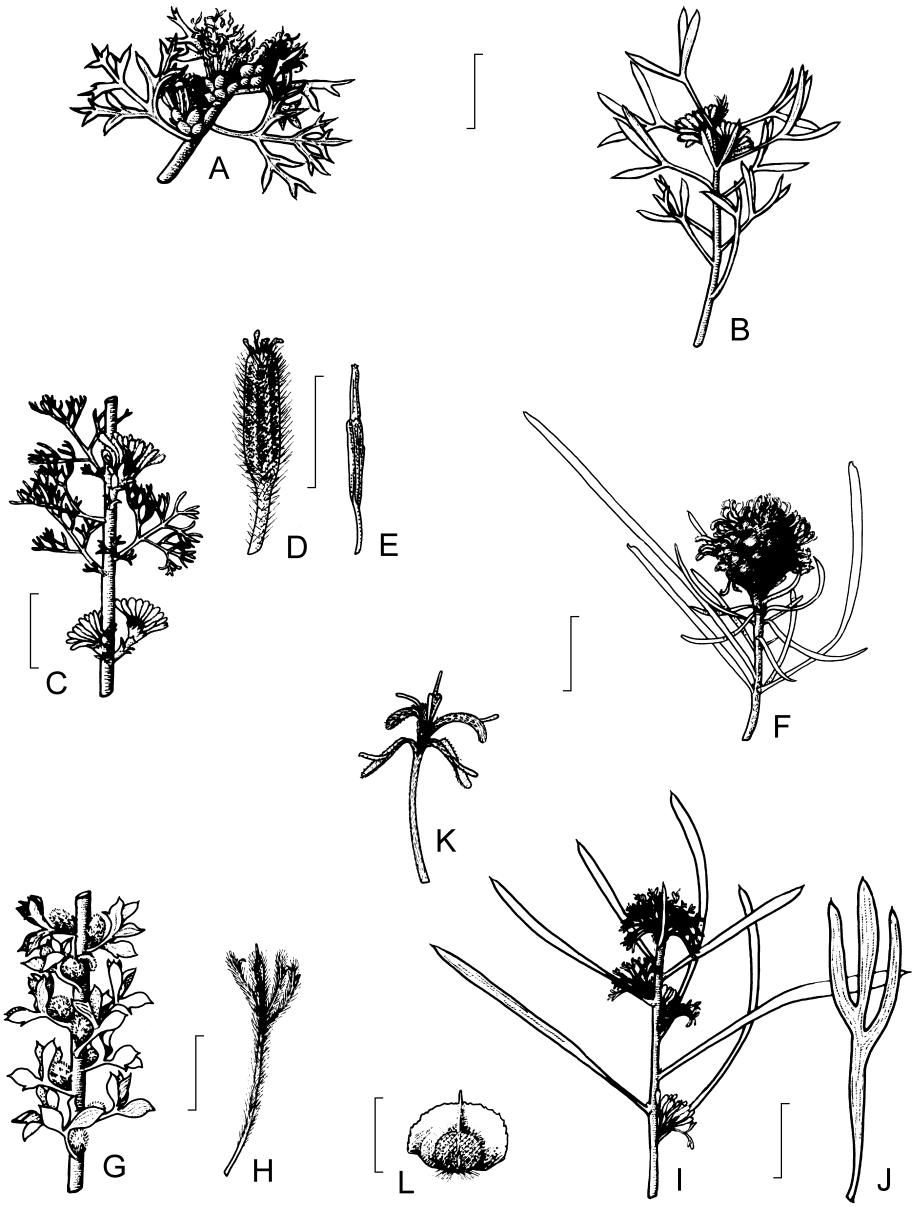



**Figure 97**. *Petrophile*. **A**, *P. striata*, flowering branchlet (K.Newbey 1585, PERTH). **B**, *P. squamata*, flowering branchlet (K.Newbey 345, PERTH). **C–E**, *P. serruriae*. **C**, flowering branchlet; **D**, apical portion of flower showing appendages; **E**, pollen presenter (**C–E**, M.Corrick 9664, MEL). **F**, *P. anceps*, flowering branchlet (Stirling Ra., W.A., F.Mueller, MEL). **G–H**, *P. biloba*. **G**, flowering branchlet, showing young inflorescence; **H**, flower (**G–H**, M.Corrick 9604, MEL). **I–L**, *P. heterophylla*. **I**, flowering branchlet (A.George 124, PERTH); **J**, lobed leaf (A.Ashby 5258, PERTH); **K**, flower; **L**, adaxial view of nut (**K–L**, A.George 124, PERTH). Scale bars: **A–C**, **F**, **G**, **I**, **J** = 2 cm; **D**, **H**, **K**, **L** = 5 mm; **E** = 3 mm. Drawn by P.Cooper.

A somewhat variable species in need of further study. J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 507 (1989) referred to 'yellow and pink [flower] colour forms'. G.Bentham, *Fl. Austral.* 5: 327 (1870) pointed out that some northern specimens have leaves which are 'more silky-hairy and less pungent'. These specimens were what J.Lindley (*loc. cit.*) described as *P. glanduligera*. This is probably the variant referred to by B.L.Rye, *Fl. Perth Reg.* 1: 353 (1987) as having 'greyish mauve flowers, ... sessile flower cones, large bracts and narrow calyces, with inconspicuous points'.

### 50. Petrophile heterophylla Lindl., *Sketch Veg. Swan R.* xxxv (1840)

T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; syn: CGE, in Herb. J.Lindley.

*Petrophile heterophylla* var. *latifolia* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 274 (1856). T: locality not stated, *J.Drummond 3: 244*; syn: MEL.

*Petrophile heterophylla* var. *intermedia* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 274 (1856). T: Mt Bakewell [W.A.], 12 Sept. 1839, *J.Preiss 658*; syn: MEL; Gordon and Hay Rivers [W.A.], 7 Nov. 1840, *J.Preiss 659*; syn: MEL.

*Petrophile heterophylla* var. *angustifolia* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 274 (1856). T: locality unknown [W.A.], *J.Drummond 1: 571*; syn: MEL.

Spindly shrub to 2 m tall. Branchlets and leaves glabrous. Leaves deeply 2–3-lobed or entire, to c. 14 cm long overall, 2–6 mm wide; lamina linear, linear-lanceolate or narrowly obovate, ±flattened, finely veined, pungent; midrib obscured. Inflorescence ovoid, sometimes terminal but mostly axillary, sessile, solitary, 6–8 mm long; involucral bracts numerous, imbricate, glabrous outside, villous inside; margins shortly ciliate; cone scales ovate, tomentose or shortly villous outside, glabrous inside. Flowers c. 10–15 mm long, pale yellow, yellow or cream, fragrant, shortly silky. Pollen presenter 3 mm long overall, clavate to turbinate, distinctly 4-angled below the brush; brush c. 1.5 mm long, glabrous. Cones ovoid to ovoid-oblong, c. 12 mm diam. Nuts flattened, c. 5 mm long, winged. Fig. 97I–L.

Occurs in the Stirling Range and extends to about midway between Ravensthorpe and Esperance; also extends northwards through the Narrogin area to near Chittering, W.A.; grows in dense scrub on sandplain, in open woodland in sandy loam with abundant surface gravel, in open woodland in gravel and in tall heath in gravelly sand over laterite; also in Jarrah forest in gravel and in low open heath in pale grey-brown sandy silt. Flowers Aug.–Oct. Map 181.

W.A.: junction of Cranbrook turn-off with Perth–Albany road, *N.T.Burbidge 2484* (CANB); Great Northern Hwy, 1 km S of turn-off to Wannamal, *R.W.Purdie 5020* (CBG, MEL); Red Gum Springs, Stirling Ra. Natl Park, 10 Oct. 1968, *J.W.Wrigley & L.T.Choo* (CBG); 33 km E of Pinararing, along road to Varley, *B.Barnsley 979* (CBG, PERTH).

### 51. Petrophile biloba R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830)

T: ora occid.-merid., Swan River [W.A., 1827], *C.Fraser 9*; syn: BM.

*Petrophile argyrotricha* Gand., *Bull. Soc. Bot. France* 66: 226 (1919). T: Greenmount, Darling Range, W.A., 24 Aug. 1897, *R.Helms s.n.*; holo: LY, *fide* L.A.S.Johnson & D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 350 (1973).

*Petrophile chrysotricha* Gand., *Bull. Soc. Bot. France* 66: 226 (1919). T: Australia occid. [W.A.], *J.Drummond s.n.*; holo: LY, *fide* L.A.S.Johnson & D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 350 (1973); the sheet at LY is ex-MEL, but no matching duplicates were found; there are several Drummond collections, but all are undated.

Shrub to c. 2 m tall. Branchlets tomentose to villous, glabrescent. Leaves ±sparsely spreading, to c. 4 cm overall; petiole to 20 mm long; lamina obliquely ovate-rhomboid, rigid, flattened, prominently veined, pungent, deeply 3-lobed; lobes often further divided, hairy, glabrescent; pinnae 5–20 mm long. Inflorescence ±ovoid, sessile, axillary, numerous, crowded near ends of branchlets, to c. 8 mm long; involucral bracts few, deciduous; cone scales silky-villous with tip glabrous. Flowers to c. 22 mm long, mostly grey to pink, villous. Pollen presenter to c. 3.5 mm long, narrowly obovoid or clavate, sometimes turbinate below the brush; brush c. 1.5 mm long, yellow, sometimes cream, white or mauve, glabrous or

minutely hairy. Cones ±ovoid, usually 10–14 mm long. Nuts flattened, to c. 6 mm long, winged . Figs 32, 97G–H.

Occurs on the Darling Range from the Canning River area to near Wannamal, W.A.; grows on gravelly granitic slopes with outcropping boulders, in heath over laterite, sometimes with clay and granite, sometimes with gravel and with *Eucalyptus marginata*/*E. calophylla* in shallow granitic soil. Flowers June–Oct. Map 182.

W.A.: Maida Vale, on Helena Valley Rd, *R.G.Coveny 8230* (NSW); 2 km NW of Darlington, *P.Armstrong 51* (PERTH); c. 53 km E of Perth, on Toodyay Rd, *G.J.Keighery 1812* (PERTH); Darling Ra. escarpment, Susannah Brook, *M.G.Corrick 9929* (MEL); Kalamunda, 19 km E of Perth, *R. & M.Hamilton 7* (CBG, MEL, PERTH).

The leaf lobes are often divided into 2 broad, lateral lobes and a narrow, often pointed, central lobe, or are pinnately 4-lobed.

### 52. Petrophile squamata R.Br., *Trans. Linn. Soc. London* 10: 70 (1810)

T: King George Sound [W.A.], Dec. 1801, *R.Brown s.n.*; lecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 478 (1995); towards Cape ?Howe, *R.Brown (Britten 3236)*; syn: BM.

*Petrophile trifida* R.Br., *Trans. Linn. Soc. London* 10: 70 (1810), *non P. trifida* Lodd., *nom. illeg.* T: Lucky Bay [W.A.], Jan. 1802, *R.Brown s.n.*; lecto: BM; isolecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 478 (1995).

*Petrophile propinqua* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830). T: Swan River [W.A., 1827], *C.Fraser 4*; lecto: BM; isolecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 476 (1995).

*Petrophile propinqua* var. *sericiflora* Benth., *Fl. Austral.* 5: 325 (1870). T: Cape Arid [W.A.], date unknown, *G.Maxwell s.n.*; lecto: K; syn: K, *fide* D.B.Foreman, *Fl. Australia* 16: 477 (1995).

*Petrophile colorata* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 246 (1848). T: [Swan R., W.A.], *J.Drummond 2: 296*; syn: MEL.

*Petrophile cunninghamii* Meisn. var. *cunninghamii in* J.G.C.Lehmann, *Pl. Preiss.* 1: 499 (1845); *P. cunninghamii* var. *major* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 499 (1845). T: Albany [W.A.], 11 Oct. 1840, *J.Preiss 652*; syn: MEL.

*Petrophile cunninghamii* var. *brachyphylla* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 499 (1845). T: ?Nelson [W.A.], Dec. 1839, *J.Preiss 651*; syn: MEL.

*Petrophile cunninghamii* var. *gracilis* A.Cunn. ex Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 499 (1845). T: King George Sound [W.A.], *A.Cunningham s.n.*; *n.v.*

Erect shrub to 1.5 m tall. Branchlets glabrous or slightly tomentose. Leaves usually deeply divided, rarely simple, to c. 6.5 cm long overall, primarily 3-lobed; petiole to 28 mm long; lamina flattened, ±rigid, pungent, glabrous or with sparse, fine, spreading hairs; lobes often 3–5-lobulate, 3–35 mm long. Inflorescence ovoid, sessile, axillary, 5–6 mm long; involucral bracts small, deciduous; cone scales ovate, villous; tip glabrous. Flowers 8–10 mm long, creamy yellow or yellow, sericeous to almost villous. Pollen presenter 4 mm long overall, slightly thickened to turbinate and truncate below the brush; brush c. 2.5 mm long, yellow, glabrous or sparsely and minutely hairy. Cones ±ovoid, c. 16 mm long. Nuts c. 6 mm long, winged. Fig. 97B.

A common, widespread and somewhat variable species occurring from Swan River [Perth] south to Israelite Bay, W.A.; grows in heathland in grey or white sand, in shrubland in loam, laterite, deep brown sand or clay flats and in heathland, associated with *Eucalyptus marginata*/*E. calophylla* in laterite; also in *Eucalyptus wandoo* woodland in grey gravelly clay soil, in open scrub in sandy soil, in damp sandy areas and in swampy forest on ironstone. Flowers July–Dec. Map 183.

W.A.: 10 km S of Narrogin, on Narrogin–Wagin road, *D.B.Foreman 725* (CANB, MEL, NSW, PERTH); 32 km N of Hopetoun, along road to Ravensthorpe, *P.S.Short 2675, M.Amerena & B.A.Fuhrer* (AD, MEL, PERTH); Governor Broome Rd, c. 10 km S of Brockman Hwy, *D.B.Foreman 1525* (CANB, MEL, PERTH); Darling Ra., *M.G.Corrick 9365* (MEL).


**Figure 98**. *Petrophile aculeata*. **A**, fertile branchlet (remains of flowers and cones); **B**, style; **C**, nut showing abaxial surface; **D**, nut showing adaxial surface (**A–D**, E.Griffin 1758, PERTH). Scale bars: **A** = 1 cm; **B** = 1 mm; **C**, **D** = 2 mm. Drawn by A.Barley.

**53. Petrophile aculeata** Foreman, *Fl. Australia* 16: 474 (1995)

T: Coorow Reserve, W of Coorow, W.A., 30 Jun. 1967, *C.Chapman s.n.*; holo: PERTH; iso: MEL.

Small shrub to c. 35 cm tall. Branchlets and leaves hirsute, glabrescent. Leaves simple; lamina narrowly obovate, 4–9 cm long, flattened, minutely scabrous, irregularly toothed in upper half; teeth ±retrorse; longitudinal veins 3 with a few lateral veins clearly visible on both surfaces. Inflorescence ±globose, terminal or axillary, sessile, 10–12 mm diam.; involucral bracts grey, narrowly ovate, hirsute; cone scales ovate to broadly ovate, grey, hirsute. Flowers c. 11 mm long; colour unknown, villous towards tip, glabrous at base. Pollen presenter fusiform, c. 2.5–3 mm long, covered with sparse, short, erect hairs (based on withered remains). Cones ±globose, to c. 12 mm diam. Nuts c. 6 mm long. Fig. 98.

Known from a restricted area around 30°S and 115–116°E, in Alexander Morrison Natl Park, west of Coorow and another locality south of Eneabba, W.A.; grows in low open heath in grey sand and lateritic pebbles. Flowers Nov. Map 184.

W.A.: Alexander Morrison Natl Park, *E.A.Griffin 1758* (PERTH); *loc. id.*, *E.A.Griffin 2203* (PERTH); Reserve 31030, 20 km S of Eneabba, *E.A.Griffin 3044 & M.I.Blackwell* (PERTH).

## Excluded species

*Petrophile inconspicua* Meisn., *Hooker's J. Bot. & Kew Gard. Misc.* 7: 68 (1855).

T: between Moore R. and Murchison R. [W.A.], date unknown, *J.Drummond 6: 172*; syn: MEL, PERTH.

This is *Isopogon inconspicuus* (Meisn.) Foreman.

*Petrophile dubia* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830).

T: Swan River [W.A.], 1827, *W.Baxter*; lecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 479 (1995).

This is *Isopogon dubius* (R.Br.) Druce.

*Petrophile trifida* Lodd., *nom. inval.*, *nom. illeg.*, *Bot. Cab.* 19, t. 1883 (1833), *non* R.Br. (1810).

This is *Isopogon trilobus* R.Br.

*Petrophile adiantifolia* Sm. ex Meisn., *nom. inval.*

Manuscript name in Herb., *fide* C.F.Meisner *in* A.L.P.P. de Candolle, *Prodr.* 14: 274 (1856).

*Petrophile rhoifolia* Sm. ex Meisn.

Manuscript name in Herb., *fide* C.F.Meisner *in* A.L.P.P. de Candolle, *Prodr.* 14: 274 (1856).

*Petrophile falcata* A.Cunn. ex Meisn.

Manuscript name in Herb., *fide* C.F.Meisner *in* A.L.P.P. de Candolle, *Prodr.* 14: 267 (1856).

*Petrophile gracilis* A.Cunn. ex Meisn.

Manuscript name, *fide* S.F.L.Endlicher, *Gen. Pl.*, *Suppl. IV, Pars II:* 76 (1847).

# 11. ISOPOGON

*D.B.Foreman*

*Isopogon* R.Br. ex Knight, *Cult. Prot.* 93 (1809), *nom. cons.*; from the Greek *isos* (equal) and *pogon* (a beard), referring to the tufts of hairs at the apex of the perianth segments of some species or, possibly, referring to the hairs of ±equal length which cover the nut on all sides.

Type: *Protea anemonifolia* Salisb. = *Isopogon anemonifolius* (Salisb.) Knight

*Atylus* Salisb., *Parad. Lond.* 66 (1807) *p.p.* [Description incorporates features of both *Isopogon* and *Petrophile*].

*Atylus* sect. *Isopogon* (R.Br. ex Knight) Kuntze *in* T.E. von Post & C.E.O.Kuntze, *Lex. Gen. Phan.* 54 (1903).

Shrubs or small trees. Leaves simple or compound, terete or flattened, rigid, sometimes broad. Inflorescence a dense spike or 'cone', terminal or axillary, ±globose or ovoid, sessile or pedunculate, solitary or several clustered; receptacle cylindrical to concave; involucral bracts usually present, somewhat more persistent than cone scales; cone scales tomentose to villous outside, glabrous inside, deciduous after flowering or shed with the fruit; floral bracts absent. Flowers actinomorphic, bisexual, sessile. Tepals spreading at anthesis; upper part decidous; basal part persisting until the fruit expands on ripening. Stamens 4, sessile, with a short connective. Hypogynous glands absent. Ovary sessile, 1-locular; ovules 1 (–2), pendulous; style filiform, straight; pollen presenter usually dilated or clavate, often separated from the brush by a constriction, with various parts glabrous or hairy, rarely fusiform, with a very small stigma, otherwise the tip slightly enlarged to form a stigmatic cup. Fruiting cones not persisting; scales separating readily. Fruit a small, hairy nut, not compressed or winged. *Conesticks*, *Conebushes*, *Coneflowers*. *n* = 13, H.P.Ramsay, *Austral. J. Bot.* 11: 4 (1963).

A genus of 35 species, including 7 subspecies and 4 varieties, endemic in extra-tropical Australia. Most species (27) are concentrated in south-western W.A.

Preliminary observations suggest that at least some of the taxa presently included in *Isopogon*, e.g. *I. buxifolius s. lat.*, may have as their closest relatives some of the South African Proteoideae. *Isopogon* is generally distinguishable from *Petrophile* by the dried cone scales that fall with the fruits and by the fruits, themselves, which are hairy and not compressed. Less clearly defined are differences in the morphology of the pollen presenters of the two genera, with taxa in both *Isopogon* and *Petrophile* having simple, ±fusiform structures or more ornate pollen presenters. Studies presently underway, including a cladistic analysis of the family, may shed more light on the relationships between *Isopogon*, *Petrophile* and other Proteoideae.

In the following descriptions the inflorescence measurement (usually its diameter) is inclusive of the flowers. If the flowers tend to be held more erect rather than spreading the overall length of the inflorescence is given. The morphology of the receptacle is recorded only if it might be a useful diagnostic character.

B.L.Rye, *Isopogon*, *in* N.G.Marchant *et al.*, *Fl. Perth Reg.* 1: 345–347 (1987); R.M.Sainsbury, *Field Guide Isopogons & Petrophiles* 1–55 (1987); W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildflowers* part 1, 2nd edn, 143–152 (1988); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 425–440 (1989).

**1** Leaves terete

**2** Flowers creamy yellow or yellow

**3** Leaves simple **11. I. sp. A**

**3:** Leaves pinnate, bipinnate or divaricately divided

**4** Leaves pinnate or bipinnate; shrub to 2 m tall [N.S.W.] **2. I. anethifolius**

**4:** Leaves divaricately divided; shrub to 1.6 m tall [W.A.]

**5** Shrub to 0.6 m tall; petiole to c. 13 cm long; lamina to c. 12 cm long; flowers to 20 mm long **12. I. villosus**

**5:** Shrub to 1.6 m tall; petiole to c. 25 mm long; lamina to c. 4 cm long; flowers to 30 mm long **15. I. gardneri**

**2:** Flowers dirty white tinged with pink, creamy pink, reddish, purple or mauve

**6** Perianth completely glabrous **20. I. asper**

**6:** Perianth hirsute, villous, densely pubescent or largely glabrous but with a tuft of hairs at the apex of each tepal

**7** Perianth glabrous but with a tuft of hairs at the apex of each tepal; flowers pale to dark pink, reddish or mauve

**8** Mature leaves 1.2–2.6 cm long, with long, fine, spreading hairs, trifid or occasionally simple **23. I. adenanthoides**

**8:** Mature leaves to c. 5.5–18 cm long, ±glabrous, variously divided but not trifid

**9** Leaves with a shallow longitudinal groove

**10** Flowers to c. 25 mm long; leaves to 5.5 cm long, smooth **16. I. formosus**

**10:** Flowers to c. 30 mm long; leaves to 18 cm long, longitudinally wrinkled, thicker than above **13. I. heterophyllus**

**9:** Leaves lacking a shallow longitudinal groove

**11** Leaves usually pinnate, occasionally simple; branchlets glabrous; flowers to 25 mm long **17. I. divergens**

**11:** Leaves simple or forked; branchlets minutely pubescent; flowers to c. 18 mm long **18. I. scabriusculus**

**7:** Perianth hirsute, villous or densley pubescent; flowers creamy pink, pink, or dirty white tinged with pink or purple

**12** Flowers drooping, grey-hirsute; low shrub to 0.8 m tall **22. I. inconspicuus**

**12:** Flowers not drooping, villous or densely pubescent; shrub to 2 m tall

**13** Flowers densely pubescent, to c. 15 mm long; shrub to 2 m tall **14. I. teretifolius**

**13:** Flowers villous, to c. 30 mm long; shrub to 1.6 m tall **15. I. gardneri**

**1:** Leaves flat or slightly concave

**14** Leaves undivided; margins entire

**15** Flowers pink to mauve to purplish pink

**16** Inflorescence axillary; flowers villous-plumose towards the apex **34. I. axillaris**

**16:** Inflorescence terminal, sometimes clustered towards the end of the branchlets; flowers glabrous or with a tuft of hairs at the apex of each tepal

**17** Perianth glabrous **25. I. linearis**

**17:** Perianth with a tuft of hairs at the apex of each tepal

**18** Inflorescence terminal or clustered towards the ends of the branchlets, to 2 cm long; flowers 10–15 mm long **35. I. buxifolius**

**18:** Inflorescence terminal, solitary, to 8 cm diam.; flowers to c. 35 mm long

**19** Lamina narrowly obovate to oblong-obovate; apex obtuse; flowers c. 25 mm long **30. I. cuneatus**

**19:** Lamina obovate to broadly elliptic; apex acute; flowers c. 35 mm long **31. I. latifolius**

**15:** Flowers white, creamy white, greenish, creamy yellow, yellow or creamy green

**20** Flowers glabrous

**21** Inflorescences often densely clustered; flowers whitish to yellow or cream; spreading shrub to 1 m tall [W.A.] **26. I. polycephalus**

**21:** Inflorescences solitary; flowers creamy yellow to creamy green; erect bushy shrub to c. 1.5 m tall [N.S.W.] **4. I. fletcheri**

**20:** Flowers silky-villous, or with a tuft of hairs at the apex of each tepal or or the whole limb and sometimes part of the tube villous

**22** Tufted shrub to 0.4 m tall; lamina apex usually uncinate **28. I. uncinatus**

**22** Erect bushy shrub, 1–2.5 m tall; lamina apex never uncinate

**23** Flowers with a tuft of hairs on the apex of each tepal; lamina to 3.5 cm long **35. I. buxifolius**

**23:** Flowers silky-villous or the limb and sometimes part of the tube villous; lamina to 16 cm long

**24** Flowers silky-villous; shrub to 2.5 m tall; inflorescence solitary **10. I. longifolius**

**24:** Flowers with the limb and sometimes part of the tube villous

**25** Leaves glabrous, oblong-spathulate to ±linear; lamina margins not recurved; petiole to c. 5 cm long **27. I. attenuatus**

**25:** Leaves often remaining hirsute, linear to narrowly obovate; lamina margins often recurved; petiole not discernible **29. I. sphaerocephalus**

**14:** Leaves variously divided or lobed

**26** Flowers white, silvery white, creamy white, pale grey, pink or purple

**27** Erect shrub or small tree, to c. 5 m tall [N.S.W.] **3. I. dawsonii**

**27:** Low to medium, erect shrub, 0.4–1.5 (–2) m tall [W.A.]

**28** Lamina canaliculate **32. I. dubius**

**28:** Lamina not canaliculate

**29** Flowers to 35 mm long, greyish-villous **21. I. baxteri**

**29:** Flowers to 30 mm long, glabrous except for a tuft of hairs on the apex of each tepal, or pubescent or silky

**30** Lamina to 6.5 cm long

**31** Leaves simple, 3-toothed; lamina, to 6.5 cm long; flowers mostly white **24. I. tridens**

**31:** Leaves once or twice ternately divided; lamina to 4 cm long; flowers reddish pink **33. I. crithmifolius**

**30:** Lamina to c. 18 cm long

**32** Low shrub, to 0.45 m tall; flowers yellowish, densely silky towards the top **19. I. alcicornis**

**32:** Shrub to 2 m tall; flowers pink or red, with a tuft of hairs at the apex of each tepal, the tube glabrous or pubescent **18. I. scabriusculus**

**26:** Flowers creamy yellow or yellow

**33** Perianth glabrous except for a tuft of hairs at the apex of each tepal, or glabrous at the base and becoming villous towards the apex [eastern Australia]

**34** Perianth creamy yellow, glabrous at the base and becoming villous towards the apex, 17–20 mm long **5. I. mnoraifolius**

**34:** Perianth yellow, glabrous except for a tuft of hairs at the apex of each tepal, to c. 10–15 mm long

**35** Erect shrub to 2 m tall **6. I. anemonifolius**

**35:** Low-growing or prostrate shrub to 1 m tall, often less

**36** Petiole to c. 12 cm long; involucral bracts pubescent **1. I. petiolaris**

**36:** Petiole to 6 cm long; involucral bracts glabrous or sparsely hairy, often only the margins ciliate

**37** Prostrate, spreading shrub; lamina to c. 4.5 cm long, variously divided into linear lobes; apices acute; petiole to c. 6 cm long **7. I. prostratus**

**37:** Compact shrub; lamina 1.8–3.6 cm long, pinnatisect; apices pungent-pointed; petiole 1.2–5.6 cm long **8. I. ceratophyllus**

**33:** Perianth ±uniformly silky-villous or silky-pubescent [W.A.]

**38** Low shrub to 45 cm tall; lamina 10–40 cm long; flowers white or pink, 15–20 mm long **19. I. alcicornis**

**38:** Shrub to 2–2.5 m tall; lamina to 15.5 cm long; flowers cream to yellow, 8–15 mm long

**39** Flowers c. 8–10 mm long, silky-pubescent; lamina 3–9-toothed to deeply 3–5-lobed, 2–5.5 cm long **9. I. trilobus**

**39:** Flowers to c. 15 mm long, silky-villous; lamina simple or deeply 2–3-lobed, c. 15.5 cm long **10. I. longifolius**

## 1. Isopogon petiolaris A.Cunn. ex R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 8 (1830)

*Atylus petiolaris* (A.Cunn. ex R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: ora orient., Moreton Bay [Qld], 1827, *A.Cunningham*; syn: BM.

*Isopogon anemonifolius* var. *ceratophylloides* Cheel, *Proc. Linn. Soc. New South Wales* 48: 682 (1923). T: Warialda, N.S.W., Oct. 1904, *N.W.Garrand s.n.*; syn: NSW.

Illustration: G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 21 (1991).

Low, spreading shrub, mostly less than 1 m tall. Branchlets reddish brown, pubescent. Leaves ternately to pinnately divided, erect; petiole to c. 3–12 cm long; lamina flat, to c. 1.5–7.5 cm long, striate, acute to pungent-pointed, glabrescent; lateral pinnae often divaricate. Inflorescence globose, terminal, sessile, solitary, c. 15–20 mm diam., surrounded by leaves; involucral bracts broad, acuminate, pubescent; cone scales broadly cuneate, villous to very woolly on outside, except for acuminate apex. Flowers to c. 10 mm long, yellow, glabrous except for a short tuft of apical hairs on each tepal. Pollen presenter to c. 2–3 mm long; basal part minutely papillose, scarcely swollen, constricted near mid-point then slightly dilated; apical part glabrous, scarcely swollen except for stigmatic cup. Cones ovoid to globose, to c. 20 mm diam. Nuts ovoid, beaked, to c. 4.5 mm long, villous. Fig. 99K.

Widely distributed from the Darling Downs, south-eastern Qld, to the New England Tableland, extending south to near Parramatta and west to the Pilliga State Forest and Bumberry, near Parkes, N.S.W.; grows in heath or dry sclerophyll forest or woodland, often in sandy soils of granite origin. Flowers July–Nov. Map 185.

Qld: Bald Rock Ck, 10 km N of Wallangara, *I.R.Telford 3185* (CBG); Tobacco Rd, 17 km ESE of Inglewood, *A.N.Rodd 4123* (MEL). N.S.W.: 40 km NNE of Coonabarabran on Narrabri road, *H.Streimann 649* (CBG); Parramatta, July 1855, *F.Mueller* (MEL); Pilliga State Forest, 0.4 km W along Burma Rd from Newell Hwy, *R.G.Coveny 12740, P.Cuneo & B.Wiecek* (MEL, NSW).

Reported as having several stems arising from a lignotuber.

## 2. Isopogon anethifolius (Salisb.) Knight, *Cult. Prot.* 94 (1809)

*Protea anethifolia* Salisb., *Prodr. Stirp. Chap. Allerton* 48 (1796); *Atylus anethifolius* (Salisb.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: ex Port Jackson [N.S.W.], *auct.* Jac. Lee; not located.

*Isopogon eriophorus* Gand., *Bull. Soc. Bot. France* 66: 229 (1919). T: Berowra, N.S.W., July 1899, *J.H.Maiden*; holo: LY, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 344 (1973).

*Isopogon confertus* Gand., *Bull. Soc. Bot. France* 66: 229 (1919). T: Never Never, Rylstone, N.S.W., Oct. 1897, *R.T.Baker s.n.*; holo: LY, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 344 (1973).

*Isopogon globosus* Gand., *Bull. Soc. Bot. France* 66: 229 (1919). T: Port Jackson, N.S.W., Aug. 1897, *C.Walter s.n.*; lecto: LY, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 344 (1973); Port Jackson, N.S.W., 1910, *J.R.Tovey s.n.*; syn: LY.

*Isopogon virgulatus* Gand., *Bull. Soc. Bot. France* 66: 229 (1919). T: (Australia occid.), N.S.W., 1902 (ex Herb. *C.Walter*); holo: LY, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 344 (1973).

Illustrations: W.R.Elliot & D.L.Jones, *Encycl. Austral. Pl.* 5: 441 (1990); G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 21 (1991).

Erect, bushy shrub to c. 2 m tall. Branchlets reddish brown, glabrous. Leaves pinnate or bipinnate; petiole c. 3.5–5.5 cm long; lamina terete, 6–10.5 cm long, acute, glabrous. Inflorescence globose, terminal or axillary, sessile or shortly pedunculate, solitary, to c. 40 mm diam.; involucral bracts small and narrow, ±acuminate, glabrous or with a short marginal fringe of hairs; inner ones broader; cone scales numerous, imbricate, broad, truncate, tomentose to villous except for deciduous apex. Flowers to c. 12 mm long, yellow, shortly silky, with longer tufts of hairs on apex of each tepal. Pollen presenter to c. 3.5 mm long; basal part swollen, minutely pubescent, constricted near mid-point then dilated into a globose part; apical part scarcely swollen, glabrous. Cones ovoid to globose, to c. 25 mm diam. Nuts ovoid, beaked, to c. 4 mm long, villous. *Narrowleaf Drumsticks*. Fig. 99J.

Restricted to coastal and nearby tablelands of central and southern N.S.W.; grows in dry sclerophyll forest and heathland on sandstone. Flower Sept.–Nov. Map 186.

N.S.W.: Bulee Gap, 7.1 km from Nerriga towards Nowra, *H.Thompson 814 & S.Donaldson* (CBG, MEL, NSW); Green Gully, Glen Davis, c. 40 km N of Lithgow, *E.F.Constable 5155* (NSW); Wattamolla Rd, Royal Natl Park, *D.J.McGillivray & E.F.Constable 5699* (NSW); Deanes siding (abandoned), c. 20 km NNE of Lithgow, *B.G.Briggs 7177 & L.A.S.Johnson* (NSW).

## 3. Isopogon dawsonii R.T.Baker, *Proc. Linn. Soc. New South Wales* ser. 2, 9: 658, t. 45 (1895), as *dawsoni*

T: Murrumbo, near the Goulburn River, 50 miles [c. 80 km] N of Rylstone [N.S.W.], Oct. 1893, *R.T.Baker s.n.*; holo: NSW.

Illustrations: W.R.Elliot & D.L.Jones, *Encycl. Austral. Pl.* 5: 444 (1990); G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 21 (1991).

Erect shrub or small tree to c. 5 m tall. Branchlets reddish brown, hoary at first, glabrescent. Leaves pinnately divided into narrow segments, occasionally simple; petiole to c. 7 cm long; lamina flat, to c. 11.5 cm long, acute, hoary at first, glabrescent; lateral pinnae simple or variously subdivided. Inflorescence ±globose, terminal, sessile, solitary, c. 40–45 mm diam., surrounded by leaves; involucral bracts broadly ovate to ovate, imbricate, tomentose; cone scales broadly ovate, velvety to villous on upper half, glabrous inside, with longer hairs on lower half outside. Flowers to c. 16 mm long, silvery white, creamy white or grey-white, densely silky-villous, longer towards apex. Pollen presenter to c. 4 mm long; basal part swollen, densely papillose, constricted near mid-point then dilated into a globose part; apical part glabrous, scarcely swollen except for stigmatic cup. Cones ±globose, to c. 20–25 mm diam. Nuts ovoid, beaked, to c. 4 mm long, villous. *Nepean Conebush*. Fig. 99C.

Restricted to the central-western slopes of the Great Dividing Range, and the central tablelands and central coast of N.S.W. where it may be locally common; grows mostly in sclerophyll forest on rocky, sandstone slopes or near cliff edges. Flowers Aug.–Oct. Map 187.

N.S.W.: Green Gully, Glen Davis, c. 40 km N of Lithgow, *E.F.Constable 5922* (MEL, NSW); Honeysuckle Ck, Coxs Gap, 6 Oct. 1969, *J.H.Willis* (MEL); Green Gully, 2.5 km SSW of Glen Davis, c. 40 km NNE of

Lithgow, *I.R.Telford 5016 & M.D.Crisp* (CBG); Currant Mtn Gap, 24 km by road E of Rylstone, *R.G.Coveny 6620 & P.Hind* (NSW).

Reports of plants to 6 m tall appear to be based on an annotation of the holotype label by R.T.Baker suggesting that trees may reach a height of 20 feet. No recent label information seen by me can confirm this observation.

### 4. **Isopogon fletcheri** F.Muell., *Proc. Linn. Soc. New South Wales*, ser. 2, 9: 151 (1894)

T: Blackheath, overlooking the Grose Valley, Blue Mountains [N.S.W.], *J.J.Fletcher*; holo: MEL 1531488; iso: NSW.

Illustration: G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 22 (1991).

Erect bushy shrub, mostly to c. 1.5 m tall. Branchlets reddish brown, glabrous. Leaves simple, scarcely petiolate; lamina flat, narrowly ovate to oblanceolate, to c. 12 cm long, terminating in a short, acute point, glabrous. Inflorescence turbinate to globose-ovate, terminal, sessile, solitary, c. 20–25 mm diam., surrounded by leaves; involucral bracts broadly ovate to almost deltoid, apiculate, imbricate, glabrous; cone scales broadly ovate to almost elliptic, white-velvety, glabrous at apex. Flowers to c. 15 mm long, creamy yellow to creamy green, glabrous. Pollen presenter c. 3–4 mm long; basal part swollen, densely papillose, constricted near mid-point then dilated into a globose part; apical part glabrous, scarcely swollen except for stigmatic cup. Cones ±globose, to c. 20 mm diam. Nuts ovoid, beaked, c. 2–3 mm long, villous. Fig. 99A.

Restricted to a few localities near Blackheath, Blue Mountains, N.S.W.; grows in wet places on or near sandstone cliffs. Flowers Sept.–Nov. Map 188.

N.S.W.: Govetts Leap, Blackheath, *E.F.Constable 6138* (MEL, NSW); Perrys Lookdown, Blackheath, Apr. 1969, *S.C.Clemesha* (MEL); Perrys Lookdown, 7 km NE of Blackheath Railway Station, *R.G.Coveny 1028* (NSW); foot of Govetts Leap, Blackheath, 4 Dec. 1918, *J.L.Boorman* (NSW).

### 5. **Isopogon mnoraifolius** McGill., *Telopea* 1: 31 (1975)

T: Bald Knob, Angourie, 6 km S of Yamba, N.S.W., 27 Sept. 1967, *D.J.McGillivray 2705 & J. de S.Disney*; holo: NSW; iso: BRI, PERTH.

Illustration: G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 21 (1991).

Shrub 40–80 mm tall. Branchlets mid-grey, pubescent. Leaves sometimes simple, or divided into 2–7 linear, upwardly curving lobes which may be further divided; petiole to c. 7 cm long; lamina flat, to c. 10 cm long, acute, mostly glabrous. Inflorescence ovoid to globose, terminal, sessile, solitary, often very numerous, 30–40 mm diam., surrounded by simple or sparingly divided leaves; involucral bracts sericeous outside, broadly ovate to ovate; apex glabrous; cone scales woolly on lower half of outer surface; apex elliptic to obovate, glabrous. Flowers 17–20 mm long, creamy yellow, glabrous at base, becoming villous towards apex. Pollen presenter to c. 4 mm long; basal part papillose, scarcely swollen, constricted near mid-point then slightly dilated into a globose part; apical part glabrous, scarcely swollen except for stigmatic cup. Cones ovoid to ellipsoidal, to c. 22 mm diam. Nuts villous, ovoid to ellipsoidal, to c. 3 mm long. Fig. 99B.

Restricted to the north coast of N.S.W.; grows in open heath or at the edge of woodland in clay or sand. Flowers Sept. Map 189.

N.S.W.: Minnie Water, N of Wooli, *J. de S.Disney & D.J.McGillivray 2719* (NSW); 13 km SSE of Coaldale, *S.Clark, J.Pickard & R.G.Coveny 1881* (NSW); Bald Knob, Angourie, c. 4 miles [6.5 km] S of Yamba, *D.J.McGillivray 2155* (NSW).

The specific epithet refers to the shape of some of the leaves which resemble the menorah or Jewish candelabra. Elliot & Jones (1990) reported the presence of a lignotuber, but this feature was not noted in the original description or on the labels of any of the specimens seen by me.

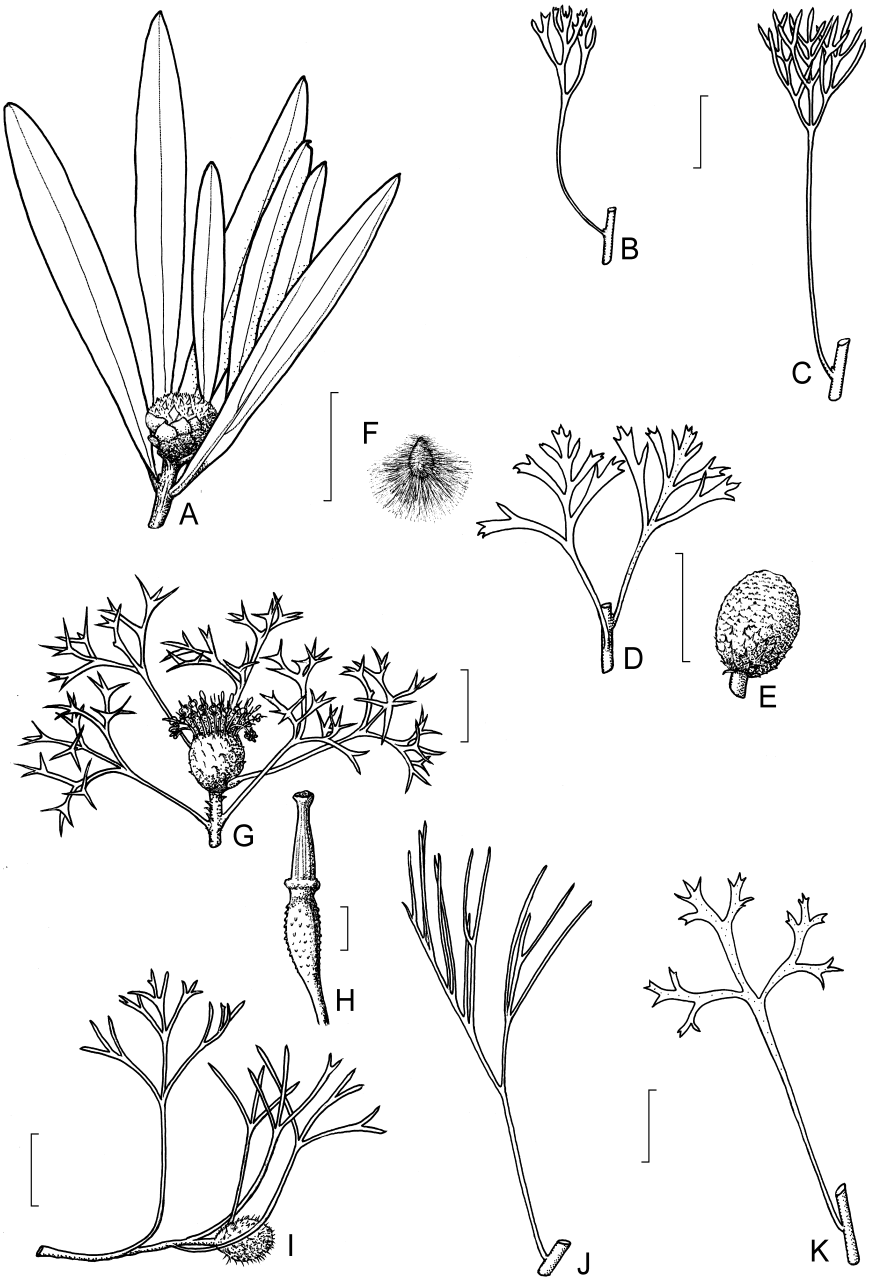



**Figure 99**. *Isopogon*. **A**, *I. fletcheri*, branchlet with young inflorescence (Perrys Lookdown, Blackheath, N.S.W., S.Clemesha, MEL). **B**, *I. mnoraifolius*, leaf (D.McGillivray 2705, BRI). **C**, *I. dawsonii*, leaf (I.Telford 5103, MEL). **D–F**, *I. anemonifolius*. **D**, leaves; **E**, fruiting cone; **F**, nut (**D–F**, D.Foreman 974, MEL). **G–H**, *I. ceratophyllus*. **G**, flowering branchlet; **H**, pollen presenter (**G–H**, Brisbane Ranges Natl Park, Vic., D.Foreman, MEL). **I**, *I. prostratus*, branchlet with young inflorescence (R.Coveny 5816, MEL). **J**, *I. anethifolius*, leaf (F.Sieber 17, MEL). **K**, *I. petiolaris*, leaf (Mudgee, N.S.W., N.Taylor, MEL). Scale bars: **A**, **D**, **E** = 3 cm; **B**, **C**, **G**, **I–K** = 2 cm; **F** = 1 cm; **H** = 1 mm. Drawn by P.Cooper.

## 6. Isopogon anemonifolius (Salisb.) Knight, *Cult. Prot.* 93 (1809)

*Protea anemonifolia* Salisb., *Prodr. Stirp. Chap. Allerton.* 48 (1796); *Atylus anemonifolia* (Salisb.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: ex Port Jackson [N.S.W.], *auct.* Jac. Lee; *n.v.*

*Protea tridactylitis* Cav., *Anal. Hist. Nat.* 1: 235, t. 16 (1800); *Isopogon tridactylitis* (Cav.) Roem. & Schult., *Syst. Veg.* 3: 340 (1818). T: habita junto de los tejares de Jackson [N.S.W.]; not located.

*Isopogon anemonifolius* var. *glaber* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 8 (1830). T: not designated; Port Jackson [N.S.W.], *R.Brown s.n.*; ?syn: K (two fragments mounted on left hand side of sheet).

*Isopogon anemonifolius* var. *pubiflorus* Benth., *Fl. Austral.* 5: 347 (1870). T: Sydney [N.S.W.], *B.Bynoe*; syn: K (specimen mounted on right hand side of sheet).

*Isopogon anemonifolius* var. *pubescens* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 8 (1830). T: Port Jackson [N.S.W.], 1807, *G.Caley*; *n.v.*

*Isopogon anemonifolius* f. *simplicifolia* Cheel, *Proc. Linn. Soc. New South Wales* 48: 682 (1923). T: Mt Victoria and Hornsby, *coll. unknown*; syn: NSW.

Illustrations: W.R.Elliot & D.L.Jones, *Encycl. Austral. Pl.* 5: 440 (1990); G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 22 (1991).

Shrub to 2 m tall. Branchlets often reddish, pubescent. Leaves simple and linear or 2–3-lobed to pinnatisect; petiole not clearly defined; lamina flat, to c. 5–11 cm long, acute (prickly); undivided part up to 5 cm long; lateral pinnae often variously lobed, mostly glabrous or minutely hairy. Inflorescence globose, terminal or sometimes axillary, sessile, profuse, solitary, to c. 30–40 mm diam.; involucral bracts ±ovate, pubescent; cone scales broad, truncate, imbricate, villous outside almost to the short, narrow apex. Flowers c. 10–14 mm long, yellow, glabrous except for a tuft of hairs on apex of each tepal. Pollen presenter to c. 3.5 mm long; basal part papillose, scarcely swollen, constricted near mid-point then dilated into globose part; apical part glabrous, scarcely swollen except for stigmatic cup. Cones globose, to c. 25 mm diam. Nuts ovoid, beaked, to c. 4 mm long, villous. *Broadleaf Drumsticks*. Fig. 99D–F.

Common on the north, central and south coasts and nearby tablelands of N.S.W.; often on sandstone ridges, mostly in sand or sandy soil, in heath, dry to moist sclerophyll forest or woodland. Flowers July–Dec.; fruits present most of the year. Map 190.

N.S.W.: Christmas Bell Heath, 10 km S of Port Macquarie on road to Laurieten, *D.B.Foreman 974* (CANB, MEL, NE, NSW, WELTU); Deanes siding (abandoned), c. 20 km NNE of Lithgow, *B.G.Briggs 7175 & L.A.S.Johnson* (NSW); c. 10 km by road NE of Mongarlowe, *D.J.McGillivray 1452* (NSW).

Leaf form can be extremely variable not only between specimens but also on a single specimen. Some collections have only undivided leaves, but these are rare and, in most cases, a few lobed leaves are also present. Further study of the variants is advisable. Axillary buds develop on plants if the terminal bud is lost.

## 7. Isopogon prostratus McGill., *Telopea* 1: 32 (1975)

*Isopogon anemonifolius* var. *tenuifolius* F.Muell. ex Benth., *Fl. Austral.* 5: 347 (1870). T: Twofold Bay [N.S.W.], Sept. 1860, *F.Mueller s.n.*; holo: MEL; iso: K.

Illustrations: D.B.Foreman, *Victorian Naturalist* 105(4): 79, fig. 7 (1988); G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 21 (1991).

Prostrate, spreading shrub, to 1 m or more diam. Branchlets reddish, pubescent. Leaves variously divided into linear lobes; petiole to c. 6 cm long; lamina flat, to c. 4.5 cm long, acute, sparsely pubescent, glabrescent, minutely scabrous. Inflorescence ±globose, terminal, sessile, solitary, to c. 20–35 mm diam.; involucral bracts ovate, ±acuminate, sparsely hairy, usually with a short, marginal fringe of hairs; cone scales numerous, imbricate, broad, truncate, villous to woolly, except for deciduous apex. Flowers to c. 12 mm long, yellow, glabrous except for a tuft of hairs on apex of each tepal. Pollen presenter to c. 4 mm long; basal part slightly swollen, minutely papillose, constricted near mid-point then dilated into a globose part; apical part scarcely swollen, glabrous. Cones ±globose, to c. 20 mm diam. Nuts ovoid, beaked, to c. 3 mm long, villous. Fig. 99 I.

Occurs from near Sydney, N.S.W., to Fernbank, East Gippsland, Vic.; sometimes in open grassy areas, mostly in heath and dry sclerophyll forest, often in association with *Allocasuarina nana*; usually grows in sand or sandy soils. Flowers Oct.–Dec. Map 191.

N.S.W.: summit of Mt Budawang, E of Braidwood, *R.Pullen 4119* (AD, BRI, CANB, MEL, NSW); White Rock R., 50 km W of Eden, *D.Binns* (NSW 181105); Paddys River Bridge, 7 km SW of Mt Wog Wog trig., western side of White Rock R., c. 2.3 km NW of Penrose, *J.D.Briggs 703* (CBG). Vic.: c. 3 km SW of Fernbank, 27 Oct. 1984, *J.G.Eichler* (MEL); E slopes of Howe Ra., c. 9.5 miles [15 km] ENE of Mallacoota P.O., *A.C.Beauglehole 31642 & J.H.Willis* (MEL, NSW).

Older plants usually have a substantial lignotuber or rootstock. Plants have not been observed to regenerate from seedlings at the Fernbank site in Victoria and, although the seeds have proven to be viable, it would appear from the number of nests around the surviving plants, that the seed could be subject to predation by ants. Plants previously recorded by J.H.Willis as occurring on the Fernbank railway reserve have disappeared in recent years due to sustained burning and clearing. In 1994 this species was accepted for inclusion under the Victorian *Flora and Fauna Guarantee Act 1988*.

### 8. Isopogon ceratophyllus R.Br., *Trans. Linn. Soc. London* 10: 72 (1810)

*Atylus ceratophyllus* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: Port Phillip, in lateribus montum, Arthurs Seat [Vic.], 24–25 Jan. 1804, *R.Brown (Britten 3250)*; syn: BM.

*Isopogon ceratophyllus* var. *mitchellii* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 280 (1856). T: in Nova-Holl. orientali interiore, 1836, *Mitchell Expedition*; ?syn: MEL.

*Isopogon cornu-damae* Gand., *Bull. Soc. Bot. France* 66: 229 (1919). T: locality unknown, Vic., 1902 (ex Herb. *C.Walter*); holo: LY, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 344 (1973).

*Isopogon scaberulus* Gand., *Bull. Soc. Bot. France* 66: 229 (1919). T: Mentone, Vic., 1910, *J.R.Tovey s.n.*; holo: LY, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 344 (1973).

Illustrations: G.R.Cochrane *et al.*, *Fl. & Pl. Victoria & Tasmania* 17, fig. 2 (1980); J.P.Jessop & H.R.Toelken, *Fl. S. Australia* part 1, 152, fig. 78 (1986); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 437 (1989).

Prickly shrub, mostly 15–c. 100 cm tall, to 120 cm diam. Branchlets red-brown, sparsely villous. Leaves pinnatisect; petiole 1.2–5.6 cm long; lamina flat, 1.8–3.6 cm long, pungent-pointed, sparsely villous, glabrescent; lateral pinnae dichotomously or trichotomously divided. Inflorescence transversely ellipsoidal to globose, terminal or axillary, sessile, solitary, to c. 30 mm diam., surrounded by leaves; involucral bracts broadly ovate to ovate, imbricate, glabrous; cone scales narrowly ovate to ovate, villous outside on lower half. Flowers to c. 15 mm long, yellow, glabrous except for a tuft of hairs on apex of each tepal. Pollen presenter to c. 3 mm long; basal part papillose, scarcely swollen, constricted near mid-point then dilated into a globose part; apical part glabrous, scarcely swollen except for stigmatic cup, c. 3 mm long. Cones transversely ellipsoidal to globose, to c. 22 mm diam. Nuts villous, ovoid, beaked, to c. 3 mm long. *Horny Conebush*. Fig. 99G–H.

Occurs throughout south-western Vic., the south-eastern corner of S.A. and on islands of Bass Strait, Tas.; grows mostly in sclerophyll forest, woodland or heathland, in sand or sandy soils. Flowers July–Jan. Map 192.

S.A.: Mt Lofty Ra., c. 20 km ENE of Adelaide, *H.V.Dam 191* (AD); Rocky R., Kangaroo Is., 9 Feb. 1924, *J.B.Cleland* (AD). Vic.: Billywing Ck, the Grampians, *R.B.Filson 5301* (MEL); between Great Ocean Rd and Harvey St, Anglesea, *R.V.Smith 59/382* (MEL, NBG, RSA). Tas.: Flinders Is., *J.Milligan 601* (BRI).

Plants may regenerate from a woody lignotuber after fire.

### 9. Isopogon trilobus R.Br., *Trans. Linn. Soc. London* 10: 72 (1855)

*Atylus trilobus* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: (near base of mountain in granite hills) [Lucky Bay?, W.A.], *R.Brown (Britten 3251)*; lecto: BM; isolecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 481 (1995).

*Isopogon tripartitus* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 8 (1830). T: ora occid.-merid., King George's Sound [W.A.], 1828–1829, *W.Baxter*; lecto: BM; isolecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 481 (1995).

*Isopogon tripartitus* var. *plurilobus* Domin, *Vestn. Král. Ceské Spolecn. Nauk. Tr. Mat.-Prír.* 1921–22(2): 5 (1923). T: sandy plain, Cranbrook to Warrungup, W.A., *A.A.Dorrien-Smith s.n.*; *n.v.*

*Isopogon trilobus* var. *eloba* F.Muell., *Fragm.* 6: 239 (1868). T: Cape Riche, W.A., *G.Maxwell*; syn: MEL.

[*Petrophile trifida auct. non* R.Br., *nom. inval., nom. illeg.*: C.Loddiges, *Bot. Cab.* 19, t. 1883 (1833)]

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 150 (1988).

Shrub to c. 2 m tall. Branchlets pale to reddish brown, slightly pubescent, glabrescent. Leaves varying from 3–9-toothed to deeply 3–5-lobed; petiole to c. 2–5.5 cm long; lamina narrowly cuneate, flat, to c. 2–5.5 cm long, thick, obscurely veined; lobes usually with a sharp or callous point. Inflorescence ovoid to globose, often barrel-shaped, terminal, sessile, solitary, to c. 25–30 mm diam.; involucral bracts few, broadly ovate, imbricate, acute to acuminate, tomentose; cone scales closely imbricate, cuneate, acuminate, becoming truncate, densely woolly. Flowers c. 8–10 mm long, cream to yellow, silky-pubescent. Pollen presenter c. 5 mm long, fusiform, minutely and sparsely hairy along fine ridges. Cones barrel-shaped, c. 28 mm diam. Nuts ovoid, beaked, c. 4 mm long, villous. *Barrel Coneflower*. Figs57, 101J–K.

Widespread near the south-west coast from near the Stirling Range to Israelite Bay, W.A.; occurs in heath or shrubland in sand or sand overlying laterite. Flowers Sept.–Dec. Map 193.

W.A.: Lucky Bay, *A.S.George 7516* (PERTH); Cape Le Grand Natl Park, *R.D.Royce 8618* (PERTH); 7 km S of Stirling Range Natl Park on Chillinup Rd, *D.B.Foreman 1452* (CANB, MEL, PERTH); 22.5 km E of Mt Ragged road junction with road to Israelite Bay, Cape Arid Natl Park, *D.B.Foreman* 1311 (CANB, MEL, PERTH).

A somewhat variable species with regard to leaf morphology. Extremely narrow-lobed forms were previously placed in *I. tripartitus*. These may be found growing with broader lobed forms and a range of intermediate types has been observed by the author in a single population.

### 10. Isopogon longifolius R.Br., *Trans. Linn. Soc. London* 10: 73 (1810)

*Atylus longifolius* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: King George's Sound [W.A.], 1801–2, *R.Brown (Britten 3252)*; lecto: BM; isolecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 480 (1995).

Shrub to 2.5 m tall. Branchlets pale brown to reddish brown to grey, minutely hairy when young, glabrescent. Leaves simple or deeply divided into 2–3 lobes; petiole not well-defined, to c. 3 cm long; lamina linear to narrowly obovate, flat, to c. 15.5 cm long, mostly glabrous; apex obtuse with a well-defined callous or acute point; leaf base often tapered gradually almost to stem; midrib prominent beneath; longitudinal striations and main veins often clearly visible on both surfaces. Inflorescence globose, terminal, sessile, solitary, to c. 25 mm diam.; involucral bracts few, deltoid, villous; cone scales ±obovate, the base often narrowed, densely villous; apex deciduous, acuminate. Flowers to c. 15 mm long, yellow, silky-villous. Pollen presenter to c. 3.5 mm long, fusiform; basal part glabrous; brush glabrous or minutely papillose in longitudinal lines. Cones globose to ovoid-oblong, to c. 26 mm diam. Nuts ovoid, beaked, to 3–4 mm long, villous. Fig. 101G–H.

Occurs in a relatively restricted area centred on the Stirling Range, Porongurup Range and near Albany; also found near Walpole and Cranbrook, and on the south coast towards Bremer Bay, W.A.; common on sandstone hills, in shallow loam over laterite with *Eucalyptus marginata* and Casuarinaceae, in heath in skeletal sandy soil, or in shrubland in sand or sandy clays over laterite. Flowers Nov.–Jan. Map 194.

W.A.: Marbellup Reserve, W of Albany, *J.W.Green 4871* (PERTH); Warburton Lake Rd, 5 km W of Pfeiffer Rd, N of Mt Manypeaks, *D.B.Foreman 1462* (CANB, MEL, PERTH); 11 km from Albany towards Jerramungup, *B.Barnsley 561* (CBG); near Cranbrook, *C.T.White 5449* (BRI).

Sainsbury (1987) suggested that two forms of this species exist; one with simple leaves and growing to c. 1.2 m and a second with lobed leaves and growing to 2.2 m. If this is so it is not obvious from the collections available to me. *Isopogon longifolius* can be distinguished from deeply lobed specimens of *I. trilobus* by its longer leaves with broader and more deeply

divided segments (usually 2–3 compared with up to 5 in *I. trilobus*) as well as by the distinct callous tip and the longitudinal striations that are clearly visible on both surfaces.

## 11. Isopogon sp. A

*Isopogon drummondii* Benth., *Fl. Austral.* 5: 344 (1870), *nom. illeg.*, *non* Jacques (1843); *Atylus drummondii* (Benth.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: Swan river, New Holland, [W.A.], *J.Drummond s.n.*; syn: K.

[*Isopogon petrophiloides auct. non* R.Br.: C.F.Meisner *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 503 (1845)]

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 146 (1988), as *I. drummondii*.

Shrub to c. 1 m tall. Branchlets pale brown to reddish brown, tomentose. Leaves simple, 1.8–7 cm long; petiole not discernible; lamina terete, curved, rather thick, grooved above, pungent-pointed, glabrous. Inflorescence depressed-globose, terminal, sessile, solitary, c. 20–30 mm diam., surrounded by numerous leaves; involucral bracts narrowly ovate to ovate, imbricate, villous; cone scales ±narrowly ovate, villous outside. Flowers to c. 12–15 mm long, pale yellow; tube pubescent; limb glabrous except for a tuft of hairs on apex of each tepal. Pollen presenter c. 3 mm long; basal part minutely papillose, scarcely swollen, slightly constricted below mid-point then dilated into a globose part; apical part glabrous, furrowed, scarcely swollen except for stigmatic cup. Cones depressed-globose or depressed-ovate, remaining covered with woolly-grey hairs, to c. 28 mm diam. Nuts ovoid, beaked, to c. 3 mm long, villous. Fig. 100C.

Scattered from Cockleshell Gully to near the Serpentine River, south of Perth, W.A.; grows in sand in low woodland. Flowers Jan.–May. Map 195.

W.A.: Welshpool Rd, Wattle Grove, *A.S.George 9852* (MEL, PERTH); Cockleshell Gully, *C.A.Gardner 15991* (PERTH); SE corner of Moore River Natl Park, *A.S.George 12936* (MEL, PERTH); Bayswater, lower Swan R., 7 May 1900, *A.Morrison* (CANB).

Reports of shorter flower lengths e.g. 4 lines [i.e. $^{4}/_{12}$ ths of an inch or 8 mm] by Bentham (1870) and 8 mm by Wrigley & Fagg (1989) are probably based on immature flowers. I have not yet determined whether or not this taxon is synonymous with *I. drummondii* Jacques. If it proves not to be synonymous, then it will require a new name.

## 12. Isopogon villosus Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 277 (1856)

*Atylus villosus* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: in coloniâ Swan River [W.A.], *J.Drummond 5: 399*; syn: MEL.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 152 (1988).

Tufted shrub to 60 cm tall. Branchlets reddish brown to dark brown; branchlets and leaves densely hairy when young. Leaves divaricately divided; petiole to c. 13 cm long; lamina terete, to c. 12 cm long, pungent-pointed, often grey-green, ±glabrescent. Inflorescence ±ovoid, terminal, sessile, c. 30 mm diam., often clustered near base of plant, surrounded but only partially obscured by leaves; involucral bracts acuminate, caducous, villous; cone scales becoming cuneate or obovate, with deciduous apices, villous outside, otherwise glabrous. Flowers to c. 15–20 mm long, cream to yellow, densely villous. Pollen presenter to c. 3 mm long; basal third papillose, slightly swollen and constricted; upper two-thirds swollen, ±cylindrical, glabrous; apex slightly enlarged into a stigmatic cup. Cones ovoid, to c. 20–25 mm diam. Nuts ovoid, beaked, to c. 3 mm long, villous. Fig. 102E–H.

Scattered from near Pingelly to near Lake King, W.A.; grows in heath or shrubland in sandy or gravelly soil. Flowers Sept.–Nov. Map 196.

W.A.: Tutanning Wildlife Sanctuary (near Pingelly), *D.B.Foreman 1090* (MEL); 33 km E of L. Grace, *D.B.Foreman 781* (CANB, MEL, PERTH); Tarin Rock, c. 20 km W of L. Grace, *A.M.Ashby 1243* (AD); 20 km E of Newdegate, *J.Taylor 2302* & *P.Ollerenshaw* (CBG); 20 km NE of Jerdacuttup, *R.J.Hnatiuk 761313* (PERTH).

### 13. **Isopogon heterophyllus** Meisn. *in* J.G.C.Lehmann, *Pl. Preiss*. 1: 504 (1845)

*Atylus heterophyllus* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: in region. interior. Australiae merid.-occid. [W.A.], Oct. 1840, *J.A.L.Preiss 672*; iso: MEL.

*Isopogon occidentalis* D.A.Herb., *J. & Proc. Roy. Soc. W. Australia* 6: 105 (1921). T: E of Solomons Well [Stirling Ra., W.A.], 28 Sept. 1902, *A.Morrison s.n.*; syn: PERTH; Cranbrook, W.A., 22 Sept. 1911, *Dr Stoward s.n.*; syn: PERTH, photo at MEL.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 149 (1988).

Shrub to 1.2 m tall. Branchlets reddish brown to mid-brown; branchlets and young leaves pubescent, glabrescent. Leaves simple, bifid or trifid; segments sometimes again divided 2 or 3 times towards the end, terete, distinctly grooved, longitudinally wrinkled, usually thickened, to c. 8 cm long overall; undivided part up to 4 cm long; segments to 45 mm long, variously curved inwardly and outwardly, pungent-pointed. Inflorescence ±globose, terminal, sessile, solitary, to c. 60 mm diam.; involucral bracts ovate, acuminate to acute, pilose to tomentose; cone scales obovate, imbricate, villous. Flowers to c. 30 mm long, mostly pink, also lilac and pinkish mauve, glabrous except for a tuft of hairs at apex of each segment. Pollen presenter to c. 4.5 mm long; basal part swollen, minutely hairy, constricted at or slightly above mid-point; apical part glabrous, tapered to a shallow stigmatic cup. Cones ovoid to globose, 15–20 mm diam. Nuts ovoid, beaked, to c. 3 mm long, densely villous. Fig. 100F

A common, widespread species occurring from near Cranbrook and Albany north to the Stirling Range and extending east throughout the Fitzgerald River Natl Park to near Howick Hill, east-north-east of Esperance, W.A.; grows in open woodland or shrubland in very gravelly soils or sand overlying gravel. Flowers Aug.–Nov. Map 197.

W.A.: 7 miles [c. 11.5 km] N of Geekabee Hill, *K.Newbey 1796* (PERTH); 7 km E of Kendenup on Red Gum Pass Rd, *D.B.Foreman 835* (CANB, MEL, NSW, PERTH); 15 miles [c. 24 km] E of Cranbrook, *K.Newbey 1795* (PERTH); 40 km E of Jerramungup on Ravensthorpe road, *D.B.Foreman 817* (CANB, MEL, PERTH); Fitzgerald River Natl Park, 16 km W of Hopetoun, *D.B.Foreman 812* (CANB, MEL, NSW, PERTH).

Specimens of *I. heterophyllus* have been confused with *I. formosus* from which it can be separated by its thicker leaves which are characteristically grooved and wrinkled when dry. The flowers of the former species are also generally somewhat longer and the cone scales more villous.

### 14. **Isopogon teretifolius** R.Br., *Trans. Linn. Soc. London* 10: 71 (1810)

*Atylus teretifolius* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: in Nova Hollandiae ora australi, Lewin's Land [King George Sound, W.A.], Dec. 1801, *R.Brown (Britten 3246)*; syn: BM, consisting of six pieces mounted on a single sheet.

*Isopogon cornigerus* Lindl., *Sketch Veg. Swan R.* xxxiv (1840); *I. teretifolius* var. *cornigerus* (Lindl.) Meisn. *in* J.G.C.Lehmann, *Pl. Preiss* 1: 504 (1845). T: Swan River district [W.A.], 1839, *J.Drummond*; holo: CGE.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 146 (1988).

Shrub to 2 m tall. Branchlets pale brown to greyish brown, silky-pubescent, glabrescent. Leaves simple or 1–3 times bifid or trifid; petiole not clearly discernible; segments usually divaricate, terete, 2.5–12.5 cm long, with acute to pungent-pointed apices, glabrous; undivided part 2.5–5.5 cm long. Inflorescence depressed-globose, terminal, sessile, solitary, erect or drooping, 25–40 mm diam.; involucral bracts red-brown, broadly ovate, imbricate, obtuse or with a short, acuminate point, glabrous or very sparsely hairy, especially near margin; cone scales obovate to cuneate, densely tomentose to villous. Flowers to c. 15 mm long, creamy pink to pale pink or dirty white tinged pink, densely pubescent, with longer hairs near apex. Pollen presenter c. 3.5–4 mm long; basal part papillose or shortly pubescent, swollen, constricted near mid-point then dilated to a globose part; apical part glabrous, scarcely swollen except for dilated stigmatic cup. Cones depressed-globose to slightly conical, 20–25 mm diam. Nuts ovoid, beaked, c. 3 mm long, villous. *Nodding Coneflower*.

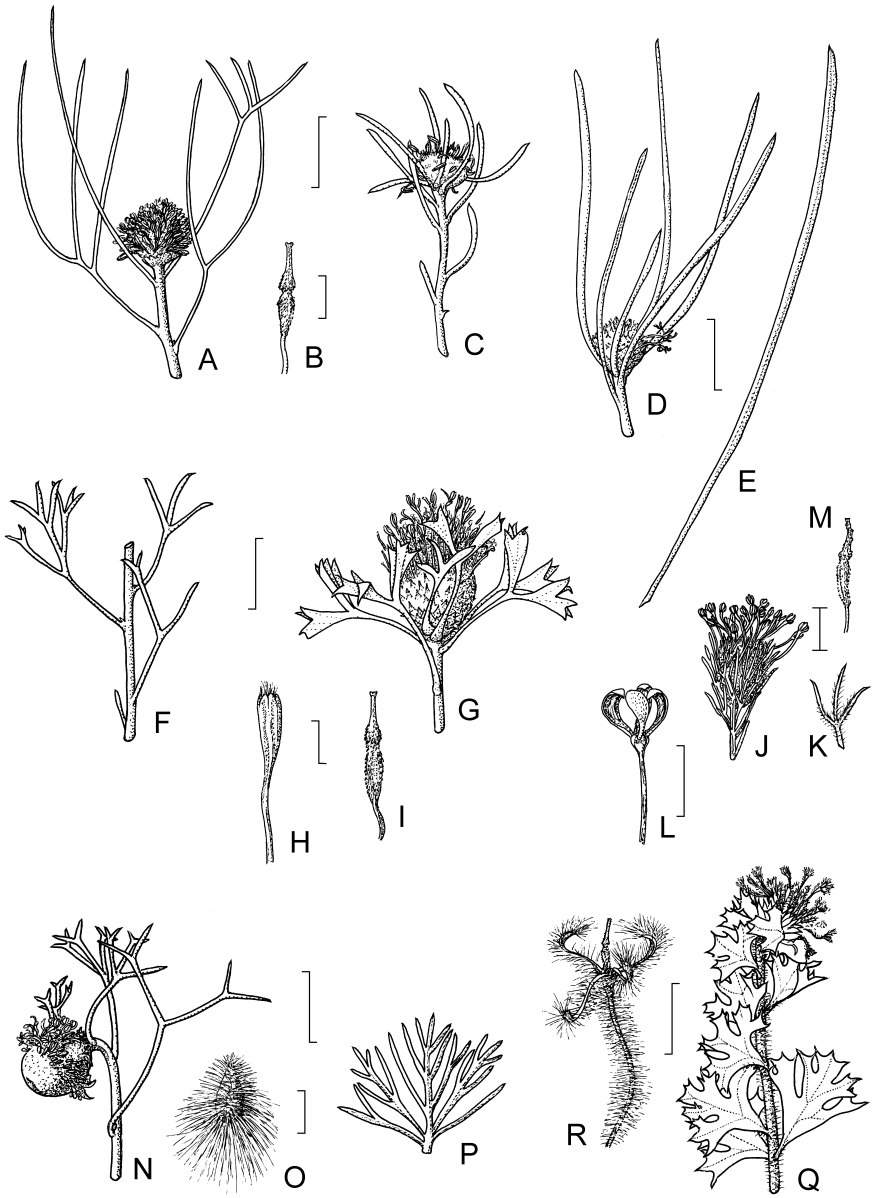



**Figure 100**. *Isopogon*. **A–B**, *I. divergens*. **A**, flowering branchlet (D.Foreman 405, MEL); **B**, pollen presenter (D.Foreman 420, MEL). **C**, *I.* sp. A, flowering branchlet (18 May 1839, A.Baird, PERTH). **D–E**, *I. scabriusculus* subsp. *scabriusculus*. **D**, flowering branchlet; **E**, leaf variation (**D–E**, M.Corrick 9270, MEL). **F**, *I. heterophyllus*, leaves (M.Corrick 7695, MEL). **G–I**, *I. dubius*. **G**, flowering branchlet; **H**, flower bud; **I**, pollen presenter (**G–I**, R. & M.Hamilton 8, MEL). **J–M**, *I. adenanthoides*. **J**, flowering branchlet; **K**, leaf; **L**, flower; **M**, pollen presenter (**J–M**, C.Gittens 1690, PERTH). **N–O**, *I. teretifolius* subsp. *teretifolius*. **N**, flowering branchlet; **O**, nut (**N–O**, R.Hnatiuk 761337, PERTH). **P**, *I. asper*, leaf (R.Cranfield 301, PERTH). **Q–R**, *I. baxteri*. **Q**, flowering branchlet; **R**, flower (**Q–R**, C.Huggins 113, MEL). Scale bars: **A**, **C–G**, **N**, **Q** = 2 cm; **B**, **I**, **M**, **O** = 2 mm; **H** = 3 mm; **J**, **K**, **P** = 1 cm; **L**, **R** = 5 mm. Drawn by P.Cooper.

Two subspecies are recognised here.

| | |
|---|---|
| Leaves much-divided | **14a.** subsp. **teretifolius** |
| Leaves simple | **14b.** subsp. **petrophiloides** |

### 14a. Isopogon teretifolius R.Br. subsp. teretifolius

Shrub to 2 m tall. Leaves 1–3 times bifid or trifid; segments usually divaricate, terete, 2.5–12.5 cm long, with acute to pungent-pointed apices, glabrous; undivided part 2.5–5.5 cm long . Figs 56, 100N–O.

Scattered from Mt Lesueur to around Cranbrook, the Stirling Range and Albany, towards Bremer Bay and to East Mt Barren in the Fitzgerald River Natl Park, W.A.; grows in heath and shrubland or Jarrah forest, in laterite, sand or clay. Flowers Sept.–Nov. Map 198.

W.A.: Elverdton Rd, 3 km from junction with Ravensthorpe–Hopetoun road, *M.G.Corrick 9571* (MEL); 8 km SE of Wellstead on road to Cheyne Inlet, *D.B.Foreman 1426* (MEL, PERTH); lower slopes of Mt Success, Stirling Ra., *G.J.Keighery 5423* (PERTH).

### 14b. Isopogon teretifolius subsp. petrophiloides (R.Br.) Foreman, *Fl. Australia* 16: 481 (1995)

*Isopogon petrophiloides* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830). T: south-west coast of New Holland, near William [W.A.], *W.Baxter s.n.*; holo: BM.

Shrubs to 1.7 m tall. Leaves simple, terete, 2.5–10 cm long; apices pungent-pointed.

Extending from near the Stirling Range to the north-east, especially between Newdegate and Lake King with a few more northerly collections between Holt Rock and Marvel Loch, W.A.; grows in shrubland in sand over laterite, or in mallee heath in clayey sand or open scrub in deep yellow sand. Flowers Sept.–Oct. Map 199.

W.A.: Chillinup Rd, c. 10 km E of Chester Pass Rd, 7 km S of Stirling Range Natl Park, *D.B.Foreman 1456* (CANB, MEL, PERTH); 18 km SE of Holt Rock, *R.J.Hnatiuk 760823* (PERTH); 20 km S of L. King, *C.E.Woolcock 23* (MEL).

### 15. Isopogon gardneri Foreman, *Fl. Australia* 16: 479 (1995)

T: 22 km S of Hyden on road to Newdegate, W.A., 18 Aug. 1984, *D.B.Foreman 774*; holo: MEL; iso: CANB, PERTH.

*Dryandra petrophiloides* C.A.Gardner, *J. Proc. Roy. Soc. Western Australia* 19: 82–83 (1933), *nom. illeg.* T: near Newdegate, W.A., Nov. 1931, *W.E.Blackall s.n*; holo: PERTH.

Very prickly, dense shrub to c. 1.6 m tall. Branchlets reddish brown, smooth, hairy when very young, glabrescent. Leaves divaricate, interlacing to form a dense mass; petiole to c. 2.5 cm long; lamina terete, to c. 4 cm long, pungent-pointed, smooth, hairy when very young, glabrescent. Inflorescence terminal, sessile, c. 35 mm long (the flowers are erect rather than spreading); involucral bracts campanulate, numerous, to c. 8 mm long, reddish brown, becoming grey, ovate, acute to acuminate, minutely hairy at first, glabrescent; margins remaining ±ciliate, imbricate; cone scales narrow, ±linear, with a tuft of hairs at apex. Flowers to c. 30 mm long, numerous, held ±upright before spreading over the persisting involucral bracts, pale pink or yellow, villous but hairs thicker and longer towards apex. Pollen presenter c. 4 mm long; basal part swollen, covered with very short, reflexed hairs, distinctly constricted at mid-point, swollen and glabrous above constriction, tapered towards stigmatic cup. Cones surrounded by persisting bracts, to c. 12 mm diam. Nuts ovoid, beaked, c. 3–3.5 mm long, villous. Fig. 60.

Occurs from Dundinin south to Kukerin and east to near Mt Hampton, Mt Holland and Hatters Hill, W.A.; grows in shrubland in laterite, or very open shrub mallee in well-drained sand, or shrub in ironstone areas. Flowers Sept.–Dec. Map 200.

W.A.: 18.5 km S of Mt Hampton, c. 82 km SSW of Southern Cross, *K.Newbey 5965* (PERTH); 14 km N of Tarin Rock, on road to Kulin, *R.W.Purdie 5340* (CBG); 10 km S of Kalgarin on L. Grace–Kalgarin road, *D.B.Foreman 770* (MEL, PERTH); Dundinin, Nov. 1934, *C.A.Gardner* (PERTH).

This is the '*Isopogon* sp.' of Sainsbury (1987) and '*Petrophile* sp. nova (Tarin Rock)' of Wrigley & Fagg (1989). The flowers of *I. gardneri* are mostly pink. An exception, however, is a specimen from 16 miles [c. 26 km] N of Hatters Hill, *J.S.Beard 3731* (PERTH), which is said to have yellow flowers.

### 16. Isopogon formosus R.Br., *Trans. Linn. Soc. London* 10: 72 (1810)

*Atylus formosus* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: in Nova-Hollandiae, ora australi, Lewin's Land [King George Sound, W.A.], *R.Brown s.n.*; syn: MEL.

*Isopogon formosus* var. *eriolepis* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 278 (1856). T: locality unknown [W.A.], *L.Preiss 687*; syn: MEL.

Shrub to 2 m tall. Young branchlets pale brown to reddish brown, silky, tomentose or shortly pubescent, later glabrescent or remaining tomentose. Leaves variously divided, crowded; petiole to c. 2.5 cm long; lamina narrowly terete, to c. 3.5 cm long, grooved, rigid, pungent-pointed, silky or tomentose, glabrescent. Inflorescence globose to ovoid, terminal or in upper axils, sessile, solitary, c. 60 mm diam.; involucral bracts ovate, ovate-lanceolate or lanceolate, acuminate, villous; cone scales broadly cuneate, minutely mucronate, densely villous. Flowers to c. 25 mm long, mauve-pink to red, glabrous except for a tuft of hairs on apex of each tepal. Pollen presenter to c. 4 mm long; basal part swollen, constricted then dilated to a globose middle point; apical part tapered to stigmatic cup, glabrous. Cones globose, ovoid or obovoid, to c. 20 mm diam. Nuts ovoid, beaked, to c. 3 mm long, villous. *Rose Coneflower*.

Two subspecies are recognised here. However, this infraspecific classification is not completely satisfactory, since a considerable number of specimens of *I. formosus* cannot be convincingly assigned to either subspecies. Further investigations on this matter are planned.

| | |
|---|---|
| Leaves spreading; lamina terete; flowers to 25 mm long | **16a.** subsp. **formosus** |
| Leaves often held ±closely to the branchlets; lamina narrow, with incurved margins; flowers to 20 mm long | **16b.** subsp. **dasylepis** |

### 16a. Isopogon formosus R.Br. subsp. formosus

Branchlets silky to tomentose when young; indumentum often persisting to maturity. Leaves spreading, 1–3 times ternately divided; petiole to c. 2.5 cm long; lamina terete, grooved, to c. 3.5 cm long, silky to tomentose when young, glabrescent. Inflorescence ±globose, terminal, c. 60 mm diam., often surrounded by leaves, but not concealed by them; involucral bracts lanceolate to ovate-lanceolate; cone scales cuneate, very villous outside. Flowers to c. 25 mm long, pink, red or mauve. Cones ±globose to ovoid, sometimes flattened at base, to c. 20 mm diam.

Centred around Albany and extending to near Frankland and Mt Barker, into the Stirling and Porongurup Ranges and west towards Mt Manypeaks to just south of Gairdner, W.A.; grows on undulating sandplain in sandy soil, or shrubland in gravelly soil or seasonally swampy sand heath. Flowers July–Nov. Map 201.

W.A.: 4 miles [6.5 km] S of Mt Barker, *K.F.Kenneally 61* (PERTH); near Albany airport, 11.5 km along Perth road from Albany, 12 Oct. 1961, *J.H.Willis* (MEL); 49 km SSW of Kojonup on Frankland road, *A.S.George 15236* (PERTH); 16 km NW of Albany on road to Jerramungup, *J.M.Fox 88/212* (MEL, PERTH).

### 16b. Isopogon formosus subsp. dasylepis (Meisn.) Foreman, *Fl. Australia* 16: 479 (1995)

*Isopogon formosus* var. *dasylepis* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 278 (1856). T: *s. loc.*, [W.A.], *J.Drummond 295*; syn: MEL; *s. loc.*, *L.Preiss 670*; syn: MEL.

Branchlets shortly pubescent to glabrous. Leaves often held ±closely to branchlets, 2 or 3 times ternately divided; secondary branches sometimes divided again, occasionally simple; petiole 2–2.5 cm long; lamina narrow, to c. 1.5–2 cm long, slightly curved, pungent-pointed with incurved margins, mostly glabrous. Inflorescence globose, terminal or in upper axils, to c. 40 mm diam.; involucral bracts ovate, acuminate, glabrous except for ciliate margins; cone

scales obovate, minutely mucronate, densely villous at base; apex glabrous. Flowers c. 20 mm long, pink to mauve. Cones globose, ovoid or obovoid, 12–20 mm diam.

Mainly confined the region around Bunbury and Busselton, extending south to Scott River, W.A.; grows in shrubland in sand or gravel, often in swampy areas. Flowers Aug.–Dec. Map 202.

W.A.: 3 km S of Ambergate on Gale Rd, *D.B.Foreman 1539* (HO, MEL, PERTH); S of Busselton, *J.C.Anway 238* (PERTH); 7 miles [c. 11 km] S of Busselton on Ambergate road, *B.G.Briggs 777* (NSW); Yoongarillup, *T.E.H.Aplin 1168* (PERTH).

### 17. **Isopogon divergens** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830)

*Atylus divergens* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: ora merid.-occid., Swan River [W.A.], 1827, *C.Fraser*; syn: BM.

Illustration: A.S.George, *Intr. Proteaceae W. Australia* 85, pl. 127 (1984).

Shrub, mostly to c. 1.5 m tall, occasionally taller. Branchlets reddish brown, glabrous. Leaves mostly pinnate to bipinnate, occasionally simple; petiole to c. 5.6 cm long; lamina terete to c. 10.5 cm long, pungent-pointed, glabrous. Inflorescence globose, ovoid or oblong-ovoid, terminal, sessile, solitary, c. 40–45 mm diam.; involucral bracts ovate, pubescent to villous; cone scales broadly cuneate, shortly acuminate, villous outside. Flowers c. 25 mm long, pink, often tinted with mauve, glabrous except for a tuft of hairs on apex of each tepal. Pollen presenter to c. 4 mm long; basal part shortly pubescent or papillose, dilated, distinctly 4-ridged, constricted near mid-point then dilated into a globose part; apical part glabrous, tapered towards stigmatic cup. Cones ovoid to oblong-cylindrical, to c. 18 mm diam. Nuts ovoid, beaked, to c. 4.5 mm long, villous. *Spreading Coneflower*. Fig. 100A–B.

Widely distributed from the Murchison River to near Lake Grace, W.A.; grows in shrubland or heath in gravelly, sandy or granitic soils. Flowers Aug.–Oct. Map 203.

W.A.: turn-off to Mogumber from Great Northern Hwy, *D.B.Foreman 706* (CANB, MEL, NSW, PERTH); 23 km S of Hyden on Newdegate road, *D.B.Foreman 1178* (CANB, MEL, PERTH); 25 km from North-west Coastal Hwy along road to Kalbarri, *R.W.Purdie 5203* (CBG); eastern edge of the Wongan Hills, 15 km N of Wongan Hills township, *K.F.Kenneally 7415* (PERTH).

### 18. **Isopogon scabriusculus** Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 276 (1856)

*Atylus scabriusculus* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: in coloniâ Swan River [W.A.], *J.Drummond 4: 263*; syn: MEL.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 143 (1988).

Shrub to 2 m tall and to 2 m in diam. Branchlets red-brown or greyish, minutely pubescent. Leaves simple or forked; petiole not distinct; lamina terete, grooved or flat, to c. 18 cm long overall, with an undivided part to 9.5 cm long, mucronate to pungent-pointed, scabrous (sometimes minutely so), minutely pubescent to sericeous, later glabrescent. Inflorescence globose to ovoid, terminal or rarely axillary, sessile, solitary, to c. 35 mm diam., surrounded by leaves; involucral bracts broad, ovate, imbricate, tomentose outside, persistent and becoming ±hard after flowering; cone scales narrower, densely villous outside, usually glabrous towards apex. Flowers to c. 18 mm long, pink or red; perianth tube glabrous or pubescent, with a tuft of hairs on apex of each tepal. Pollen presenter to c. 5 mm long; basal part papillose, 4-angled, swollen at base, constricted near mid-point then dilated into globose part; apical part glabrous, swollen near its base then tapering slightly to stigmatic cup. Cones ±globose, to c. 16 mm diam. Nuts ovoid, beaked, to c. 3 mm long, villous.

A widespread and somewhat variable species with 3 subspecies recognised here.

**1** Perianth tube pubescent — **18c.** subsp. **pubifloris**

**1:** Perianth tube glabrous; a tuft of short hairs on the apex of each tepal

**2** Leaves ±terete (oval in cross-section), simple — **18b.** subsp. **stenophyllus**

**2:** Leaves flat, simple or forked — **18a.** subsp. **scabriusculus**

**18a. Isopogon scabriusculus** Meisn. subsp. **scabriusculus**

Shrub to 2 m tall. Leaves simple or sometimes with 1–3 lobes, flat, to c. 18 cm long, with an undivided part to 9.5 cm long, scabrous, minutely pubescent, glabrescent. Flowers to 15 mm long, pink; perianth tube glabrous. Pollen presenter to c. 5 mm long. Cones c. 16 mm diam . Figs 54, 100D–E.

Occurs from near Mullewa south to near Newdegate, with most collections from around Wongan Hills and Tammin, W.A.; grows in mallee or mixed scrub in sandy soil or sand over laterite or in scrubby heath, in gravelly or sandy soils. Flowers July–Oct. Map 204.

W.A.: 3.3 km N of Wubin on Great Northern Hwy, *D.B.Foreman 669* (MEL); Narkal, *B.H.Smith 894* (MEL); 3 km SSE of Maya, *R.Melville 4293 & J.Calaby* (MEL); 24 km S of Tammin, *R.D.Royce 8446* (PERTH); North Burgulla Reserve, 17 km NW of Kellerberrin townsite, *B.G.Muir 475* (PERTH).

Specimens from near Tammin have a higher proportion of forked leaves than collections from other areas. These may represent a distinct variety but further study is needed.

**18b. Isopogon scabriusculus** subsp. **stenophyllus** Foreman, *Fl. Australia* 16: 480 (1995)

T: 17 km S of Pingaring on Lake Grace–Kalgarin road, 18 Sept. 1984, *D.B.Foreman 767*; holo: MEL; iso: CANB, K, NSW, PERTH.

Shrub to 1.5 m tall. Branchlets greyish and minutely pubescent, becoming reddish brown, glabrescent. Leaves simple, never forked, ±terete, (oval in cross-section), to c. 16 cm long, ±grooved, scabrous (sometimes minutely so), sericeous to minutely pubescent, glabrescent. Flowers to c. 15 mm long, pink or red; perianth tube glabrous. Pollen presenter to c. 4.5 mm long. Cones c. 12 mm diam.

Scattered from north of Wubin to around Southern Cross and Muntadgin and extending to south of Lake Grace and near Newdegate, with one isolated collection putatively from Darlington, W.A.; grows in heath and shrubland in gravelly or sandy soil. Flowers July–Oct. Map 205.

W.A.: between Southern Cross and Merredin, 4.5 km W of Caarabin Hotel along Great Eastern Hwy, *R.Spjut 7245 et al.* (PERTH); 20.9 km E of L. Grace, *J.W.Green 446* (PERTH); 16 km E of L. Grace township towards Newdegate, *J.Taylor 2266 & P.Ollerenshaw* (CBG, MEL, PERTH).

**18c. Isopogon scabriusculus** subsp. **pubifloris** Foreman, *Fl. Australia* 16: 480 (1995)

T: c. 110 km SW of Norseman, 11.5 km WSW of Dog Rock, *J.Taylor 726, M.D.Crisp & R.Jackson*; holo: CBG; iso: PERTH.

Shrub to 1.2 m tall. Leaves simple, terete, to c. 13 cm long, minutely scabrous, minutely pubescent, glabrescent. Flowers to c. 16 cm long, pink; perianth tube pubescent. Pollen presenter to c. 3 mm long. Cones c. 12 mm diam.

Scattered from near Hyden to between Southern Cross and Coolgardie and south to around Lake King and Frank Hann Natl Park, W.A.; grows in low scrub or shrubland or open low woodland in sand or sandy-gravelly soil. Flowers Sept.–Nov. Map 206.

W.A.: c. 6.5 km E of L. King, *J.S.Beard 3683* (PERTH); 32.5 km N of Hyden on Hyden North Rd, *D.B.Foreman 1166* (AD, CANB, MEL, PERTH); 26 miles [42 km] E of L. King, *T.E.H.Aplin 2843* (PERTH).

**19. Isopogon alcicornis** Diels *in* F.L.E.Diels & E.Pritzel, *Bot. Jahrb. Syst.* 35: 134 (1904)

T: 45 km north of Esperance [W.A.], *F.L.E.Diels 5331*; syn: PERTH.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 151 (1988).

Low shrub c. 45 cm tall. Branchlets short, suckering from thick, underground stems, pale brown to grey, villous to tomentose. Leaves mostly pinnately divided in the upper part into 2–5 broad lobes, rarely simple; petiole to at least 15 cm long; lamina flat, linear to linear-lanceolate, oblanceolate or broadly linear, 10–40 cm long overall, minutely scabrous, villous

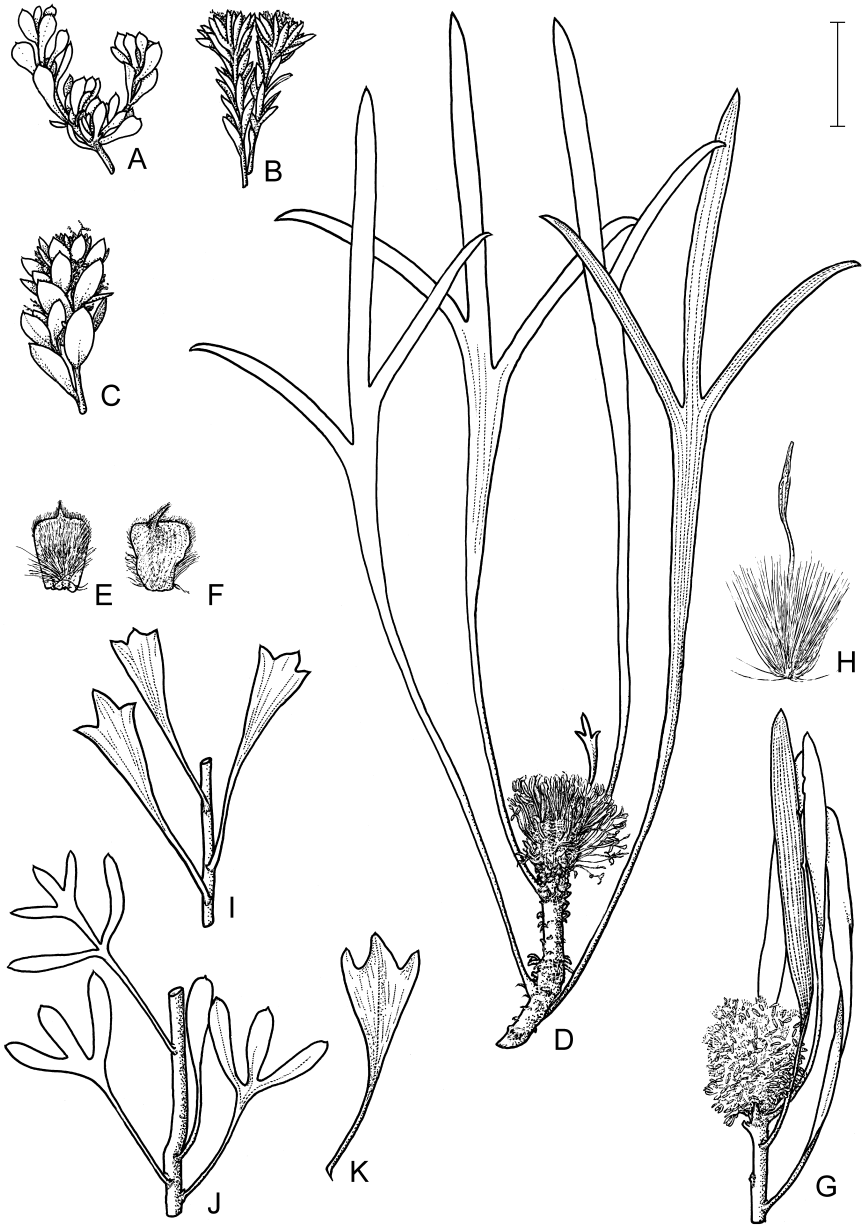



**Figure 101**. *Isopogon*. **A**, *I. buxifolius* var. *spathulatus*, vegetative stem (J.Drummond 3: 249 MEL). **B**, *I. buxifolius* var. *linearis*, flowering branchlet (J.Drummond 5: 395, MEL). **C**, *I. buxifolius* var. *obovatus*, flowering branchlet (J.Drummond 896, MEL). **D–F**, *I. alcicornis*. **D**, flowering branchlet; **E**, adaxial view of cone scale; **F**, abaxial view of cone scale (**D–F**, D.Foreman 1242, MEL). **G–H**, *I. longifolius*. **G**, flowering branchlet; **H**, flower with perianth removed (**G–H**, D.Foreman 1462, MEL). **I**, *I. tridens*, leaves (J.Drummond, MEL 672932). **J–K**, *I. trilobus*. **J**, deeply lobed leaves (D.Foreman 1411, MEL); **K**, shallowly lobed leaves (D.Foreman 1398, MEL). Scale bar: **A–D**, **G**, **I–K** = 3 cm; **E**, **F** = 1 cm; **H** = 5 mm. Drawn by P.Cooper.

on both surfaces at first, glabrescent; apices acute, sometimes slightly uncinate; venation prominent. Inflorescence ovoid to ellipsoidal, terminal, sessile, solitary or somewhat clustered, often borne near ground level, to c. 40 mm diam., frequently obscured by leaves; involucral bracts ±spathulate, villous; tips acute to acuminate, deciduous; cone scales similar to involucral bracts but somewhat narrower. Flowers 15–20 mm long, white or pink, silky-hairy. Pollen presenter c. 3 mm long, very narrowly ovoid to fusiform, scarcely constricted, gradually tapered to a slightly expanded, stigmatic cup. Cones ovoid, to c. 25 mm diam. Nuts villous; mature nuts not seen. Fig. 101D–F.

Known from near Esperance and at Mt Baring, W.A.; grows in low shrubland in sandy soil. Flowers Oct.–Nov. Map 207.

W.A.: Mt Burdett, c. 50 km NE of Esperance, *D.B.Foreman 1229* (AD, CANB, MEL, NSW, PERTH); between Treslove and Esperance, *W.E.Blackall 1055* (PERTH); Mt Baring, *C.A.Gardner 16377* (PERTH).

Petiole length is difficult to ascertain because the lamina gradually tapers into it with no perceptible distinction at least in external morpology.

Actual flower colour and that reported on herbarium labels and in the literature ranges from pink to white to cream or yellow. The colours mentioned above are those from herbarium labels.

### 20. Isopogon asper R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 8 (1830)

*Atylus asper* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: ora merid.-occid., Swan River [W.A.], 1827, *C.Fraser*; syn: BM.

*Isopogon scaber* Lindl., *Sketch Veg. Swan R.* xxxiv (1840). T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; lecto: CGE; isolecto: CGE, *fide* D.B.Foreman, *Fl. Australia* 16: 480 (1995).

Low shrub, usually less than 1 m tall. Branchlets red-brown, pubescent. Leaves crowded, pinnate; some pinnae further divided; petiole to c. 13 mm long; lamina terete or grooved, to c. 20 mm long, with an acute apex, slightly scabrous, slightly hairy, mostly glabrous. Inflorescence depressed-globose, terminal or on short axillary branches, densely clustered towards tips of branchlets, sessile, solitary, to c. 40 mm diam.; floral leaves numerous; involucral bracts ovate-acuminate, sparsely hairy; cone scales obovate to spathulate, imbricate, villous on lower half outside; apices reddish, glabrous. Flowers to c. 18 mm long, pink, glabrous. Pollen presenter to c. 6 mm long; basal part papillose to shortly pubescent, dilated, constricted above mid-point then dilated into globose part; apical part glabrous, tapered to the slightly swollen, stigmatic cup, to c. 6 mm long. Cones ±globose, c. 20 mm diam. Nuts ovoid, beaked, to c. 4 mm long, villous . Figs 55, 100P.

Occurs mainly on the Darling Scarp, extending from Harvey to near Jurien Bay, W.A.; grows in low open heath in laterite or in granitic areas, sometimes in clay soils. Flowers June–Oct. Map 208.

W.A.: Mt Lesueur, NE of Jurien, *E.A.Griffin 1861* (PERTH); Kalamunda, 19 km E of Perth, *R. & M.Hamilton 3* (CBG, MEL, PERTH); Darling District, 7 km N of Bullsbrook, *R.K.Ellyard 13* (CBG); Gooseberry Hill, Darling Ra., 22 July 1899, *A.Morrison* (CANB).

Sometimes several stems arise from a well-developed lignotuber.

### 21. Isopogon baxteri R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 9 (1830)

*Atylus baxteri* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: ora occid.-merid., King George's Sound [W.A.], 1823, *W.Baxter*; syn: BM.

Illustrations: A.S.George, *Intr. Proteaceae W. Australia* 82, pls 121, 122 (1984); W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 151 (1988).

Erect shrub 0.4–1.5 m tall. Branchlets reddish brown to mid-brown, villous. Leaves with petiole to c. 6 mm long; lamina flat, wedge-shaped, often 3-lobed, 1.5–5.5 cm long, villous when immature, glabrescent; lobes variously toothed; each tooth ending in a pungent-point; margins wavy; main veins prominent. Inflorescence depressed-globose, terminal, sessile, sometimes clustered, to c. 30–35 mm diam.; involucral bracts ovate, villous; cone scales linear to linear-lanceolate, villous. Flowers to c. 3.5 cm long, pink, greyish-villous. Pollen

presenter c. 5 mm long; basal part clavate, pubescent, constricted above mid-point, then dilated into a minute, globose part; apical part ±glabrous, scarcely swollen except for stigmatic cup. Cones transversely ellipsoidal to globose, to c. 22 mm diam. Nuts ovoid to broadly ovoid, beaked, to c. 3 mm long, villous. *Stirling Range Coneflower*. Fig. 100Q–R.

Known from the Stirling Range and Mt Barker, W.A.; grows in heath, shrubland or mallee heath, in gravelly sands or loams. Flowers Aug.–Jan. Map 209.

W.A.: Stirling Range Drive, Stirling Range Natl Park, *D.B.Foreman 843* (MEL); Chester Pass, Stirling Ra., 4 Sept. 1947, *J.H.Willis* (MEL); Stirling Range Drive to Red Gum Pass, c. 0.9 km NW of Chester Pass Rd turn-off; Stirling Range Natl Park, *W.R.Barker 2409* (AD).

### 22. Isopogon inconspicuus (Meisn.) Foreman, *Fl. Australia* 16: 479 (1995)

*Petrophile inconspicua* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 68 (1855). T: between Moore R. and Murchison R. [W.A.], date unknown, *J.Drummond 6: 172*; syn: MEL, PERTH.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 160 (1988), as *Petrophile inconspicua*.

Small shrub 20–80 cm tall. Branchlets pale reddish brown to mid-brown to greyish, tomentose to villous. Leaves crowded on branchlets, pinnate; petiole to c. 2 mm long; lamina terete, grooved, 10–12 mm long, with acute apices, minutely scabrous, tomentose to villous, glabrescent. Inflorescence globular, axillary, sessile, crowded towards ends of branchlets, to c. 25–30 mm diam., surrounded by leaves; involucral bracts narrowly ovate to linear, villous; cone scales lanceolate to linear, villous to tomentose. Flowers very slender, tending to droop, to c. 25 mm long, pink to purple, grey-hirsute. Pollen presenter 1–1.5 mm long, ±fusiform, covered with minute, reflexed hairs, slightly swollen at base, minutely constricted near mid-point; apical part slightly expanded then tapering to stigmatic cup. Cones ±globular, to c. 5 mm diam. Nuts ovoid, beaked, to c. 2 mm long.

Rather common in the Mt Lesueur area, W.A., extending from near Dandaragan to around Eneabba; grows in sandplain heath or shrubland, in white, yellow or grey sand often with a high gravel content. Flowers July–Oct. Map 210.

W.A.: Three Springs Road, c. 15 miles [c. 24 km] NNE of Jurien Bay, *R.V.Smith 66/198* (CANB, MEL, PERTH); Marchagee Track, 4 km E of Brand Hwy, *D.B.Foreman 458* (CANB, MEL, NSW, PERTH); 9 miles [c. 14.5 km] N of Dandaragan, *C.A.Gardner 9281* (PERTH); 7 km S of Eneabba, *E.A.Griffin 863* (PERTH).

*Isopogon inconspicuus* is sometimes confused with *I. adenanthoides*. However, it can be distinguished from the latter by its hairy, rather drooping flowers and pinnate rather than trifid leaves.

### 23. Isopogon adenanthoides Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 69 (1855)

*Atylus adenanthoides* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891), as *adenanthodes*. T: [hills W of Moore River, W.A.], *J.Drummond 6: 171*; syn: MEL, PERTH.

Illustration: A.S.George, *Intr. Proteaceae W. Australia* 81, pl. 120 (1984); W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 147 (1988).

Shrub to c. 1 m tall, to c. 1 m diam. Branchlets grey or pale brown to reddish brown, villous. Leaves trifid or, occasionally, simple; petiole 2–8 mm long; lamina terete, 10–18 mm long, pungent-pointed, villous. Inflorescence globose, sometimes slightly depressed, terminal, sessile, solitary, 40–45 mm diam., surrounded by leaves; involucral bracts ovate, villous outside; cone scales ±spathulate to almost linear, villous outside. Flowers to c. 25 mm long, pink, glabrous except for a tuft of hairs on apex of each tepal. Pollen presenter c. 4 mm long; basal part papillose, swollen, constricted near mid-point then dilated into globose part; apical part tapered to stigmatic cup, glabrous. Cones ±globose, c. 15 mm diam. Nuts ovoid, beaked, to c. 4 mm long, villous. *Spider Coneflower*. Fig. 100J–M.

Restricted to a small area from Three Springs to near Eneabba and Badgingarra and extending to Moora, W.A.; grows in shrubland or open heath in gravelly soils. Flowers July–Oct. Map 211.

W.A.: road to Jurien, 6–8 km E of township, *D.B.Foreman 447* (MEL, PERTH); Hill R., 21 July 1934, *C.A.Gardner* (PERTH); near Brand Hwy, 32 km S of Eneabba, *M.G.Corrick 9908* (HO, MEL).

According to Bentham (1870), the type was collected in 'hills west of the Moore river'. However, the syntype seen at MEL has a blue 'Mueller label' which lacks this information.

### 24. Isopogon tridens (Meisn.) F.Muell., *Fragm.* 6: 239 (1868)

*Isopogon trilobus* var. *tridens* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 70 (1855); *Atylus tridens* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: towards Diamond Spring [Moore River, W.A.], *J.Drummond 6: 170*; syn: MEL, PERTH.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 149 (1988).

Shrub to c. 1.2 m. Branchlets pale reddish brown to greyish brown, slightly pubescent, glabrescent. Leaves simple; petiole not clearly defined; lamina flat, narrowly cuneate, to c. 6.5 cm long, 3-toothed, pungent-pointed, glabrous. Inflorescence depressed-globose, terminal, sessile, solitary, c. 20–30 mm diam.; involucral bracts broadly ovate, imbricate, acuminate, tomentose; cone scales ovate to narrowly ovate, densely tomentose near apex, becoming villous to fulvous at base. Flowers 22–28 mm long, white (once reported as deep purple), glabrous except for a tuft of hairs on apex of each tepal. Pollen presenter to c. 5 mm long; basal part shortly pubescent, swollen, constricted near mid-point then dilated into a globose part; apical part glabrous, scarcely swollen except for stigmatic cup. Cones depressed-globose or depressed-obovate, c. 20 mm diam. Nuts ovoid, beaked, c. 3 mm long, villous. Fig. 101 I.

Restricted to a small area from near the Arrowsmith River to Eneabba, W.A.; usually grows in heath or shrubland, in sand or sand over laterite. Flowers June–July. Map 212.

W.A.: NE of L. Logue, *C.A.Gardner 9111* (PERTH); 8 km S of Eneabba, *E.A.Griffin 881* (PERTH); 7–7.5 km along an unnamed road off the Brand Hwy, 3–4 km N of Arrowsmith R., *D.B.Foreman 551* (MEL); 25 km S of Eneabba, *R.J.Cranfield 263* (MEL, PERTH).

### 25. Isopogon linearis Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 69 (1855)

*Atylus linearis* (Meisn.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: locality not stated, *J.Drummond 6: 169*; syn: MEL, PERTH (fragment from MEL collection).

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 143 (1988).

Shrub to 1.5 m tall. Branchlets pale to mid-brown, reddish brown or grey, softly pubescent, glabrescent. Leaves simple, to c. 9 cm long; petiole not distinct; lamina linear, flat, with thickened margins and a few ±oblique veins visible, minutely scabrous, softly pubescent, glabrescent; apex tapering to a sharp point. Inflorescence ±globose, terminal, sessile, mostly solitary or sometimes 2–3-clustered, 35–40 mm diam.; involucral bracts broadly ovate, imbricate, acute, silky-pubescent; cone scales narrowly ovate to linear, acuminate, woolly-villous outside. Flowers to c. 22 mm long, pink, glabrous. Pollen presenter c. 4 mm long; basal part papillose, swollen, constricted near mid-point then dilated into a globose part which merges with the glabrous, gradually tapered brush. Cones globose to ovoid-conical, c. 25 mm diam. Nuts ovoid, beaked, to c. 2.5–4 mm long, villous. Fig. 103J–L.

Occurs from the Burma Rd (north of Geraldton Highway) south to near the Moore River and east to the vicinity of Wongan Hills, W.A.; grows in low, open heath in bleached sand or laterite, and in open shrubland on laterite ridges. Flowers Aug.–Sept. Map 213.

W.A.: Hill R., *C.A.Gardner 12782* (PERTH); c. 8 km S of Eneabba, *R.J.Hnatiuk 790072* (PERTH); Burma Rd, c. 38 km NW of Midlands Rd, *D.B.Foreman 591* (CANB, MEL, NSW, PERTH); c. 16.5 km from Mogumber along Moore River Rd, *R.W.Purdie 5064* (CBG, MEL).

## 26. Isopogon polycephalus R.Br., *Trans. Linn. Soc. London* 10: 73 (1810)

*Atylus polycephalus* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: in Novae Hollandiae ora australi, Lewin's Land [W.A.], Jan. 1802, *R.Brown (Britten 3255)*; lecto: BM; isolecto: BM, ?NSW, *fide* D.B.Foreman, *Fl. Australia* 16: 480 (1995); west coast of New Holland [W.A.], 1828–9, *W.Baxter*; syn: BM.

Spreading shrub to c. 1 m tall. Branchlets reddish brown, densely hairy. Leaves simple, 6–21 |cm long; petiole not well-differentiated; lamina ±linear-oblong to oblanceolate, flat, thick, obscurely veined; apex obtuse and ending in a hard, sharp point; immature leaves densely hairy, glabrescent. Inflorescence ±globose, terminal or axillary, sessile, often densely clustered, 25–30 mm diam.; involucral bracts few to many, elliptic, acute, tomentose to villous; cone scales mostly narrowly ovate or linear, subulate, densely-villous to plumose. Flowers 10–15 mm long, whitish to yellow or cream, glabrous. Pollen presenter c. 3 mm long, fusiform, not constricted, ±glabrous, without a distinct brush; basal part sometimes slightly swollen. Cones ovoid to ±globose, c. 20 mm diam. Nuts ±ovoid, beaked, c. 2–3 mm long, villous. Fig. 102C–D.

Mostly confined to near coastal locations between East Mt Barren and Condingup Peak, east of Esperance, W.A.; grows in heathland or sandplain, in sandy soils usually over granite, or on gravel or quartzite. Flowers Aug.–Jan. Map 214.

W.A.: No Tree Hill, *H.Demarz 3166* (PERTH); 34 km from Hopetoun along Ravensthorpe road, *R.W.Purdie 5391* (CBG); Fitzgerald River Natl Park, 35 km S of Ravensthorpe along road to Hammersley R. estuary, *B.Barnsley 504* (CBG); Hopetoun, *J.S.Beard 2236* (PERTH).

The description of *I. polycephalus* given by F.J.H. von Mueller (*Fragm.* 6: 236, 1868) appears to be an attempt to expand Robert Brown's earlier account of the species rather than describe a new species using the same epithet. Specimens collected by both Maxwell and Mueller at MEL bear the inscription '*Isopogon polycephalus*' Br. in Mueller's hand.

## 27. Isopogon attenuatus R.Br., *Trans. Linn. Soc. London* 10: 73 (1810)

*Atylus attenuatus* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: in Novae Hollandiae ora australi, Lewin's Land, King George's Sound [W.A.], 1802–1805, *R.Brown (Britten 3256)*; syn: BM, NSW.

*Isopogon attenuatus* var. *angustatus* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 281 (1856). T: locality unknown [W.A.], *J.Drummond* 2: 294; syn: MEL.

*Isopogon attenuatus* var. *dilatatus* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 281 (1856). T: locality unknown [W.A.], *L.Preiss 663*; syn: MEL.

*Isopogon attenuatus* var. *latebracteata* Benth., *Fl. Austral.* 5: 340 (1870). T: Gordon River [W.A.], *A.F.Oldfield*; syn: MEL 1532985, 1532986, NSW.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 150 (1988).

Shrub to c. 1.5 m tall, often sprouting from a lignotuber. Branchlets pale to mid-reddish brown, mostly glabrous. Leaves simple; petiole narrowed from lamina base, usually c. 5 cm long; lamina oblong-spathulate to ±linear, flat, thick, to c. 16 cm long, obscurely veined to almost veinless, glabrous; apex obtuse and ending in a hard, sharp, straight or hooked point. Inflorescence ±globose, often slightly flattened, terminal or in upper axils, sessile, mostly solitary, to 40–50 mm diam.; involucral bracts few, ovate, acute, glabrous except for a ciliate margin; cone scales mostly narrowly ovate or linear, ±villous. Flowers 10–15 mm long, creamy yellow to pale yellow, villous towards tips of tepals, otherwise glabrous. Pollen presenter c. 3 mm long, glabrous, fusiform, slightly dilated at base. Cones ±globose, slightly flattened, c. 25 mm diam. Nuts ovoid, c. 3 mm long with a persistent beak, villous.

A somewhat variable species scattered from south to south-east of Perth to around Albany and Mt Manypeaks, W.A.; grows in open *Eucalyptus* or sclerophyllous woodland with a heathy understorey, in ironstone gravels or laterite. Flowers Sept.–Feb. Map 215.

W.A.: Palgarup, *M.Koch 2664* (PERTH); Chester Pass, Stirling Ra., 4 Sept. 1945, *J.H.Willis* (MEL); 30 miles [48 km] E of Albany, near Mt Manypeaks, 4 Nov. 1963, *H.B.Shugg* (PERTH); near L. Carabundup, between Frankland and Mt Barker, *R.Pullen 9993* (CANB).


**Figure 102**. *Isopogon*. **A–B**, *I. uncinatus*. **A**, flowering branchlet; **B**, flower bud (**A–B**, A.George 9692 PERTH). **C–D**, *I. polycephalus*. **C**, flowering branchlet (M.Corrick 9548, MEL); **D**, dehisced flower (D.Foreman 811, MEL). **E–H**, *I. villosus*. **E**, flowering branchlet; **F**, pollen presenter; **G**, adaxial view of cone scale; **H**, abaxial view of cone scale (**E–H**, D.Foreman 1196, MEL). Scale bars: **A**, **C**, **E** = 2 cm; **B**, **D**, **G**, **H** = 5 mm; **F** = 2 mm. Drawn by P.Cooper.

Specimens collected to the east of the above range and previously attributed to *I. attenuatus* appear to have been misidentifications of other species, especially *I. polycephalus*. The status of the varieties recognised by Bentham (1870) requires further study.

### 28. Isopogon uncinatus R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 8 (1830)

*Atylus uncinatus* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: ora occi.-merid., King George's Sound [W.A.], 1828–1829, *W.Baxter*; syn: NSW, PERTH.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 150 (1988).

Tufted spreading shrub to 40 cm tall. Branchlets short, mid- to dark brown; branchlets and leaves densely hairy, glabrescent. Leaves simple, erect; petiole to c. 15 cm long; lamina flat, linear to linear-obovate, to c. 15 cm long, tapered to petiole, mostly uncinate. Inflorescence globose, terminal, sessile, surrounded by leaves in basal clusters, c. 25–30 mm diam.; involucral bracts few, hairy to ±glabrous; cone scales narrowly obovate, ferruginous-villous; outer scales broader. Flowers to c. 25 mm long, yellowish, glabrous near base, densely silky-hairy towards top. Pollen presenter c. 2–3 mm long; basal part scarcely swollen, minutely papillose or pubescent, very slightly constricted below mid-point, slightly dilated at base of glabrous, apical part, hardly swollen towards apex. Cones ±globose, to c. 12 mm diam. Nuts ovoid, beaked, to c. 3 mm long, villous. Fig. 102A–B.

Known only from Mt Willyung, north of Albany, W.A.; grows in clay soil, in stunted Jarrah scrub. Flowers Oct. Map 216.

W.A.: Mt Wuljenup [Willyung], *L.Preiss 758* (MEL); Mt Willyung, N of Albany, *A.S.George 9692* (MEL, PERTH).

Reports of this species from other localities have not, to my knowledge, been substantiated by vouchered collections. In most cases it has been confused with the variable *I. attenuatus*.

### 29. Isopogon sphaerocephalus Lindl., *Sketch Veg. Swan R.* xxxiv (1840)

*Atylus sphaerocephalus* (Lindl.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; lecto: CGE, *fide* D.B.Foreman, *Fl. Australia* 16: 480 (1995).

*Isopogon eriocladus* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: near Serpentine, Darling Range, W.A., Sept. 1900, *W.V.Fitzgerald*; holo: LY, *fide* D.J.McGillivray, *Contr. New South Wales Natl.* Herb. 4: 344 (1973).

*Isopogon ovoideus* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: Smith's Mill, Darling Range, W.A., Jan. 1898, *A.Morrison*; holo: LY, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 344 (1973).

Illustrations: A.S.George, *Intr. Proteaceae W. Australia* 83, pl. 123 (1984); N.G.Marchant, *et al.*, *Fl. Perth Reg.* part 1, 347, fig. 125 (1987).

Shrub to 1.5 m tall. Branchlets pale brown to mid-brown; branchlets and immature leaves hirsute long, spreading, reddish hairs. Leaves simple, sessile; lamina linear to narrowly obovate, flat, 5–16 cm long, obtuse, mucronate, glabrescent, occasionally remaining hirsute; margin often recurved; midrib prominent beneath. Inflorescence globose, terminal, sessile, solitary or occasionally with 2 additional cones clustered towards end of branchlets, 30–40 mm diam.; involucral bracts deltoid, villous; cone scales ±obovate, densely villous, with a deciduous, acuminate apex. Flowers to c. 15 mm long, white, creamy yellow to pale yellow, densely hairy over most of limb; tube glabrous. Pollen presenter c. 3.5 mm long; basal part papillose, swollen, constricted then dilated into a globose part; apical part glabrous, distinctly channelled, scarcely swollen except for stigmatic cup. Cones globose to ovoid-oblong, 20–30 mm diam. Nuts ovoid, beaked, to c. 4 mm long, villous. *Drumstick Isopogon*. Fig. 103 I.

Found from Jurien Bay to near Pemberton and Northcliffe, W.A.; grows in laterite or sand, often in Jarrah forest, or shrubland. Flowers July–Jan. Map 217.

W.A.: 1.5 km NNE of Mt Lesueur, NE of Jurien, *E.A.Griffin 1980* (PERTH); Carpel–Donnybrook road, *C.E.Woolcock P26* (MEL); 18 km SE of Busselton on Nannup road (Vasse Hwy), *D.B.Foreman 1543* (AD, CANB, MEL, NSW, PERTH); Mt Lesueur, *J.S.Beard WA/621113* (CBG); Kelmscott, 17 Sept. 1898, *R.Helms* (NSW).

There appears to be a broad, hairy leaf form at Mt Lesueur. However, its status is uncertain as there seems to be a gradation from narrow, ±glabrous forms from southern parts of the species range.

### 30. Isopogon cuneatus R.Br., *Trans. Linn. Soc. London* 10: 73 (1810)

*Atylus cuneatus* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: in Novae Hollandiae ora australi, Lewin's Land [W.A.], *D.A.Menzies*; syn: BM.

*Isopogon loudonii* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 8 (1830), as *loudoni*. T: ora occid.-merid [King George Sound, W.A.], 1828–29, *W.Baxter*; syn: NSW.

*Isopogon latifolius* var. *lanceolatus* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 283 (1856); *I. lanceolatus* (Meisn.) B.D.Jackson, *Index Kew.* 1: 1239 (1895). T: locality unknown [W.A.], *J.Drummond 5: 397*; syn: MEL.

*Isopogon latifolius* var. *preissii* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 508 (1845). T: in plareosis sylvae ad radices occidentales montis Wuljenup [Mt Willyung, W.A.], 20 Oct. 1840, *J.A.L.Priess 664*; syn: MEL.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 144 (1988).

Shrub to c. 2.5 m tall. Branchlets and immature leaves silky-pubescent; branchlets often pale to reddish brown. Leaves simple; petiole short, not well differentiated from lamina; lamina flat, narrowly obovate to oblong-obovate, 4–10 cm long, thick, obscurely veined, often dilated and partly clasping stem, glabrescent; apex obtuse or ending in a hard, sharp point. Inflorescence depressed-globose, terminal, conspicuous, solitary, to c. 40–55 mm diam.; involucral bracts broadly ovate, acute, ±glabrous to hairy; cone scales mostly narrowly ovate or linear, densely villous. Flowers c. 25 mm long, pale pink to purplish pink, glabrous except for a tuft of hairs at apex of each segment. Pollen presenter c. 5 mm long, spindle-shaped, glabrous from base to below the reflexed-hairy brush. Cones depressed-globose to hemispherical, to c. 35 mm diam. Nuts ovoid, beaked, c. 3 mm long, villous. Fig. 103E–F.

Occurs from near Albany, north to the Stirling Range and east to near Cheyne Bay, W.A.; grows in heathland, shrubland or low woodland in lateritic soil. Flowers July–Oct. Map 218.

W.A.: c. 75 km NE of Albany on Jerramungup road, *D.B.Foreman 822* (CANB, MEL, NSW, PERTH); 4–5 km SE of Wellstead on road to Cheyne Inlet, *D.B.Foreman 1421* (AD, CANB, MEL, PERTH); Albany, *A.M.Ashby 3625* (AD, MEL); 28 miles [45 km] E of Mt Manypeaks, *A.S.George 6265* (PERTH).

### 31. Isopogon latifolius R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 8 (1830)

*Atylus latifolius* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: ora occid.-merid., King George's Sound [W.A.], 1828–1829, *W.Baxter*; syn: BM.

*Isopogon protea* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 283 (1856). T: in coloniâ Swan River [W.A.], *J.Drummond 5: 398*; syn: MEL.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 147 (1988).

Shrub to c. 3 m tall. Branchlets often reddish, usually pubescent towards apices. Leaves simple; petiole very short, indistinct; lamina flat, obovate to broadly elliptic, 4–14 cm long, thick, obscurely veined, glabrous; apex acute, ending in a hard, sharp point. Inflorescence depressed-globose, terminal, conspicuous, solitary, to 80 mm diam.; involucral bracts broadly ovate, acute, numerous, imbricate, pubescent; cone scales mostly linear, woolly. Flowers c. 35 mm long, pale pink to purplish pink, glabrous except for a tuft of hairs at apex of each segment. Pollen presenter 4–6 mm long; base slightly swollen, glabrous, constricted beneath the spindle-shaped brush which has 8 rows of short, reflexed hairs. Cones depressed-globose to hemispherical, to c. 45 mm diam. Nuts ovoid, beaked, c. 3 mm long, villous. Receptacle often persisting after fruit has fallen . Figs 59, 103G–H.

Confined to the Stirling Range, W.A.; grows in shrubland or mallee woodland in gravelly or sandy soils, sometimes among rocks. Flowers Sept.–Dec. Map 219.

W.A.: Stirling Range Drive, Stirling Range Natl Park, *D.B.Foreman 844* (CANB, MEL, PERTH); Bluff Knoll, Stirling Ra., *S.J.Forbes 1123* (MEL); Mt Warrungup, *K.Newbey 1452* (PERTH).

**32. Isopogon dubius** (R.Br.) Druce, *Rep. Bot. Soc. Exch. Club Brit. Isles* 1916, Suppl. 2: 629 (1917)

*Petrophile dubia* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830). T: Swan River [W.A.], 1827, *W.Baxter*; lecto: BM, *fide* D.B.Foreman, *Fl. Australia* 16: 479 (1995).

*Isopogon roseus* Lindl., *Edwards's Bot. Reg.* 28: misc. p. 39, no. 37 (1842); *Atylus roseus* (Lindl.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: a handsome Swan River shrub, raised by Robert Mangles, Esq. of Sunning Hill, from seed imported by Captain James Mangles, R.N.; *n.v.*

*Isopogon scaber* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 506 (1845). T: locality unknown [W.A.], 25 July 1838, *L.Preiss 686*; syn: MEL.

Illustrations: R.M.Sainsbury, *Field Guide Isopogons & Petrophiles* 23 (1987); N.G.Marchant *et al.*, *Fl. Perth Reg.* part 1, 347, fig. 124 (1987).

Shrub to c. 1.2 m tall. Branchlets reddish brown; branchlets and young leaves hairy, glabrescent. Leaves often deeply 3-lobed or pinnate; petiole c. 2 cm long; lamina flat, canaliculate, c. 3.5 cm long, rigid; apex pungent-pointed, often recurved. Inflorescence ±globose, terminal or in upper leaf axils, conspicuous, solitary, 40–50 mm diam.; receptacle flattened; involucral bracts numerous, narrowly ovate, acuminate, imbricate, densely hairy at base; hairs becoming more sparse towards apex; cone scales linear, densely hairy. Flowers 25–30 mm long, pink to red-pink, glabrous except for a tuft of hairs at apex of each tepal. Pollen presenter c. 5.5 mm long; basal part slightly swollen, covered with short, reflexed hairs, distinctly constricted near mid-point; brush glabrous, expanded into a minute, stigmatic cup. Cones ±hemispherical, to c. 30 mm diam., surrounded by persistent bracts. Nuts ovoid, beaked, c. 3.5 mm long, villous. *Pincushion Coneflower, Rose Coneflower* . Figs 58, 100G–I.

Occurs mainly on the Darling Range, extending from near Cockleshell Gully and Wongan Hills south to near Narrogin, south-western W.A.; grows in open woodland in sandy loam, in heath in laterite or on granite. Flowers July–Sept. Map 220.

W.A.: 1 km S of turn-off to Wannamal, Great Northern Hwy, *R.W.Purdie 5029* (CBG, MEL); Wongan Hills, *E.H.Ising 84* (AD); Hacketts Gully, 3.6 km from Kalamunda, *J.H.Ross 2932* (MEL); 6 miles [c. 10 km] S of Bullsbrook, *K.Newby 1391* (PERTH); 2 km NW of Darlington, *P.Armstrong 44* (PERTH).

**33. Isopogon crithmifolius** F.Muell., *Fragm.* 6: 239 (1868)

*Atylus crithmifolius* (F.Muell.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891)]. T: Australia occidentalis, Swan River [W.A.], *J.Drummond 1: 574*; syn: MEL, NSW, PERTH.

Shrub 0.4–1.3 m tall. Branchlets pale brown, hairy when immature, remaining ±tomentose. Leaves once or twice ternately divided; main segments often further divided; petiole 12–25 mm long; lamina flat, 15–40 cm long, ±concave, acute, tomentose when immature, soon ±glabrescent. Inflorescence ±globose, terminal, sessile, solitary, c. 30–35 mm diam.; receptacle elongated; involucral bracts ovate, acute, shortly hairy; cone scales broadly cuneate, minutely mucronate, imbricate, villous, glabrescent near apex. Flowers 25–30 mm long, reddish pink, glabrous except for a tuft of hairs at apex of each tepal. Pollen presenter to c. 4 mm long; basal part minutely hairy, constricted above mid-point; apical part glabrous and swollen at base, tapered to a shallow stigmatic cup. Cones ±globose, c. 15–20 mm diam. Nuts ovoid, beaked, to c. 3 mm long, villous.

Found near Perth and extending to the south-east as far as Cranbrook, W.A.; grows in *Eucalyptus* forest or in shrubland in laterite. Flowers Sept.–Oct. Map 221.

W.A.: 23 km NW of North Bannister, *N.N.Donner 1473* (AD); Mt Dale Rd between main picnic area and Ashendon Rd corner, Darling Ra., *M.G.Corrick 9375* (MEL); Armadale, 22 Sept. 1946, *W.H.Nicholls* (MEL); Tutanning Wildlife Santuary, *D.B.Foreman 1086* (MEL, PERTH).

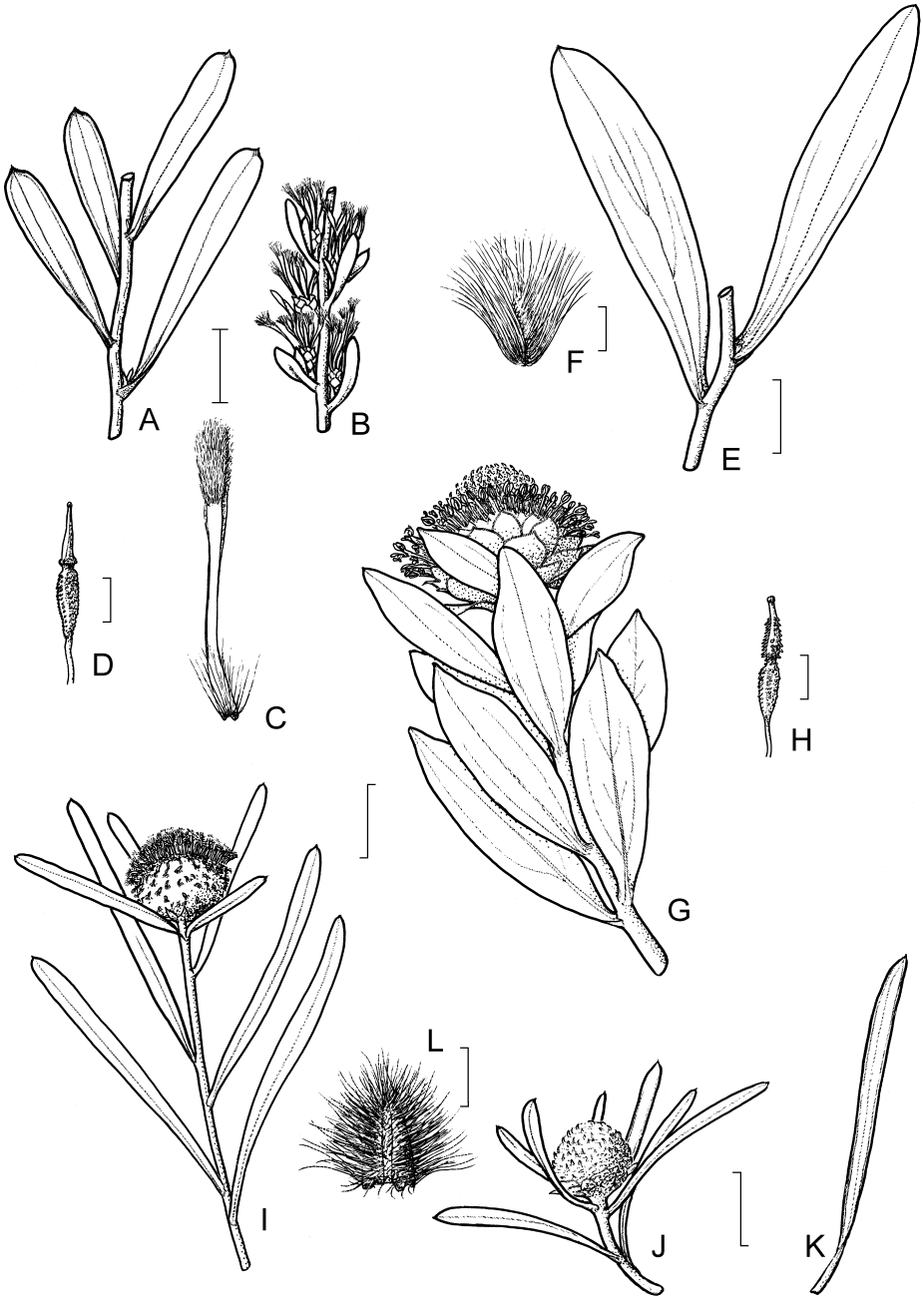



**Figure 103**. *Isopogon*. **A–D**, *I. axillaris*. **A**, leaves from non-flowering portion of stem (W.Wittwer 267, PERTH); **B**, flowering branchlet; **C**, flower bud; **D**, pollen presenter (**B–D**, B.Goadby 156, PERTH). **E–F**, *I. cuneatus*. **E**, leaves; **F**, nut (**E–F**, D.Foreman 1421, MEL). **G–H**, *I. latifolius*. **G**, flowering branchlet; **H**, pollen presenter (**G–H**, N.Walsh 1024, MEL). **I**, *I. sphaerocephalus*, flowering branchlet (D.Foreman 1509, MEL). **J–L**, *I. linearis*. **J**, branchlet with young inflorescence; **K**, leaf variation; **L**, nut (**J–L**, D.Foreman 434, MEL). Scale bars: **A**, **B**, **E**, **G**, **I–K** = 2 cm; **C** = 5 mm; **D**, **F**, **H**, **L** = 2 mm. Drawn by P.Cooper.

## 34. Isopogon axillaris R.Br., *Trans. Linn. Soc. London* 10: 74 (1810)

*Atylus axillaris* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: in Novae Hollandiae ora australi, Lewin's Land [King George Sound, W.A.], Dec. 1801, *R.Brown (Britten 3253)*; syn: BM, NSW.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 145 (1988).

Shrub to c. 1 m tall. Branchlets mid- to dark brown, glabrous. Leaves simple, to c. 12 cm long; petiole not distinct; lamina linear to oblanceolate, flat, thick, to 12 cm long overall; apex rounded and ending in a pungent point; veins obscured, glabrous. Inflorescence ovoid, axillary, sessile, to 35 mm long; receptacle concave; involucral bracts few, elliptic, imbricate, obtuse, minutely pubescent to almost glabrous, with ciliate margins; cone scales silky-villous; outer ones ovate; inner ones linear. Flowers 25–35 mm long, pale pink to purplish pink, plumose-villous towards apex; tube glabrous. Pollen presenter 5–7 mm long; basal part swollen, minutely pubescent, constricted near mid-point then dilated into a globose part which tapers slightly to stigmatic cup. Cones ovoid, c. 10 mm diam. Nuts globose, beaked, c. 3 mm diam., villous. Fig. 103A–D.

Extends from near Karridale to Albany, W.A.; grows in sand, in seasonally wet or swampy areas. Flowers July–Oct. Map 222.

W.A.: 19 km N of King R. on Albany–Mt Manypeaks road, *R.Melville 4414 & R.D.Royce* (MEL, PERTH); 4 km S of Karridale–Nannup road (Brockman Hwy), c. 25 km E of Karridale, *N.G.Walsh 1104* (MEL); 14 miles [22.5 km] NNW of Albany, *A.C.Beauglehole 12870* (MEL, NSW, PERTH); Scott River Rd, *S.Paust 264* (PERTH).

A collection by A.J.Eames & A.T.Hotchkiss (*s.n.*; PERTH) is said to be from Busselton; however, this is much further north than other collections.

## 35. Isopogon buxifolius R.Br., *Trans. Linn. Soc. London* 10: 73 (1810)

*Atylus buxifolius* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 577 (1891). T: in Novae Hollandiae, ora australi, Lewin's Land [W.A.], *R.Brown s.n.*; type: ?BM *n.v.*

*Isopogon buxifolius* var. *typicus* Benth., *nom. inval.*, *Fl. Austral.* 5: 370 (1870). T: not designated.

Illustration: A.S.George, *Intr. Proteaceae W. Australia* 85, pl. 126 (1984).

Shrub to 1.7 m tall. Branchlets pale brown to reddish brown, pubescent. Leaves simple, sessile or petiolate; lamina flat or slightly concave, 8–35 mm long, glabrous; apex rounded, terminating in a straight, sharp or recurved point. Inflorescence a dense spike, solitary, terminal or mostly clustered towards end of branchlets on very short lateral shoots, to c. 20 mm long, surrounded by leaves; involucral bracts few, lanceolate with ciliate to villous margins; cone scales villous on both surfaces or inner surface glabrous. Flowers 10–15 mm long, glabrous except for a tuft of hairs on apex of each tepal. Pollen presenter ±fusiform, 1.5–2 mm long, slightly constricted below the mid-point; basal area covered with minute, reflexed hairs, sometimes glabrescent; apical part glabrous, terminating in a minute stigmatic cup. Cones cup-shaped, to c. 10 mm long. Nuts villous, ovoid, beaked, 2.5–4 mm long.

Four varieties are recognised here. Pending further study of *I. buxifolius s. lat.*, I prefer to maintain their present status.

**1** Leaves distinctly petiolate; lamina spathulate to obovate — **35b.** var. **spathulatus**

**1:** Leaves mostly sessile; lamina ovate, elliptic, obovate, oblong, linear or narrowly oblong

**2** Leaves linear or narrowly oblong — **35d.** var. **linearis**

**2:** Leaves not linear or narrowly oblong

**3** Leaves mostly ovate, sometimes elliptic; apex recurved — **35a.** var. **buxifolius**

**3:** Leaves obovate or oblong; apex acute — **35c.** var. **obovatus**

### 35a. Isopogon buxifolius R.Br. var. buxifolius

Shrub to 60 cm tall. Leaves sessile; lamina mostly ovate, sometimes elliptic, 10–15 mm long, flat, or slightly concave, terminating in a recurved point, glabrous. Cone scales lanceolate,

villous on both surfaces except for glabrous outer surface of apex. Flowers pink, becoming white with age. Pollen presenter 1.5 mm long; basal part covered with minute, reflexed hairs. Nuts to c. 2.5 mm long.

Restricted to an area from Collie to near Denmark and Albany, W.A.; grows in quartzite sand in swampy areas with reeds and rushes. Flowers July–Dec. Map 223.

W.A.: 4 miles [6.5 km] W of Marbellup, *R.Melville 4452 & R.D.Royce* (MEL, PERTH); Denmark, W of Albany, 27 July 1952, *N.H.Speck* (CANB); by Hay R. on Keith Rd, off South Coast Hwy, E of Denmark, 26 Aug. 1994, *J.Raudino* (MEL, PERTH); Collie, Sept. 1930, *E.Ashby* (PERTH).

### **35b. Isopogon buxifolius** var. **spathulatus** (R.Br.) Benth., *Fl. Austral.* 5: 341 (1870)

*Isopogon spathulatus* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 8 (1830). T: ora occid-merid., King George's Sound, [W.A.], 1829, *W.Baxter s.n.*; syn: BM.

Shrub 0.5–1.7 m tall. Leaves with petiole 2–20 mm long, sometimes not clearly defined; lamina flat, mostly spathulate, sometimes ±obovate, 8–35 mm long, glabrous; apex rounded, terminating in a sharp point. Cone scales villous on outer surface only. Flowers mauve, creamy white, white or greenish. Pollen presenter 1.5–2 mm long; basal part glabrescent. Nuts to c. 2.5 mm long. Fig. 101A.

Appears to be the most widely distributed of the varieties; extends from near Collie to near Wagin, and the Stirling Range to the western end of Fitzgerald River Natl Park, W.A.; grows on sandplain, in wet or swampy sand, in mixed heath or shrubland in sandy soils. Flowers Aug.–Dec. Map 224.

W.A.: reserve W of Collie, *E.M.Scrymgeour 2020* (PERTH); 35 miles [56 km] from Albany, towards Borden, along Chester Pass Rd, *E.M.Canning 6840* (CANB); northern slopes of the Stirling Range, *E.C.Nelson 17362* (CANB); c. 13 km S of Wagin, *Hj.Eichler 15883* (AD).

A somewhat variable variety which, as circumscribed here, may include elements better placed elsewhere. The range of flower colour from mauve to white which may be age related. Further studies are planned to resolve these matters.

### **35c. Isopogon buxifolius** var. **obovatus** (R.Br.) Benth., *Fl. Austral.* 5: 341 (1870)

*Isopogon spathulatus* var. *obovatus* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 9 (1830). T: south-west coast of New Holland, 1829, *W.Baxter*; syn: BM.

Shrub 0.6–1.5 m tall. Leaves sessile or the petiole barely discernible and to c. 2 mm long; lamina obovate or oblong, 15–35 mm long, flat, glabrous; apices rounded, terminating in a short, acute point. Cone scales villous on outer surface only. Flower colour not recorded. Pollen presenter 1.5 mm long; basal part covered with minute, reflexed hairs. Nuts to c. 4 mm long. Fig. 101C.

Restricted to a small area from the Stirling Range to near Cape Riche and Bremer Bay, W.A.; ecological data is limited but has been recorded as growing in sandy loam over laterite, with *Eucalyptus redunca*, *E. goniantha* and *E. uncinata*. Flowers June–Oct. Map 225.

W.A.: 5 km from turn-off to Bremer Bay at Boxwood Hill along Higway 1 towards Jerramungup, *B.Barnsley 619* (CANB); Cape Riche, *J.W.Wrigley 4953* (CANB); Darkin to Collie Rd, *C.E.Woolcock 49* (MEL); Stirling Range Natl Park, 23 Sept. 1985, *W.Huggins* (MEL).

### **35d. Isopogon buxifolius** var. **linearis** (R.Br.) Benth., *Fl. Austral.* 5: 341 (1870)

*Isopogon spathulatus* var. *linearis* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 9 (1830). T: not designated.

Shrub 0.6–1.5 m tall. Leaves sessile, flat, mostly linear or narrowly oblong, 9–23 mm long, sometimes the upper ones tending to be obovate, glabrous; apex acute. Cone scales villous on outer surface only. Flowers pink. Pollen presenter to c. 2 mm long; basal area covered with minute reflexed hairs. Nuts to c. 2.5 mm long. Fig. 101B.

Restricted to an area from near Cranbrook to the Stirling Range and around Albany, W.A.; ecological information often lacking, recorded as growing on sandplains or in low, wet places, in sandy or red stony soil. Flowers May–Nov. Map 226.

W.A.: Stirling Range Natl Park, *R.D.Royce 10279* (PERTH); Mt Mandurup, Stirling Ra., *C.A.Gardner 14708* (PERTH); Cranbrook, *C.A.Gardner 1166* (PERTH); S from Tenterden, 25 Sept. 1902, *A.Morrison* (PERTH); Stirling Ra., Oct. 1867, *F.Mueller* (MEL).

## Excluded names

*Isopogon divaricatus* Roem. & Schult., *Syst. Veg.* 44 (1817)

T: *n.v.*

According to A.D.Chapman, *Austral. Pl. Name Index* D–J: 1680 (1991), this taxon is based on the illegitimate name *Protea divaricata* Andrews, which is possibly based on cultivated material from the Cape of Good Hope.

*Isopogon pedunculatus* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 5 (1830)

T: ora merid.-occid., Swan River [W.A.], 1827, *C.Fraser 8*; syn: BM.

This is *Petrophile seminuda* Lindl.

## Names not accounted for in this treatment

*Isopogon drummondii* Jacques, *Ann. Fl. Pomone* 216 (1843)

T: Nouvelle-Hollande, date and coll. unknown, *fide* A.D.Chapman, *Austral. Pl. Name Index* 2: 1680 (1991); not located.

*Isopogon eugellii* Jacques, *Ann. Fl. Pomone* 216 (1843)

T: Nouvelle-Hollande, date and coll. unknown, *fide* A.D.Chapman, *Austral. Pl. Name Index* 2: 1680 (1991); not located.

*Isopogon propinquus* A.Cunn. ex Sweet, *Hort. Brit.* 490 (1827)

T: New Holland, 1824, *coll. unknown*, *fide* A.D.Chapman, *Austral. Pl. Name Index* 2: 1681 (1991), not located, *nom. inval.*, *nom. nud.*

*Isopogon diversifolius* Ettingsh., *Blatt-Skel. Dikot.* 284, t. 12, fig. 2 (1861)

T: cultivirt im k.k. Hofgarten zu Schönbrunn, *fide* A.D.Chapman, *Austral. Pl. Name Index* 2: 1680 (1991), not located, *nom. inval.*

Apparently based only on an illustration without a diagnosis.

## Subtrib. 4. CONOSPERMINAE

*Proteaceae* subtrib. *Conosperminae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 171 (1975).

Type: *Conospermum* Sm.

Leaves entire to ±pinnate. Inflorescence of 1–many short, dense spikes. Flowers weakly or (more commonly) strongly zygomorphic, bisexual; tepal bases connate. One anther and 2 half-anthers abortive; loculi of adjacent anthers cohering in bud. Hypogynous glands absent. Style variously modified but pollen presenter absent. Fruit a nut, often with long hairs. $n = 11$.

Comprises the extra-tropical and mainly south-western Australian endemic genera *Conospermum* and *Synaphea*.

## 12. CONOSPERMUM

*E.M.Bennett*

*Conospermum* Sm., *Trans. Linn. Soc. London* 4: 213 (1798); from the Greek *conos* (a cone) and *sperma* (a seed), in reference to the shape of the fruit.

Type: *C. longifolium* Sm.

*Isomerium* (R.Br.) Spach, *Hist. Nat. Vé*g. 10: 401 (1841). T: *Conospermum flexuosum* R.Br.

Shrubs and small trees. Leaves simple, entire. Inflorescence paniculate or corymbose, of 1–many short, dense spikes. Flowers sessile, solitary; each flower subtended by a bracteole; rachis thickened and lengthening in fruit. Perianth tubular with 4 nearly equal lobes, or 2-lipped; adaxial lip of 1 broad lobe; abaxial lip 3-lobed. Stamens inserted in gibbous apex of perianth tube, or in base of lower lip; filaments short, thick; adaxial stamen 2-locular, connate with 1-locular, lateral stamens; abaxial stamen sterile. Ovary sessile; ovule 1, pendulous; style filiform at base, thickened above and incurved abaxially, beaked; stigma lateral, subterminal. Fruit an obconical or urceolate nut, hairy or glabrous.

A genus of 53 species endemic in Australia, with its centre of distribution in south-western W.A.

The juvenile leaves of all *Conospermum* species are prominently 3-nerved and are both longer and broader than mature leaves.

C.F.Meisner, *Conospermum*, *in* A.L.P.P. de Candolle, *Prodr.* 1: 316–325 (1856); L.A.S.Johnson & D.J.McGillivray, *Conospermum* Sm. (Proteaceae) in eastern Australia, *Telopea* 1: 58–65 (1975); A.S.George, *Intr. Proteaceae W. Australia* 22–29 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 132–147 (1989); D.A.Morrison *et al*., Reproductive isolation mechanisms among four closely-related species of *Conospermum* (Proteaceae), *Bot. J. Linn. Soc.* 116: 13–31 (1994).

### KEY TO SUBGENERA, SECTIONS AND SUBSECTIONS

| | | |
|---|---|---|
| **1** | Perianth of 4 nearly equal lobes | |
| **2** | Perianth lobes as long as tube | subg. 1. **ISOMERIUM** |
| **2:** | Perianth lobes much longer than tube | subg. 2. **CHILURUS** |
| **3** | Flowers glabrous; leaves terete | sect. 1. **TERETIFOLIA** |
| **3:** | Flowers pubescent; leaves flat | sect. 2. **CAPITATAE** |
| **1:** | Perianth 2-lipped | subg. 3. **CONOSPERMUM** |
| **4** | Flowers glabrous to sericeous | |
| **5** | Stems leafy at base only | |
| **6** | Inflorescence paniculate | sect. 1. **PANICULATA** |
| **6:** | Inflorescence a dense spike or corymb | sect. 2. **SCAPOSA** |
| **5:** | Stems leafy throughout | |
| **7** | Spikes simple, axillary | sect. 3. **AXILLARIA** |
| **7:** | Spikes corymbose, terminal and axillary | sect. 4. **CORYMBOCEPHALA** |
| **4:** | Flowers woolly or silky | sect. 5. **ERIOSTACHYA** |
| **8** | Inflorescence arising from axils of upper leaves | |
| **9** | Spikes simple | |
| **10** | Perianth lobes much shorter than tube | subsect. 1. **FOLIOSA** |

**10:** Perianth lobes nearly equal in length to tube — subsect. 2. **SERICEA**

**9:** Panicle loose and much-branched — subsect. 3. **RAMOSA**

**8:** Inflorescence terminal; leaves basal

**11** Peduncle with numerous sterile bracts — subsect. 4. **MULTIBRACTEATA**

**11:** Peduncle without numerous sterile bracts — subsect. 5. **PEDUNCULATA**

## KEY TO SPECIES

**1** Perianth of 4 nearly equal lobes

**2** Flowers in dense heads exceeded by the leaves

**3** Perianth lobes ±equal in length to tube — **5. C. capitatum**

**3:** Perianth lobes much longer than tube — **6. C. petiolare**

**2:** Flowers in panicles exceeding the leaves

**4** Leaves terete

**5** Shrub; flowers more than 16 mm long — **4. C. teretifolium**

**5:** Undershrub; flowers less than 6 mm long — **3. C. quadripetalum**

**4:** Leaves flat

**6** Panicle flexuose, divaricate — **1. C. flexuosum**

**6:** Panicle not flexuose — **2. C. paniculatum**

**1:** Perianth 2-lipped; upper lip 1-lobed; lower lip 3-lobed

**7** Perianth woolly, occasionally silky-villous

**8** Leaves terete or subterete

**9** Spikes simple in the upper leaf-axils

**10** Lower lip of perianth pilose, without a dense beard of hairs

**11** Bracteoles blue, 5–6 mm long; upper lip of perianth glabrous; simple spikes arising from the upper axillary leaves — **39. C. spectabile**

**11:** Bracteoles bluish-green, 2–4 mm long; upper lip of perianth velutinous or glabrous; flowering axis elongated well above the leaves

**12** Flowers white, rarely blue; perianth tube 1.5–3 mm long below lobes — **34. C. filifolium**

**12:** Flowers blue to grey-blue; perianth tube 1–1.5 mm long below lobes — **35. C. sigmoideum**

**10:** Lower lip of perianth villous, with a dense beard of hairs

**13** Upper lip partially or completely hairy; leaves dense along stem

**14** Leaves regularly incurved; upper lip sericeous, more than 1.5 mm long — **38. C. floribundum**

**14:** Leaves appressed, ±incurved; upper lip densely hairy, less than 1.5 mm long — **37. C. multispicatum**

**13:** Upper lip glabrous; leaves scattered, to occasionally dense — **36. C. distichum**

**9:** Spikes racemose or paniculate on terminal peduncles

**15** Panicle dense, sparingly branched; peduncle with bracts below the inflorescence

**16** Upper lip of perianth with scattered, white hairs along midline — **52. C. galeatum**

**16:** Upper lip of perianth glabrous

**17** Leaves mostly less than 25 mm long, incurved **49. C. incurvum**

**17:** Leaves mostly more than 25 mm long, ascending, ±curved **50. C. brachyphyllum**

**15:** Panicle loose and much-branched; peduncle with bracts below each branch

**18** Perianth tube tomentose, noticeably swollen at apex **41. C. microflorum**

**18:** Perianth tube woolly, not noticeably swollen at apex **42. C. stoechadis**

**8:** Leaves linear to lanceolate, or oblong to ovate

**19** Leaves linear to oblanceolate

**20** Upper surface of leaves canaliculate, especially at base; inflorescence a spicate panicle in the upper leaf axils **43. C. canaliculatum**

**20:** Upper surface of leaves with raised veins; inflorescence a corymb of spikes **53. C. crassinervium**

**19:** Leaves lanceolate or oblong to ovate

**21** Perianth lobes ±equal in length to perianth tube **40. C. bracteosum**

**21:** Perianth lobes much shorter than perianth tube

**22** Peduncle with numerous sterile bracts below the inflorescence **51. C. unilaterale**

**22:** Peduncle with bracts supporting the inflorescence branches only

**23** Leaf margins undulate **46. C. undulatum**

**23:** Leaf margins entire

**24** Bracteoles 3–8.5 mm long; upper lip of perianth longer than 2.25 mm **47. C. wycherleyi**

**24:** Bracteoles to 3 mm long; upper lip of perianth less than 2.2 mm long

**25** Single-stemmed tree to 4 m tall **44. C. triplinervium**

**25:** Multistemmed shrub less than 2 m tall

**26** Leaves coriaceous, puberulous **45. C. cinereum**

**26:** Leaves thin, glabrous **48. C. boreale**

**7:** Perianth glabrous, velutinous or tomentose, but not woolly

**27** Perianth glabrous

**28** Leaves pungent-pointed **20. C. acerosum**

**28:** Leaves ±acute, but not pungent-pointed

**29** Inflorescence a panicle

**30** Panicle branches dichotomous **10. C. eatoniae**

**30:** Panicle branches not dichotomous

**31** Bracteoles to 16 mm long, much longer than the flowers **13. C. glumaceum**

**31:** Bracteoles shorter than the flowers

**32** Undershrub, leafy at base only; spikes sessile along a central axis **11. C. ephedroides**

**32:** Shrub, leafy up to the inflorescence; panicle open, few-branched **8. C. leianthum**

**29:** Inflorescence corymbose or a simple spike on a long peduncle

**33** Leaves ovate to oblanceolate **17. C. brownii**

**33:** Leaves terete **15. C. huegelii**

**27:** Perianth velutinous or tomentose, occasionally the upper lobe glabrous

**34** Inflorescence ±equal to or shorter than the leaves

**35** Most leaves less than 5.5 cm long

**36** Leaves oblong to ovate, 3-veined

**37** Leaves flat; flowers white **27. C. ellipticum**

**37:** Leaves folded along midvein; flowers blue to pink **24. C. nervosum**

**36:** Leaves terete, linear or spathulate

**38** Inflorescence a simple spike

**39** Inflorescence leaves expanded at base into 2 auricles; flowers puberulous to ±glabrous **21. C. amoenum**

**39:** Inflorescence leaves not auriculate at base; flowers silky to woolly

**40** Cauline leaves terete; peduncle 2.5–9 mm long **22. C. croniniae**

**40:** Cauline leaves filiform to narrowly lanceolate; peduncle 7–60 mm long **23. C. coerulescens**

**38:** Inflorescence a panicle or corymb

**41** Leaves spathulate, ±incurved **28. C. hookeri**

**41:** Leaves flat, occasionally spathulate but not incurved **26. C. taxifolium**

**35:** Most leaves longer than 5.5 cm

**42** Leaves terete; inflorescence an open panicle **9. C. toddii**

**42:** Leaves flat, often narrow; inflorescence a corymb or dense panicle

**43** Leaf venation raised; circumference hairs of nut c. 0.5 mm long; central tuft of hairs absent **30. C. burgessiorum**

**43:** Leaf venation not raised; circumference hairs of nut 1.3–1.8 mm long; central tuft of hairs 1.5–1.8 mm long **33. C. mitchellii**

**34:** Inflorescence longer than the leaves

**44** Inflorescence a loose, elongate panicle; flowers in dense spikes

**45** Basal and cauline leaves terete **12. C. polycephalum**

**45:** Basal leaves oblanceolate or ovate; cauline leaves lanceolate or terete **14. C. caeruleum**

**44:** Inflorescence a few-branched panicle or simple spike; flowers in loose spikes, but occasionally dense

**46** Undershrubs with basal leaves only

**47** Leaves with a distinct, terete petiole; lamina flat **18. C. scaposum**

**47:** Leaves without a distinct petiole; lamina terete or oblanceolate

**48** Leaves to 6.5 cm long, curved, ±velutinous **16. C. densiflorum**

**48:** Leaves to 20 cm long, ±sigmoid; apex spirally incurved **19. C. tenuifolium**

**46:** Shrubs with leaves up to the inflorescence

**49** Leaves less than 4.5 cm long

**50** Peduncle longer than 6 cm **29. C. patens**

**50:** Peduncle less than 5 cm long

**51** Leaves ±terete **25. C. ericifolium**

**51:** Leaves flat **26. C. taxifolium**

**49:** Leaves more than 4.5 cm long

**52** Flowers in loose spikes **7. C. elongatum**

**52:** Flowers in dense spikes or dense, corymbose panicles

**53** Leaves glabrous **32. C. longifolium**

**53:** Leaves hirsute, occasionally glabrous, but base always sericeous **31. C. sphacelatum**

## Subg. 1. Isomerium

**Conospermum** subg. **Isomerium** (R.Br.) E.M.Benn., *Fl. Australia* 16: 481 (1995).

*Conospermum* sect. *Isomerium* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 11 (1830); *Isomerium* (R.Br.) Spach, *Hist. Nat. Vég.* 10: 401 (1841). T: *C. flexuosum* R.Br.

Perianth lobes 4, equal, spreading; tube nearly as long as lobes, slightly gibbous on adaxial side; style persistent. Nut urceolate, puberulous, without circumference hairs.

A subgenus of 3 species, all endemic in south-western W.A.

### 1. Conospermum flexuosum R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 11 (1830)

T: ora occid.-merid, regio mont. prope King George's Sound [W.A.], 1828–29, *W.Baxter*; holo: BM.

Much-branched, flexuose shrub to 1 m tall. Leaves clustered at base, often absent from mature plants; petiole 1.7–7 cm long, 4-angled or semiterete; lamina spathulate, 6.5–24 cm long, 4–17 mm wide, glabrous; margins and midvein raised. Inflorescence a dichotomously branched panicle, terminating in heads of 3–7 flowers; axis 4–12-ribbed, ±pustulate; bracteoles 1.5–2.5 mm long, 2–3 mm wide, brownish blue, velutinous. Perianth white to pale blue, with white or rusty tomentum; tube 2–3.5 mm long; lobes 2–4 mm long, 0.5–1 mm wide. Nut urceolate, 2.5–3 mm long, 1.75–2.5 mm wide, puberulous, brown, red, or white.

Widespread between Busselton and Wellstead (east of Albany), W.A.; often growing in areas subject to inundation. There are 2 subspecies.

Stems prominently 4–6-angled, with scattered to dense tubercles **1a.** subsp. **flexuosum**

Stems 8–12-ribbed, without tubercles **1b.** subsp. **laevigatum**

### 1a. Conospermum flexuosum R.Br. subsp. flexuosum

*Conospermum flexuosum* f. *minus-diffusa* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 251 (1848). T: locality unknown [W.A.], *L.Preiss 753*; iso: MEL.

*Conospermum flexuosum* var. *asperulum* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 325 (1856). T: locality unknown [W.A.], *L.Preiss 753*; lecto: MEL, *fide* E.M.Bennett, *Fl. Australia* 16: 485 (1995); Swan River [W.A.], *J.Drummond 5: 402*; syn: PERTH.

Illustrations: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* 1: 140 (1954); part 1, 2nd edn, 233 (1988).

Vegetative and inflorescence branches tuberculate, prominently 4–6-angled, with veining between.

Occurs in the Albany area, south of the Stirling Range and east to Wellstead, W.A. Map 227.

W.A.: 6 miles [c. 9.5 km] S of Narrikup on Albany Rd, *R.Melville 4402 & R.D.Royce* (MEL); 9.5 miles [c. 15.5 km] NW of Albany, *A.C.Beauglehole 12838* (NSW); Millbrook Rd, N of Albany, *E.Wittwer 270* (KPBG); 9 miles [c. 14.5 km] E of Pfeiffer Rd, South Stirling, *F.Lullfitz 3469* (PERTH); 10 km W of Wellstead, between Albany and Jerramungup, *G.J.Keighery 6049* (PERTH).

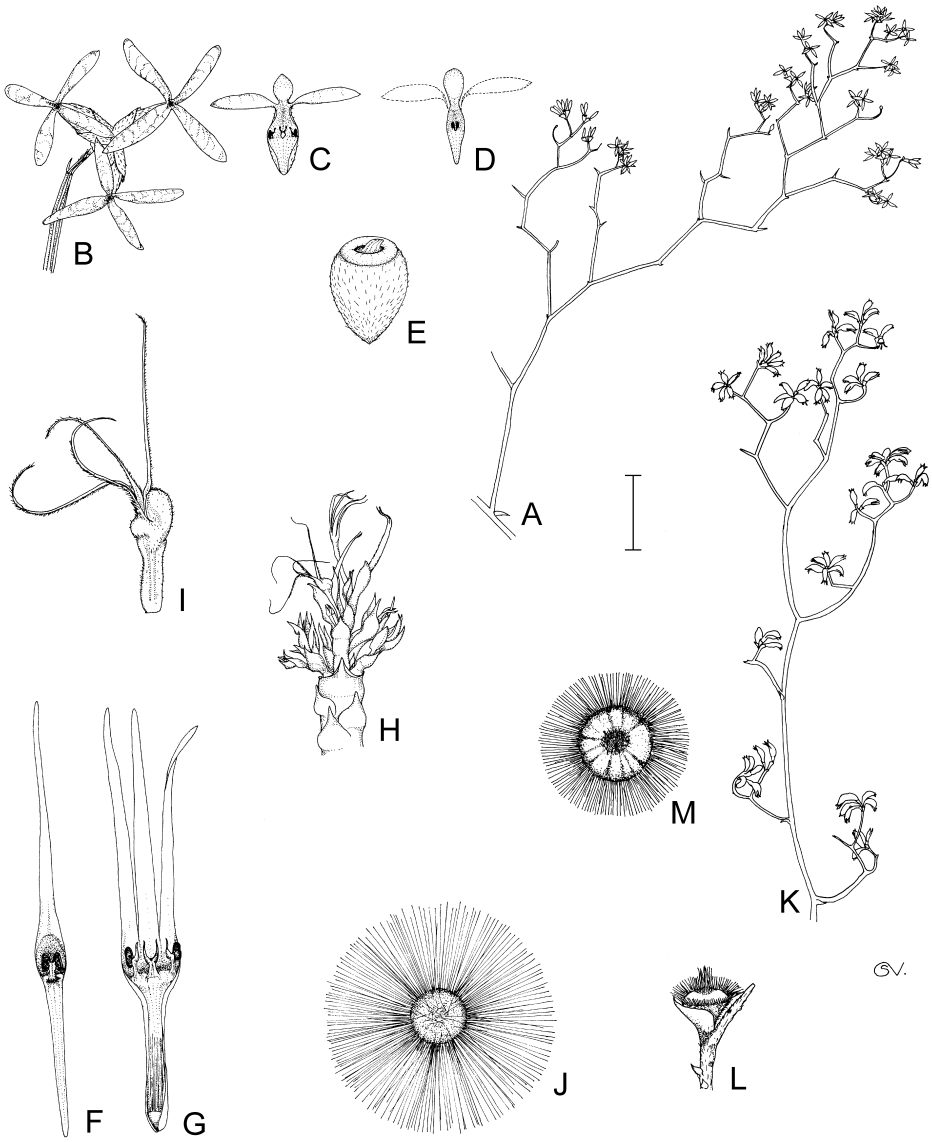



**Figure 104**. *Conospermum*. **A–E**, *C. flexuosum* subsp. *laevigatum*. **A**, inflorescence; **B**, part of inflorescence; **C**, view of abaxial portion of dissected flower; **D**, view of adaxial portion of dissected flower; **E**, nut (**A–E**, E.Bennett 5166, PERTH, KPBG). **F–G**, *C. teretifolium*. **F**, view of adaxial portion of dissected flower; **G**, view of abaxial portion of dissected flower (**F–G**, E.Bennett 5262, PERTH). **H–J**, *C. petiolare*. **H**, inflorescence; **I**, lateral view of flower; **J**, nut (**H–J**, E.Bennett 5309, PERTH, KPBG). **K–M**, *C. eatoniae*. **K**, inflorescence (23 Aug. 1987, E.Bennett, KPBG); **L**, nut with bracteole; **M**, nut (**K–M**, R.Royce 9722, PERTH). Scale bar: **A**, **K** = 2 cm; **B–D**, **F**, **G**, **I**, **J**, **L** = 4 mm; **E**, **M** = 2 mm; **H** = 1 cm. Drawn by C.Vasiliu.

The stems are prominently angled but stem tubercles vary from many and conspicuous to few and relatively inconspicuous.

### 1b. **Conospermum flexuosum** subsp. **laevigatum** (Meisn.) E.M.Benn., *Fl. Australia* 16: 484 (1995)

*Conospermum flexuosum* var. *laevigatum* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 325 (1856). T: locality unknown [W.A.], *J.Drummond 2: 309*; syn: MEL, NSW, PERTH.

*Conospermum flexuosum* f. *ramosissima* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 251 (1848). T: locality unknown [W.A.], *J.Drummond 2: 309*; syn: MEL, NSW, PERTH.

Vegetative and inflorescence branches 8–12-ribbed, without tubercles. Fig. 104A–E.

Occurs in the Capel–Busselton area and east to Nannup, with an isolated collection from Waroona, W.A. Map 228.

W.A.: Margaret River, *A.Morrison 8528* (NSW); E of Waroona, Darling Ra., *F.Ross* (NSW); 22.7 miles [c. 36 km] from Augusta on Nannup Rd, *F.Lullfitz 5811* (KPBG); Busselton district, *R.D.Royce 5763* (PERTH); 10 km S of Yornup, *G.J.Keighery 4011* (PERTH).

### 2. **Conospermum paniculatum** E.M.Benn., *Fl. Australia* 16: 485 (1995)

T: 3.6 km S on Scott River Rd from Stewart Rd, W.A., 4 Sept. 1985, *E.M.Bennett 5160*; holo: PERTH; iso: CANB, K, MEL.

[*Conospermum flexuosum* var. *asperulum auct. non* Meisn.: C.F.Meisner *in* A.L.P.P. de Candolle, *Prodr.* 14: 325 (1856); as to *J.Drummond 2: 310, non sensu lectotypica*]

Open shrub to 1.25 m tall. Leaves basal, erect, persistent; petiole 1.5–10 cm long; lamina spathulate or very narrowly obovate, 5–21 cm long, 5–15 mm wide, glabrous. Inflorescence a racemose panicle, to 115 cm long, terminating in heads of 3–7 flowers; peduncle prominently 3–6-angled; bracteoles deltoid, 2–2.5 mm long, 4–5 mm wide, rusty- and white-velutinous. Perianth white to pale blue, white- and rusty-velutinous; tube 2–3.5 mm long; lobes narrowly oblong, 1.75–3 mm long, 0.75–1 mm wide; inner surface undulate. Nut urceolate, c. 1.5 mm long, c. 1.25 mm wide, white- to fawn-tomentose with red hairs. Fig. 105A–E.

Occasional in swampy areas between Busselton and Scott River, W.A. Flowers July, Sept.–Nov. Map 229.

W.A.: Scott River Rd, *S.Paust 252* (NSW, PERTH); Stuart Rd, 11 miles [17 km] from junction with Pemberton–Nannup road, *J.W.Wrigley* (CBG, NSW); Sabina Rd, Busselton, *E.Wittwer 720* (KPBG); Witchcliffe, *R.D.Royce 1391* (PERTH); Rosa Brook, *G.S.McCutcheon 800* (PERTH).

This species is readily distinguished from *C. flexuosum* by the more regularly branched panicle and the persistent leaves. Both species occasionally grow together, especially in the Busselton area.

### 3. **Conospermum quadripetalum** E.M.Benn., *Fl. Australia* 16: 486 (1995)

T: Scott River Rd, 4 Sept. 1985, *E.M.Bennett 5159*; holo: PERTH; iso: CANB, K, MEL.

Spreading, lax undershrub to 30 cm tall. Leaves basal and cauline, terete, 13–35 cm long, 0.75–1 mm wide; apex acute, uncinate. Inflorescence a few-branched, leafless panicle; each branch terminating in 2 (–6) flowers; peduncle 4–16 cm long, terete, glabrous; bracteoles 2.5–3 mm long, 2.5–3 mm wide, greenish blue, densely short white-hairy at base and sides; midvein raised; margins short rusty red-ciliate. Perianth blue, white- and red-tomentose; tube 3–4 mm long; perianth lobes ±equal, 2–2.5 mm long, 0.75–1 mm wide. Nut not seen. Fig. 105F–J.

Two collections of this very rare species are known from the Scott River area, W.A. Flowers Sept. and Nov. Map 230.

W.A.: Scott River Natl Park, *C.J.Robinson 397* (PERTH).

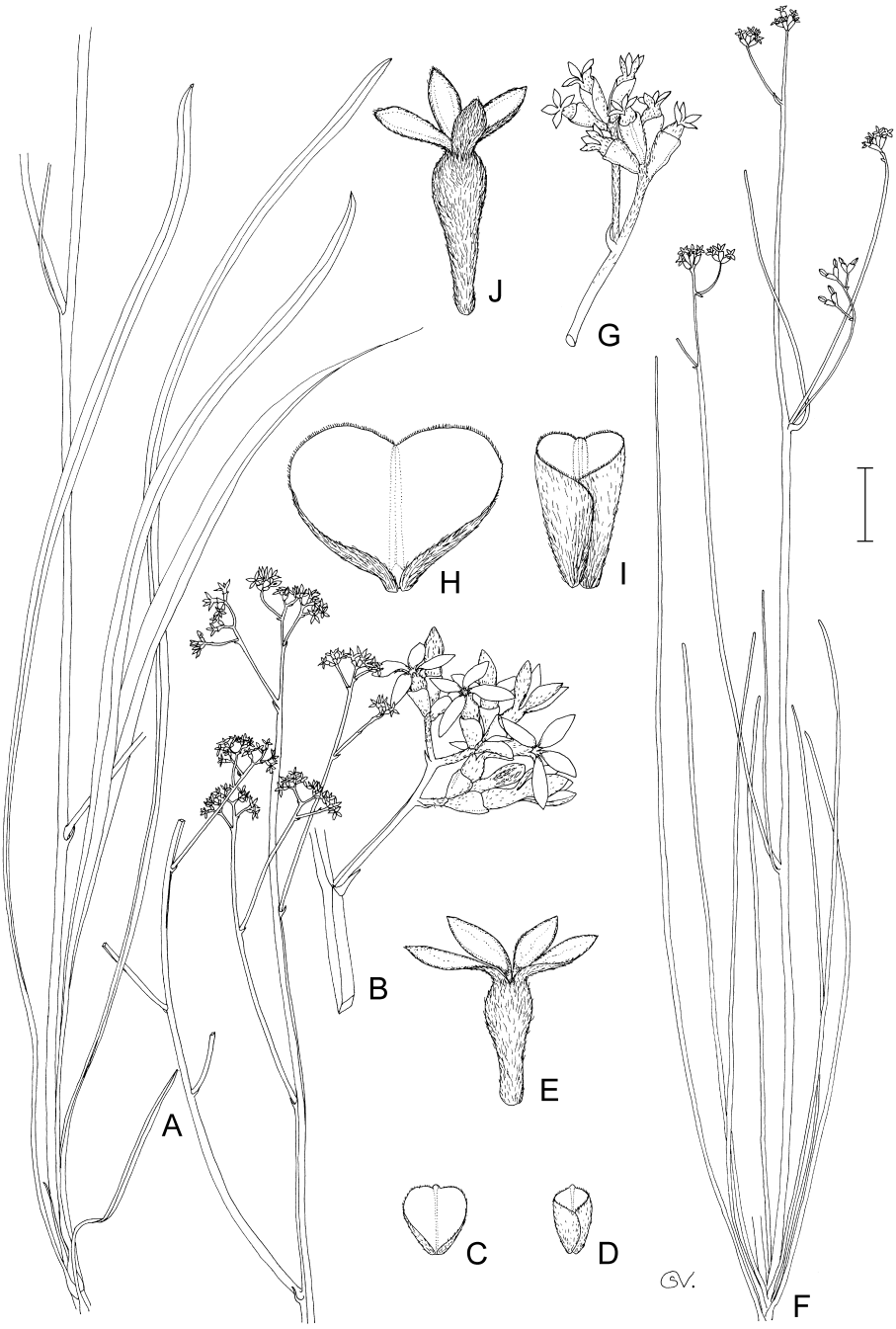



**Figure 105**. *Conospermum*. **A–E**, *C. paniculatum*. **A**, flowering stem; **B**, part of inflorescence; **C–D**, flower bracteoles; **E**, flower (**A–E**, E.Bennett 5160, PERTH). **F–J**, *C. quadripetalum*. **F**, flowering stem; **G**, part of inflorescence; **H–I**, flower bracteoles; **J**, flower (**F–J**, E.Bennett 5159, PERTH). Scale bar: **A**, **F** = 2 cm; **B**, **G** = 4 mm; **C–E**, **J** = 2 mm; **H**, **I** = 1 mm. Drawn by C.Vasiliu.

## Subg. 2. Chilurus

**Conospermum** subg. **Chilurus** (R.Br.) E.M.Benn., *Fl. Australia* 16: 481 (1995).

*Conospermum* sect. *Chilurus* R.Br., *Trans. Linn. Soc. London* 10: 155 (1810). T: *C. teretifolium* R.Br.; lecto, *fide* E.M.Bennett, *Fl. Australia* 16: 481 (1995).

Perianth segments 4, subequal, linear and tapering, longer than the tube; adaxial lobe concave at base over the semi-exserted stamens. Style ±persistent. Nut conical, velutinous; circumference hairs longer than the height or diameter of the nut.

A subgenus of 3 species endemic in south-western W.A.

### Sect. 1. Teretifolia

**Conospermum** sect. **Teretifolia** E.M.Benn., *Fl. Australia* 16: 482 (1995).

Type: *C. teretifolium* R.Br.

Leaves terete. Flowers in extended panicles, glabrous.

A monospecific section.

**4. Conospermum teretifolium** R.Br., *Trans. Linn. Soc. London* 10: 155 (1810)

T: in Novae Hollandiae, orâ Australi, Lewin's Land [W.A.], 1802–1804, *R.Brown s.n.*; iso: MEL.

Multistemmed shrub to 1.5 m tall. Leaves terete, 4–4.3 cm long, 0.8–2.5 mm wide, ascending, acute to acuminate. Inflorescence a much-branched panicle in the upper leaves; peduncle 10–35 cm long; bracteoles ovate, 3–5.5 mm long, 2–4 mm wide, brown, ciliate, cuspidate. Perianth creamy white; tube 7–11 mm long; lobes linear, 9–17 mm long, 0.8–1.5 mm wide, obtuse. Nut 2.5–4 mm long, 1.5–3 mm wide; cream- to rusty brown-velutinous; circumference hairs 0.5–5 mm long, orange to yellowish brown; central tuft absent. Fig. 104F–G.

Found from Albany to east of Esperance, W.A. Flowers Oct.–Jan. and Mar. Map 231.

W.A.: 26 miles [42 km] SE of Borden on Bremer Bay Rd, *A.S.George 1719* (PERTH); Cowaramup Hill area, c. 30 km NE of Esperance, *P.S.Short & L.Haegi 2331* (PERTH); 2 miles [3.5 km] from Hopetoun towards Ravensthorpe, *J.W.Wrigley* (NSW); Fitzgerald River Natl Park, 7.5 km W of Annie Peak, *M.D.Crisp 5017* (NSW); South Stirlings, *F.Lullfitz 4084* (KPBG).

### Sect. 2. Capitatae

**Conospermum** sect. **Capitatae** Diels & E.Pritz. ex De Wild., *Pl. Nov. Horti Then.* 1: 139, 149 (1905).

Type: *C. capitatum* R.Br.; lecto, *fide* E.M.Bennett, *Fl. Australia* 16: 481 (1995).

Leaves petiolate; lamina flat. Flowers pubescent, aggregated in dense, short panicles.

A section of 2 species.

**5. Conospermum capitatum** R.Br., *Trans. Linn. Soc. London* 10: 155 (1810)

T: in Novae Hollandiae, orâ Australi, Lewin's Land [W.A.], *R.Brown s.n.*; holo: BM.

Low shrub to 40 cm tall. Leaves erect; petiole 12–70 mm long, glabrous to ±hirsute; lamina 2–36 cm long, 2–6 mm wide, ±circinnate, white-tomentose, ±glabrescent. Inflorescence a dense, paniculate head, 15–35 mm long; peduncle 4–5 mm long, densely white-tomentose; bracteoles 8–11 mm long, 3–5 mm wide, reddish brown, glabrous; margins ciliate. Perianth red to pale yellow, white-tomentose or sericeous; tube 5–7 mm long, glabrous, sometimes pilose; upper lip linear, 10–12 mm long; lower lip united for c. 2.5 mm; lobes linear, c. 8 mm long, c. 0.75 mm wide, ciliate; apex twisted. Nut 2.5–3 mm long, c. 3 mm wide, fawn-

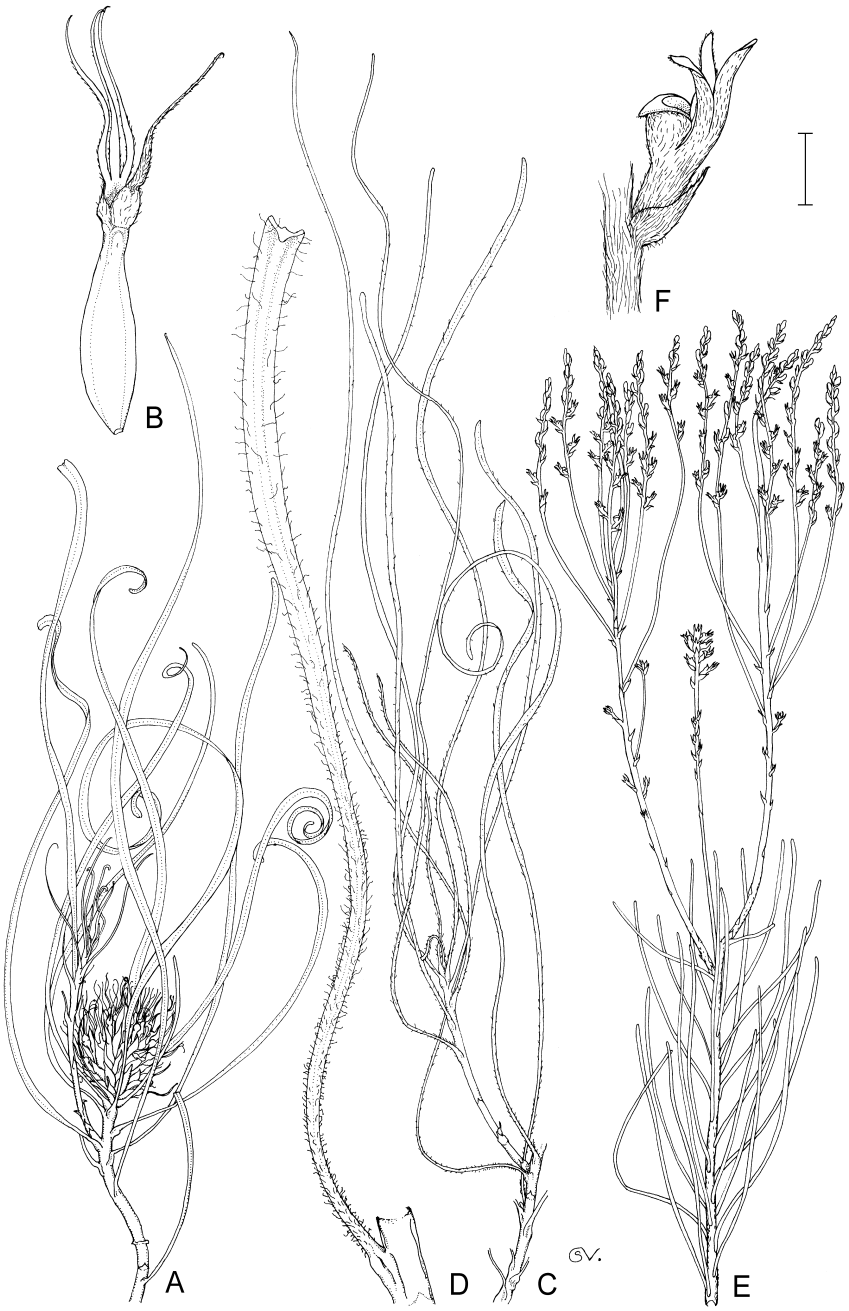



**Figure 106**. *Conospermum*. **A–B**, *C. capitatum* subsp. *glabratum*. **A**, flowering stem; **B**, flower, extended tips broken off (**A–B**, R.Royce 1411, PERTH). **C–D**, *C. capitatum* subsp. *velutinum*. **C**, vegetative stem; **D**, leaf (**C–D**, E.Bennett 5265, PERTH). **E–F**, *C. elongatum*. **E**, flowering stem; **F**, flower and bracteole on spike (**E–F**, A.Beauglehole 71150, H.Beauglehole, G. & K.Beaton, MEL). Scale bar: **A**, **C**, **E** = 2 cm; **B**, **F** = 2 mm; **D** = 4 mm. Drawn by C.Vasiliu.

tomentose; circumference hairs 4–5 mm long, pale golden to rusty; apex with tufts of reddish brown to golden hairs, 4–5 mm long, in a circle c. 0.5 mm from margin.

Widespread from south of Perth to east of Albany, W.A. Three subspecies are recognised.

**1** Leaves puberulous to glabrous; perianth tomentose

**2** Leaves less than 2 mm wide, typically puberulous — **5a.** subsp. **capitatum**

**2:** Leaves more than 2 mm wide, typically glabrous — **5b.** subsp. **glabratum**

**1:** Leaves velutinous; perianth sericeous — **5c.** subsp. **velutinum**

### 5a. Conospermum capitatum R.Br. subsp. capitatum

Leaves less than 2 mm wide, typically puberulous. Peduncle distinct, to 7 cm long. Perianth tomentose.

Occurs in the south-western coastal regions of W.A. Flowers Oct.–Nov. Map 232.

W.A.: south-west coast, 1828–1829, *W.Baxter* (PERTH); Tennessee Railway Station, near Wilsons Inlet, *S.W.Jackson* (PERTH); near Albany, *L.Preiss 759* (MEL); Windy Hill, Albany, *E.M.Bennett 5310* (PERTH).

### 5b. Conospermum capitatum subsp. glabratum E.M.Benn., *Fl. Australia* 16: 483 (1995)

T: Cowaramup, W.A., 9 Nov. 1946, *R.D.Royce 1411*; holo: PERTH.

Leaves more than 2 mm wide, typically glabrous. Peduncle 4–5 mm long. Perianth tomentose. Fig. 106A–B.

Widespread between Perth and Nannup, W.A. Flowers Oct.–Dec. Map 233.

W.A.: near Blackwood Forestry Rd, 11 miles [17.5 km] S of Nannup, *V.Mann & A.S.George 70* (NSW, PERTH); Molloy Is., *E.Wittwer 2370* (KPBG); 80 km S of Perth on Albany Hwy, *E.M.Bennett 5288* (KPBG); 6 miles [9.5 km] SW of Donnybrook, *A.S.George 7717* (PERTH); Gidgeganup townsite, *A.Swift* (PERTH).

### 5c. Conospermum capitatum subsp. velutinum E.M.Benn., *Fl. Australia* 16: 484 (1995)

T: 1 km E of junction of Mercer Rd on Emu Point Rd, Albany, W.A., 14 Jan. 1986, *E.M.Bennett 5265*; holo: PERTH; iso: CANB, K, MEL.

Leaves white-velutinous between raised, glabrous, marginal veins. Peduncle 4–5 mm long. Perianth sericeous. Fig. 106C–D.

Common in the Albany area, north to Mt Barker and in the Porongurup Range, W.A. Flowers Aug. and Sept. Map 234.

W.A.: E end of Porongurup Ra., *K.Newbey 3415* (NSW, PERTH); 457 mile peg N of Mt Barker, *F.Lullfitz 5841* (PERTH); Stirling District, 3 km ESE of Porongurup, *B.Barnsley 685* (CBG, NSW); Mt Barker to Porongurup, *F.Lullfitz 5841* (KPBG).

### 6. Conospermum petiolare R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 11 (1830)

T: ora occid-merid., King George Sound [W.A.], 1819, *A.Cunningham*; *n.v.*; locality unknown [W.A.], 1829, *W.Baxter*; syn: BM, NSW.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* 1: 139 (1954).

Caespitose subshrub or shrub to 1 m tall. Leaves ascending, dense; petiole 2.5–7 cm long, white- to grey-tomentose; lamina narrowly oblong, 8–32 cm long, 2.5–15 mm wide, circinnate, acute, glabrous or with ±scattered hairs; midvein and 2 submarginal and cross veins raised. Inflorescence a dense, terminal panicle; peduncle 7–10 mm long, white-silky; bracteoles broadly ovate, 6–10 mm long, 3–5.5 mm wide, acute, white-tomentose, ciliate. Perianth cream, orange-yellow or pink, velutinous; tube 5–8 mm long, ±glabrous at base; upper lip linear, 11–22 mm long, 0.25–0.5 mm wide, ciliate, acute; lower lip united for 1.5–2 mm; lobes narrowly linear, 10–22 mm long, 0.25–0.5 mm wide, acute. Nut c. 2.5 mm

long, c. 3 mm wide, buff to golden, tomentose; circumference hairs 4–4.5 mm long, golden to rust-coloured; central tuft c. 4 mm long, golden to red . Figs 61, 104H–J.

Common between the Stirling Range and the Fitzgerald River Natl Park, W.A. Flowers Oct.–Jan. Map 235.

W.A.: Albany District Reserve 18739, *J.S.Beard 7717* (NSW); Mt Manypeaks, *R.Melville 4442 & R.D.Royce* (NSW); Thumb Peak Ra., *A.S.George 7174* (KPBG, PERTH); E of Narrikup, *A.S.George 11770* (PERTH); Mt Melville, Oct. 1887, *F.Mueller* (MEL).

## Subg. 3. Conospermum

**Conospermum** subg. **Conospermum**.

*Conospermum* sect. *Euconospermum* Endl., *Gen. Pl.* 1: 339 (1837), *nom. inval.* T: *C. longifolium* Sm.

Perianth distinctly 2-lipped; adaxial lobe broad and concave over anthers, with upper part erect or recurved; 3 abaxial lobes united at base to form second lip. Nut conical, velutinous; circumference hairs shorter than or equal to height of nut.

A subgenus of 47 species.

## Sect. 1. Paniculata

**Conospermum** sect. **Paniculata** (Meisn.) E.M.Benn., *Fl. Australia* 16: 482 (1995).

*Conospermum* subsect. *Paniculata* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 322 (1856). T: *C. ephedroides* Kippist ex Meisn.; lecto, *fide* E.M.Bennett, *Fl. Australia* 16: 482 (1995).

Undershrubs with stems leafy at base only. Inflorescence paniculate. Flowers glabrous to sericeous.

A section of 8 species, 7 endemic in W.A. and 1 endemic in a few hills in the Grampians, Vic.

### 7. Conospermum elongatum E.M.Benn., *Fl. Australia* 16: 484 (1995)

T: E side of Mt Abrupt, Grampians, Vic., 3 Oct. 1982, *A.C.Beauglehole 71150, H.M.Beauglehole, G.W. & K.C.Beaton*; holo: MEL.

Multistemmed shrub to 65 cm tall. Leaves linear, 4.2–9.5 cm long, 1–1.7 mm wide, ascending, dense, acute; midvein depressed on both surfaces. Inflorescence a panicle of interrupted spikes exceeding upper leaves; peduncle 4–6 cm long, tomentose; bracteoles ovate-lanceolate, 1.5–2 mm long, 1–1.5 mm wide, acute, sericeous. Perianth cream, streaked with blue, velutinous; tube 2–3 mm long; upper lip ovate, 2.7–3.5 mm long, 1.5–2 mm wide; lower lip united for 1.5–2 mm; lobes narrowly oblong, 1.5–2 mm long, 0.5–0.9 mm wide, acute, recurved. Nut not seen. Fig. 106E–F.

Endemic on Mt William and Mt Abrupt in the Grampians, Vic. Flowers Oct. Map 236.

Vic.: Mt William, 1893, *G.Miller* (MEL).

Similar to *C. mitchellii* but differs in the shorter height of the plant and the elongated, interrupted spicate panicle.

### 8. Conospermum leianthum (Benth.) Diels, *Bot. Jahrb. Syst.* 35: 141 (1904)

*Conospermum polycephalum* var. *leianthum* Benth., *Fl. Austral.* 5: 368 (1870). T: Stokes Inlet [W.A.], *G.Maxwell*; *n.v.*; Esperance Bay [W.A.], *G.Maxwell*; syn: MEL.

Shrub to 1.1 m tall. Leaves filiform, 1–17 cm long, 0.5–1.3 mm wide, sigmoid or falcate, ascending; apex acute. Inflorescence a few-branched axillary panicle; branches terminating in dense heads, the longer exceeding leaves. Peduncle 0.6–16 cm long; bracteoles reniform, 1.5–3 mm long, 1.5–2.5 mm wide, puberulous. Perianth white, ±purple at base, glabrous;

tube 2–4 mm long, 4-angled, ±puberulous; upper lip deltoid, (1.5–) 2–3 mm long, (1–) 1.2–2 mm wide; apex acute, uncinate, recurved; lower lip united for c. 0.75 mm; lobes 1.5–2.5 mm long, 0.5–1 mm wide, acute. Nut 1.5–2 mm long, c. 2 mm wide, golden, tomentose; circumference hairs 1.5–2 mm long, golden, rust-coloured or white; central tuft of hairs 1.25–2 mm long, white, golden or reddish brown.

Common along the south coast of W.A. from Ravensthorpe east to Mt Ragged. There are 2 subspecies.

Cauline leaves more than 10 cm long; inflorescence open **8a.** subsp. **leianthum**

Cauline leaves less than 10 cm long, usually less than 7 cm long; inflorescence compact **8b.** subsp. **orientale**

### 8a. Conospermum leianthum (Benth.) Diels subsp. leianthum

*Conospermum toddii* var. *gwynii* F.Muell. & Tate, *Trans. & Proc. Roy. Soc. S. Australia* 16: 360 (1896). T: about 85 miles [c. 137 km] ENE from Esperance Bay [W.A.], *P.A.Gwynne*; holo: MEL.

Cauline leaves 10–17 cm long. Inflorescence open, greatly exceeding leaves. Perianth white or cream.

Occurs between Forrestania and east of Esperance, W.A. Flowers Oct. and Nov. Map 237.

W.A.: Ravensthorpe–Hopetoun road, *A.R.Fairall 2354* (PERTH); Scaddan, *R.J.Cranfield 1058* (MEL, PERTH); c. 45 km N of the coast at Stokes Inlet, *A.E.Orchard 1539* (AD, PERTH); Fence Rd, Starvation Bay, *H.Demarz 11706* (KPBG); Cowaramup Hill, c. 30 km NE of Esperance, *P.S.Short 2330 & L.Haegi* (MEL).

Specimens with longer panicles occur at the north of the species range at Forrestania, while those with finer leaves occur on the granite outcrops east of Esperance.

### 8b. Conospermum leianthum subsp. orientale E.M.Benn., *Fl. Australia* 16: 485 (1995)

T: 7 km W of Balladonia road junction with Esperance–Israelite Bay road, W.A., 10 Sept. 1985, *E.M.Bennett 5218*; holo: PERTH; iso: CANB, MEL.

Cauline leaves 4–7 (–10) cm long. Inflorescence compact, scarcely exceeding leaves. Perianth white with deep pink throat.

Occurs from c. 10 km east of Esperance to Israelite Bay, W.A. Flowers Sept.–Dec. Map 238.

W.A.: Point Malcolm, *C.A.Gardner 2889* (PERTH); c. 8 km W of Israelite Bay, *N.N.Donner 2826* (PERTH); Mt Ragged, *T.E.H.Aplin 2587* (PERTH); 5.3 km W of Mt Ragged–Point Malcolm junction, *E.M.Bennett 5217* (KPBG).

### 9. Conospermum toddii F.Muell., *Fragm.* 10: 20 (1876)

T: Queen Victoria Springs [W.A.], *J.Young*; holo: MEL.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* 1: 236 (1988).

Spreading shrub to 2 m tall. Leaves filiform, 12–25 cm long, 0.75–1 mm wide, sigmoid, glabrous, with 2 thickened, lateral veins. Inflorescence a sparingly branched panicle in upper axils, shorter than leaves; peduncle 1–4 cm long; bracteoles reniform to broadly ovate, 2–3 mm long, c. 1.5 mm wide, white to pale green, velutinous. Perianth white, with scattered hairs; tube 3–4 mm long; upper lip broadly triangular, 1–2 mm long, 1.5–1.75 mm wide, acute with a recurved apex; lower lip united for 0.4–0.5 mm; lobes narrowly oblong, acute, to c. 2.5 mm long, 0.2–0.4 mm wide. Nut c. 2 mm long, 1.5 mm wide, white-hirsute; apex brown, hairy; central tuft c. 1.5 mm long, golden.

A gazetted rare species found near Queen Victoria Springs, W.A. Map 239.

W.A.: Victoria Desert, Camp 54, *R.Helms* (NSW); Cundeelee, *P.Boswell C17* (PERTH); Queen Victoria Springs, Aug. 1975, *B.M.J.Hessey* (PERTH); 50 km NNE of Streich Mound, *D.J.Pearson 1094* (PERTH).

**10. Conospermum eatoniae** E.Pritz., *Bot. Jahrb. Syst.* 35: 141 (1904)

T: near Tammin, Avon District [W.A.], *E.Pritzel 757*; syn: *n.v.*; Youndegin [W.A.], 1880–85, *A.Eaton*; syn: *n.v.*

Illustrations: F.L.E.Diels & E.Pritzel, *op cit.* 142; W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* 1: 141 (1954); part 1, 2nd edn, 237 (1988).

Intricately branched shrub to c. 75 cm tall, spreading to 1 m. Leaves basal, obovate-oblong, present only on young plants. Inflorescence paniculate; secondary branching dichotomous, terminating in a head of 2–10 flowers; bracteoles orbicular, 1.8–2.8 mm long, 2.5–3.8 mm wide, pale green. Perianth blue, glabrous; tube 1.5–4 mm long; upper lip ovate, 3.5–5 mm long, 1–1.7 mm wide, with a recurved, acute apex; lower lip united for 1.3–2.5 mm; lobes narrowly oblong, 1.5–2 mm long, 0.5–0.7 mm wide, apex acute, recurved. Nut c. 2 mm long, c. 1.8 mm wide, orange-velutinous; circumference hairs c. 1 mm long, orange. Fig. 104K–M.

Occurs from Coorow south to Goomalling and east to Tammin, W.A. Flowers Aug.–Oct. Map 240.

W.A.: Quairading, *W.E.Blackall 3259* (PERTH); Coorow–Green Head road, 30 km E of Brand Hwy, *J.Taylor, M.D.Crisp & R.Jackson 964* (PERTH); 5 miles [c. 8 km] E of Goomalling, *R.D.Royce 7500* (PERTH); sources of Swan R., 1888, *M.Eaton* (MEL).

Variation in the division of the panicle is apparently associated with age. Thus, whereas panicles of older plants are richly branched, branching is less frequent in younger individuals. Branching is also less frequent in plants at the northern limit of the range; further collecting may lead to the recognition of a distinct subspecies.

Agriculture has led to a reduction in the abundance of *C. eatoniae.*

It is a particularly spectacular species with vivid blue flowers and with horticultural potential as a cut flower.

**11. Conospermum ephedroides** Kippist ex Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 70 (1855)

T: near Yenert, W.A., 1842, *J.Gilbert 71*; holo: K.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 238 (1988).

Tufted, multistemmed shrub to 1 m tall. Leaves few, basal, terete, 4–18 cm long, 0.6–1 mm wide, incurved, acute, puberulous. Inflorescence of interrupted, sessile spikes along leafless branches; axis puberulous; bracteoles ovate, 2.5–4.5 mm long, 1.5–3 mm wide, bluish green; apex acute; sides and base velutinous. Perianth white, pale pink or blue, glabrous; tube 2.2–4.5 mm long, puberulous; upper lip ovate, 3–4.5 mm long, 1.2–2 mm wide, with an acute, recurved apex; lower lip united for 1–1.6 mm; lobes narrowly oblong, 2–3 mm long, 0.4–0.7 mm wide, with recurved, obtuse margins. Nut 1.5–2 mm long, 1.4–1.8 mm wide, reddish brown to orange, velutinous; circumference hairs 0.8–1.3 mm long, orange; central tuft c. 2 mm long, golden . Figs 63, 107A.

Occurs from Wongan Hills south-east to Newdegate, W.A. Flowers Aug.–Oct. Map 241.

W.A.: Wongan Hills, *M.Rogers* (PERTH); c. 15 km S of Kulin, *R.H.Kuchel 2031* (PERTH); near 197 mile peg, between Dumbleyung and L. Grace, *A.S.George 275* (PERTH); 16 miles [26 km] W of Newdegate, *F.Lullfitz L3690* (KPBG); Youndegin, 1894, *A.Eaton* (MEL).

**12. Conospermum polycephalum** Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 249 (1848)

T: Swan R. district [W.A.], *J.Drummond 2: 305*; iso: MEL.

Spindly or semiprostrate shrub to 1 m tall. Leaves dense at base of stem, filiform, 1.2–20 cm long, 0.5–1 mm wide, sigmoid to curved, acute. Inflorescence a panicle; peduncle 5–7 cm long; bracteoles ovate, 3–4 mm long, 2–4 mm wide, bluish green with an acuminate apex, tomentose at sides and base. Perianth white, pink or blue, glabrous to puberulous; tube 2.5–3.5 mm long; upper lip elliptic to obovate, 3–5 mm long, 1.5–3 mm wide, with an acute apex; lower lip united for 1.5–2.5 mm; lobes linear to elliptic, 2–4 mm long, 0.25–0.5 mm


**Figure 107**. *Conospermum*. **A**, *C. ephedroides*, flowering stem (E.Bennett 5201, KPBG, PERTH). **B–C**, *C. glumaceum*. **B**, inflorescence; **C**, flower with bracteole (**B–C**, E.Bennett 5231 KPBG, PERTH). **D–E**, *C. brownii*. **D**, flowering stem; **E**, lateral view of flower (**D–E**, E.Bennett 5309, PERTH). **F**, *C. huegelii*, flowering stem (H.Demarz 10726, PERTH). Scale bar: **A**, **D**, **F** = 3 cm; **B** = 1 cm; **C**, **E** = 6 mm. Drawn by C.Vasiliu.

wide; midvein prominent, with an acute apex. Nut 2–2.5 mm long, 2.5–2.75 mm wide, cream, rusty-tomentose; circumference hairs 0.75–1 mm long, white and rust-coloured; central tuft of c. 10 hairs, 0.75 mm long, golden.

Occurs from north of Perth to Wubin, W.A. Flowers July–Sept. Map 242.

W.A.: 7 km S of Wubin, *G.J.Keighery 5150* (PERTH); near Bullsbrook, on Chittering Rd, *C.A.Gardner* (PERTH); Mogumber, *W.E.Blackall* (PERTH); 65 miles [105 km] N of Perth, on Geraldton road, *S.Paust 1103* (NSW, PERTH); 25 km S of New Norcia, *E.M.Bennett* (KPBG).

## 13. Conospermum glumaceum Lindl., *Sketch Veg. Swan R.* xxx (1839)

T: Swan R. district [W.A.], *D.Toward*; syn: CGE (photo seen); Swan R. district [W.A.], 1839, *J.Drummond s.n.*; syn: CGE (photo seen).

*Conospermum lupulinum* Endl. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 249 (1848). T: mountain summit, near waterfall, at head of Swan R., W.A., 16 Jan. 1840, *L.Preiss 1583*; holo: MEL.

Illustrations: F.L.E.Diels & E.Pritzel, *Bot. Jahrb. Syst.* 35: 142 (1904); W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* 1: 140 (1954); part 1, 2nd edn, 235 (1988).

Erect shrub to 1 m tall. Leaves linear, 1.5–7.5 cm long, 1–5 mm wide, ±clustered, glabrous to ±hirsute; apex mucronate. Inflorescence a panicle in upper axils, terminating in dense, head-like spikes; peduncle 1.5–4 cm long; bracteoles deltoid to lanceolate, 4–16 mm long, 1.2–4.5 mm wide, 3–11-nerved, yellow, becoming brown with age. Perianth cream, glabrous; tube 0.75–1.7 mm long; upper lip ovate, 0.8–1.3 mm long, 0.75–1.2 mm wide, with an acute, recurved apex; lower lip united for 0.5–1.3 mm; lobes oblong, 0.6–1 mm long, 0.3–0.6 mm wide, with an acute, incurved apex. Nut 2.7–3 mm long, 2–2.4 mm wide, white- to golden-tomentose; circumference hairs c. 0.5 mm long, cream; central tuft lacking. Fig. 107B–C.

Occurs between Eneabba and Red Hill, W.A. Flowers Sept.–Nov. Map 243.

W.A.: 70 km S of Moora on Great Northern Hwy, *D.J.E.Whibley 4994* (PERTH); Moore R., *E.Pritzel* (NSW); Mogumber, *A.Morrison* (PERTH); 46 km from eastern (Gunyidi) end of Marchagee Track, *R.J.Hnatiuk 780404* (PERTH); Three Springs Rd, 10 miles [16 km] NE of Eneabba Depot, *R.Filson 8504* (MEL).

This is the only species in which the bracteoles exceed the flowers. In many plants the inflorescences droop; only occasionally are the heads erect.

## 14. Conospermum caeruleum R.Br., *Trans. Linn. Soc. London* 10: 154 (1810)

T: Nova Hollandia, orâ australi, Lewin's Land [W.A.], *W.Baxter*; iso: MEL, NSW.

Prostrate to straggly shrub to c. 50 cm tall. Leaves clustered at base of stem and scattered above; petiole 5 mm to more than 60 mm long; lamina filiform to oblanceolate or ovate, 1.4–14.8 cm long, 2–19 mm wide, glabrous or puberulous; veins prominent; apex mucronate. Inflorescence paniculate, with dense, terminal heads, to 18-flowered; peduncle 1–18 cm long, glabrous or puberulous; bracteoles 2.75–5 mm long, 1.5–3 mm wide, blue, variably hairy, with a cuspidate apex. Perianth blue to pink; tube 1.2–3.1 mm long, glabrous to sparsely velutinous; upper lip ovate, 4–5.2 mm long, 1.5–2 mm wide, glabrous, with an acute, recurved apex; lower lip united for 1.75–3 mm; lobes narrowly oblong, 1.5–2.5 mm long, 0.4–0.5 mm wide, acute. Nut 2–2.3 mm long, 2–2.5 mm wide, tan, cream-velutinous; circumference hairs 0.75–1 mm long, cream to orange; central tuft of hairs 0.75–1.5 mm long, cream.

Widespread from Busselton to east of Albany, W.A.; often grows in soil subject to inundation. There are 6 subspecies.

**1** Basal leaves (including petiole) more than 7 cm long

- **2** Basal leaf petiole more than 6 cm long; lamina more than 9 cm long — **14a.** subsp. **caeruleum**
- **2:** Basal leaf petiole less than 5 cm long; lamina less than 3 cm long — **14b.** subsp. **oblanceolatum**

**1:** Basal leaves (including petiole) less than 7 cm long

- **3** Leaf margins undulate — **14c.** subsp. **contortum**
- **3:** Leaf margins entire, not undulate

**4** Inflorescence leaves filiform or linear to narrowly ovate

**5** Basal leaves linear; inflorescence leaves filiform to narrowly ovate **14e.** subsp. **debile**

**5:** Basal leaves spathulate; inflorescence leaves linear **14f.** subsp. **spathulatum**

**4:** Inflorescence leaves oblanceolate

**6** Basal leaves oblong-spathulate **14d.** subsp. **marginatum**

**6:** Basal leaves oblanceolate **14b.** subsp. **oblanceolatum**

### **14a. Conospermum caeruleum** R.Br. subsp. **caeruleum**

Basal leaves with petiole more than 6 cm long; lamina more than 9 cm long, to 1.8 cm wide. Bracteoles velutinous except at apex. Perianth tube sparsely hairy; indumentum most dense near lobe bases. Fig. 108A–D.

Common from Denmark to east of Albany, W.A. Flowers Mar., July–Oct. Map 244.

W.A.: near Mt Boyle, 9 miles [c. 14.5 km] NE of Albany, on Kalgan–Candyup road, *B.G.Briggs 586* (NSW); Ledge Beach Rd, *H.Demarz 7807* (PERTH); Marbellup Reserve, W of Albany, *J.W.Green 4872A* (PERTH).

A few pink-flowered plants have been recorded.

### **14b. Conospermum caeruleum** subsp. **oblanceolatum** E.M.Benn., *Fl. Australia* 16: 483 (1995)

T: S of Stirlings [Stirling Ra.], Borden–Albany area, W.A., *E.Wittwer 231*; holo: PERTH.

Basal leaves oblanceolate, with petioles less than 5 cm long; lamina to 3 cm long, to 1.7 cm wide; upper cauline leaves with thickened margins. Inflorescence leaves oblanceolate; bracteoles tomentose at base and lower sides. Perianth tube sparsely tomentose. Fig. 108F.

Occurs between Mt Barker and the Stirling Range, W.A. Flowers June–Nov. Map 245.

W.A.: 9 miles [14.5 km] S of Mt Barker township on Albany road, *C.Melville 4386 & R.D.Royce* (MEL); S of Chillinup, *C.A.Gardner* (PERTH); Mt Hassell, *H.Demarz 523A* (PERTH); 2 miles [3.2 km] N of Bremer Bay–Jerramungup, *H.Demarz 2554* (PERTH); between Stirling Ra. and Porongurup Ra., *T.E.H.Aplin 2104* (PERTH).

### **14c. Conospermum caeruleum** subsp. **contortum** E.M.Benn., *Fl. Australia* 16: 483 (1995)

T: W of Nannup, 29 Oct. 1948, *R.D.Royce 3000*; holo: PERTH.

Leaves 2–7 cm long, 2–5 mm wide; margin undulate with white hairs along midvein. Bracteoles tawny-velutinous. Perianth tube velutinous; indumentum most dense at lobe bases. Fig. 108H.

Only known from the type collection. Map 246.

The leaves of this subspecies are especially distinctive.

### **14d. Conospermum caeruleum** subsp. **marginatum** (Meisn.) E.M.Benn., *Fl. Australia* 16: 483 (1995)

*Conospermum marginatum* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 248 (1848); *C. caeruleum* var. *marginatum* (Meisn.) Benth., *Fl. Austral.* 5: 369 (1870). T: Swan R. [W.A.], *J.Drummond 2: 306*; iso: K, MEL.

Basal leaves oblong-spathulate, dense, less than 7 cm long overall; inflorescence leaves oblanceolate. Bracteoles white-hairy at base; margins ciliate. Perianth tube pubescent. Fig. 108 I.

Occurs from the vicinity of Busselton to Scott River, W.A. Flowers July–Sept. Map 247.

W.A.: Ambergate, S of Busselton, R.D.Royce 2883 (PERTH); Ludlow, 2 Aug. 1922, C.A.Gardner (PERTH); Ambergate, E.M.Scrymgeour 1275 (PERTH); locality unknown, J.Drummond 7 MEL).


**Figure 108**. *Conospermum*. **A–D**, *C. caeruleum* subsp. *caeruleum*. **A**, flowering stem (A.Beauglehole 12753, PERTH); **B**, lateral view of flower; **C**, view of abaxial portion of dissected flower; **D**, view of adaxial portion of dissected flower (**B–D**, E.Bennett 5181, PERTH, KPBG). **E**, *C. caeruleum* subsp. *debile*, flowering stem (G.McCutchen 438, PERTH). **F**, *C. caeruleum* subsp. *oblanceolatum*, flowering stem (E.Wittwer 231, PERTH). **G**, *C. caeruleum* subsp. *spathulatum*, flowering stem (A.George 15254, PERTH). **H**, *C. caeruleum* subsp. *contortum*, flowering stem (R.Royce 3000, PERTH). **I**, *C. caeruleum* subsp. *marginatum*, flowering stem (J.Drummond 2: 306, MEL). Scale bar: **A**, **E–I** = 4 cm; **B–D** = 8 mm. Drawn by C.Vasiliu.

**14e. Conospermum caeruleum** subsp. **debile** (Kippist ex Meisn.) E.M.Benn., *Fl. Australia* 16: 483 (1995)

*Conospermum debile* Kippist ex Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 70 (1855). T: locality unknown [W.A.], *J.Gilbert 164*; holo: K (photo seen).

Basal leaves less than 7 cm long, linear. Cauline lamina ±falcate, to 5 cm long, to 6 mm wide, densely clustered towards base of plant, becoming narrowly ovate to filiform near and in the inflorescence. Bracteoles ±tomentose towards base. Perianth tube occasionally puberulous. Fig. 108E.

Occurs in swampy areas from Busselton to Scott River, W.A. Flowers June, Aug.–Nov. Map 248.

W.A.: Scott River Rd, *S.Paust 260* (PERTH); Tutunup, *G.S.McCutcheon 791* (PERTH); Pirup, Manjimup district, *G.Liddelow 482* (PERTH).

**14f. Conospermum caeruleum** subsp. **spathulatum** (Benth.) E.M.Benn., *Fl. Australia* 16: 483 (1995)

*Conospermum caeruleum* var. *spathulatum* Benth., *Fl. Austral.* 5: 369 (1870). T: between Perth and King George Sound [W.A.], *W.H.Harvey*; holo: K.

Stems lax. Basal leaves oblong-spathulate, dense, ±falcate, less than 7 cm long. Inflorescence leaves linear. Bracteoles and perianth puberulous or nearly glabrous. Fig. 108G.

Occurs in lateritic and damp soils from Donnybrook south to Albany, W.A. Flowers Aug.–Oct. Map 249.

W.A.: near Kendenup, Kings George Sound road, *A.Oldfield* (MEL); 11 km S of Frankland, *A.S.George 15254* (PERTH); 24 km W of Woodanilling, *A.S.George 1933* (PERTH); 144 mile peg, Albany Hwy, *F.Lullfitz 1120* (KPBG, PERTH); Capel–Donnybrook road, *R.D.Royce 3126* (PERTH).

## Sect. 2. Scaposa

**Conospermum** sect. **Scaposa** (Meisn.) E.M.Benn., *Fl. Australia* 16: 482 (1995).

*Conospermum* subsect. *Scaposa* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 322 (1856). T: *C. scaposum* Benth.

Undershrubs with stems leafy at the base only. Inflorescence a dense spike or corymb. Flowers glabrous to sericeous.

A section of 6 species; 5 restricted to south-western W.A. and 1 endemic in N.S.W.

**15. Conospermum huegelii** R.Br. ex Endl., *Stirp. Herb. Hügel.* 19 (1838)

T: near the Swan R. [W.A.], *K.A.Huegel*; holo: W *n.v.*

*Conospermum intricatum* Lindl. ex Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 323 (1856), *nom. inval.*

Low, clumped shrub to 1 m tall when in flower, c. 40 cm tall when vegetative. Leaves filiform to narrowly terete, 3–20 cm long, 0.3–1.25 mm wide, ascending, incurved to spirally coiled. Inflorescence a ±terminal spike; peduncle 10–84 cm long, glabrous to puberulous; bracteoles ovate, 1.5–3.5 (–5.2) mm long, 1.5–2 (–4) mm wide, blue, glabrous, with cuspidate apices and ciliate margins. Perianth pale blue to cream, glabrous; tube 1.5–4.5 mm long; upper lip ovate, 2.75–4 mm long, 1–2.4 mm wide, acute, recurved; lower lip united for 2–4.2 mm; lobes narrowly oblong, 0.6–1.5 mm long, 0.4–0.5 mm wide with an acute apex. Nut 2–2.9 mm long, 2–2.5 mm wide, golden-brown- to orange-tomentose; circumference hairs 0.5–1.5 mm long, cream to reddish orange; apex of nut patterned black and white; central tuft 1–1.5 mm long, orange to cream. Fig. 107F.

Occurs in the sandy and gravelly-loamy soils of the Darling Scarp and foothills, W.A.; often found in winter-wet depressions. Flowers July–Oct. Map 250.

W.A.: 38 mile peg, Albany Hwy, *A.L.Fairall 716* (KPBG, NSW, PERTH); Hardy Rd, Forrestfield, *R.J.Cranfield 131/77* (PERTH); Barrington Quarry, *H.Demarz 10726* (KPBG, PERTH); Lesmurdie Falls, *J.Sonster 554* (NSW); Cannington, *O.H.Sargent 1275* (MEL).

This plant dies down during summer.

### 16. **Conospermum densiflorum** Lindl., *Sketch Veg. Swan R.* xxxii (1839)

T: York [W.A.], Dec. 1836, *J.S.Roe*; syn: CGE (photo seen); Swan R district [W.A.], 1839, *J.Drummond s.n.*; syn: CGE (photo seen).

Erect, much-branched shrub to 1 m tall. Basal leaves filiform, 1.2–6.5 cm long, 0.25–0.6 mm wide, ascending, curved, sparsely velutinous; apex acute. Inflorescence a spike or corymb of spikes; peduncle 17–64 cm long, sparsely velutinous; bracteoles lanceolate, 5–12 mm long, 1–3 mm wide, blue, glabrous or with scattered, golden hairs; midvein darker, ±raised. Perianth cream or blue, velutinous; tube 3.5–6 mm long; upper lip ovate, 2–3.5 mm long, 2–2.5 mm wide, with an acute, recurved apex; lower lip united for 1–1.5 mm; lobes narrowly oblong, 2–4 mm long, 0.5–0.75 mm wide; 2 outer lobes twisted. Nut 2–2.6 mm long, 1.5–2 mm wide, orange, velutinous; circumference hairs 0.5–1 mm long, rusty orange; central tuft lacking, but with scattered, orange hairs 1–1.25 mm long.

Occurs from just north of Perth to Jurien Bay, W.A. Two subspecies are recognised.

Inflorescence a corymb of spikes **16a.** subsp. **densiflorum**

Inflorescence a spike **16b.** subsp. **unicephalatum**

### 16a. **Conospermum densiflorum** Lindl. subsp. **densiflorum**

Inflorescence a corymb; each branch ending in a dense spike. Fig. 109A.

Widespread from north of Perth to Jurien Bay, W.A. Flowers Oct.–Jan. Map 251.

W.A.: 7 miles [11 km] E of Wannamal, *V.Mann & A.S.George 204* (PERTH); Wooroloo, *M.Koch 1520* (PERTH); 35 miles [57 km] E of Jurien Bay, on road to Marchagee, *J.S.Beard 7869* (PERTH); ¼ mile [c. 0.4 km] E of 40 mile peg, Perth–Toodyay road, *R.A.Saffrey 150* (PERTH); Julimar State Forest, *M.G.Corrick 8706* (MEL).

### 16b. **Conospermum densiflorum** subsp. **unicephalatum** E.M.Benn., *Fl. Australia* 16: 484 (1995)

T: 4 km S of Gillingarra, W.A., 17 Sept. 1983, *R.J.Cranfield 4101*; holo: PERTH.

Inflorescence a terminal spike. Fig. 109B.

Occurs between Gingin and Moora, W.A. Flowers Sept.–Nov. Map 252.

W.A.: near Gingin, between Midland and Moora, *W.E.Blackall 2947* (PERTH); 37 km S of Moora, on Mogumber road, *G.J.Keighery 2263* (PERTH); 4.5 miles [c. 7 km] S of Gillingarra, *H.Demarz 11409* (KPBG); Great Northern Hwy, 70 km S of Moora, *D.J.E.Whibley 4997* (AD, PERTH).

### 17. **Conospermum brownii** Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 248 (1848)

T: Swan R. district [W.A.], *J.Drummond 2: 304*; holo: K (photo); iso: MEL, PERTH.

Illustrations: W.R.Elliot & D.L.Jones, *Encycl. Austral. Pl.* 3: 66 (1984); W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 238 (1988).

Moderately open shrub to 1 m tall. Leaves sessile, oblanceolate, 2–7 cm long, 4–15 mm wide, ±glaucous, glabrous. Inflorescence a terminal, spicate corymb; peduncle 16–39 cm long; bracteoles ovate, 1.5–3 mm long, 1–2 mm wide, blue or mauve, conspicuous in bud with an acute apex. Perianth white to cream, glabrous; tube 3–7 mm long; upper lip ovate, 1.4–1.8 mm long, 1.5–2 mm wide with an obtuse, recurved apex; lower lip united for 1–1.8 mm; lobes deltoid, 1–1.5 mm long, 0.5–0.7 mm wide with an acute apex. Nut 2.3–2.6 mm long, 2.3–2.5 mm wide, golden brown-hirsute; circumference hairs 1–1.5 mm long, golden; central tuft 1.5–1.8 mm long, golden to orange . Figs 64, 107D–E.


**Figure 109**. *Conospermum*. **A**, *C. densiflorum* subsp. *densiflorum*, flowering stem (E.Bennett 5233, PERTH, KPBG). **B**, *C. densiflorum* subsp. *unicephalatum*, flowering stem (R.Cranfield 4101, PERTH). **C–E**, *C. scaposum*. **C**, flowering stem; **D**, part of inflorescence; **E**, flower bracteole (**C–E**, E.Bennett 5247, PERTH). Scale bar: **A–C** = 2 cm; **D** = 8 mm; **E** = 2 mm. Drawn by C.Vasiliu.

Widespread in the eastern part of south-western W.A., from Wongan Hills south to Lake Grace and east to Norseman. Flowers Aug.–Oct. Map 253.

W.A.: between No. 7 Pumping Station and Woolgangie, *G.E.Brockway 7* (PERTH); Bendering, *C.A.Gardner 1828* (PERTH); 26 miles [42 km] E of Newdegate, *M.E.Phillips* (NSW); North Bendering, *F.Lullfitz 1749* (KPBG); Yerbillon, *M.Koch 2889* (MEL).

### 18. Conospermum scaposum Benth., *Fl. Austral.* 5: 369 (1870)

T: between Swan River and King George's Sound, W.A., *J.Drummond 41 & 43*; holo: K.

*Conospermum sericeum* C.A.Gardner, *J. & Proc. Roy. Soc. W. Australia* 47: 54 (1964). T: Irwin District, near Hill R., Badgingarra, W.A., *F.Lullfitz 2156*; holo: PERTH.

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 239 (1988).

Low shrub to 75 cm tall when in flower, c. 15 cm tall when vegetative. Leaves dense at base of scape; petiole terete, 2.8–8.8 cm long; lamina linear, 4–10 cm long, 2–5.5 mm wide, glabrous to velutinous; midvein and margins thickened. Inflorescence a few-branched panicle with flowers in dense, terminal spikes; peduncle 30–75 cm long, sparsely long-white-hairy; bracteoles lanceolate, 4.5–6 mm long, 1–2 mm wide, creamy brown, white-velutinous, ciliate. Perianth blue, long-silky-hairy; tube 2–6 mm long; upper lip 2–2.25 mm long, 1–1.5 mm wide with an acute, recurved apex; lower lip united for 1–1.5 mm; lobes 1.5–2 mm long, 0.25–0.5 mm wide, ciliate; apex acute, twisted. Nut 2.1–2.6 mm long, 1.6–2.2 mm wide, cream, rusty red-tomentose; circumference hairs 0.5–1 mm long, cream to reddish brown; central tuft lacking but with scattered, long hairs. Fig. 109C–E.

Recorded from a few scattered localities from Mogumber to Lancelin and Toolibin, W.A. Grows in soil subject to inundation. Flowers Aug., Jan.–Feb. Map 254.

W.A.: 3 miles [c. 5 km] W of Mogumber, *A.S.George 8638* (PERTH); 13 km W of 116 mile peg on Eneabba–Geraldton road, *H.Demarz 1179* (PERTH); Lancelin, *H.Demarz 2119* (KPBG); Toolibin, *E.M.Bennett* (KPBG).

### 19. Conospermum tenuifolium R.Br., *Trans. Linn. Soc. London* 10: 154 (1810)

T: in Novae Hollandiae orâ orientali, prope Port Jackson [N.S.W.], *R.Brown s.n.*; holo: BM *n.v.*

*Conospermum repens* Sieber ex Schult. & Schult.f., *Mant.* 3: 276 (1827), *nom. inval.*

Low shrub to 60 cm tall. Leaves mostly basal, linear to oblanceolate, 4–20 cm long, 0.5–4.2 mm wide, terete or slightly flattened; apex acute, spirally incurved. Inflorescence a terminal spike; peduncle 20–35 cm long, puberulous; bracteoles ovate, 1.5–2.9 mm long, 1.5–2.8 mm wide, blue, velutinous, ciliate, with an acute apex. Perianth pinkish white to mauve; tube 1.5–4 mm long, velutinous; upper lip ovate, 3–4 mm long, 1.5–1.8 mm wide, tomentose, with an acute, recurved apex; lower lip united for 2.6–3.5 mm; lobes oblong to broadly oblong, 0.5–1 mm long, 0.5–0.6 mm wide, puberulous, with an acute apex. Nut 2–2.2 mm long, 1.4–2 mm wide, white-velutinous; circumference hairs absent; style persistent in centre; central tuft absent. Fig. 111K.

Occurs in the central coast, south coast (near Nowra) and central tablelands of N.S.W. Map 255.

N.S.W.: Cliff Drive, Katoomba, *C.Burgess 036194* (MEL); near Bulli Pass, upper waters of Loddon R., 10 Nov. 1965, *E.Gordon* (NSW); Mangrove Mtn, 30 Aug. 1930, *R.A.Black* (MEL); L. Medlow, c. 2 miles [c. 3.2 km] SE of Blackheath, *E.F.Constable 6770* (NSW).

Specimens may vary in the width and curvature of their leaves.

### 20. Conospermum acerosum Lindl., *Sketch Veg. Swan R.* xxx (1839)

T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; holo: CGE (photo seen).

Illustration: W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 234 (1988).

Erect or straggly shrub to 1.5 m tall. Leaves acicular to filiform, to 10 cm long, 0.5–1 mm wide, ±terete, pungent-pointed. Inflorescence paniculate, condensed, spicate or capitate in upper axils, exceeding or shorter than leaves; bracteoles rotund, 2–4 mm long, 1–4 mm wide,

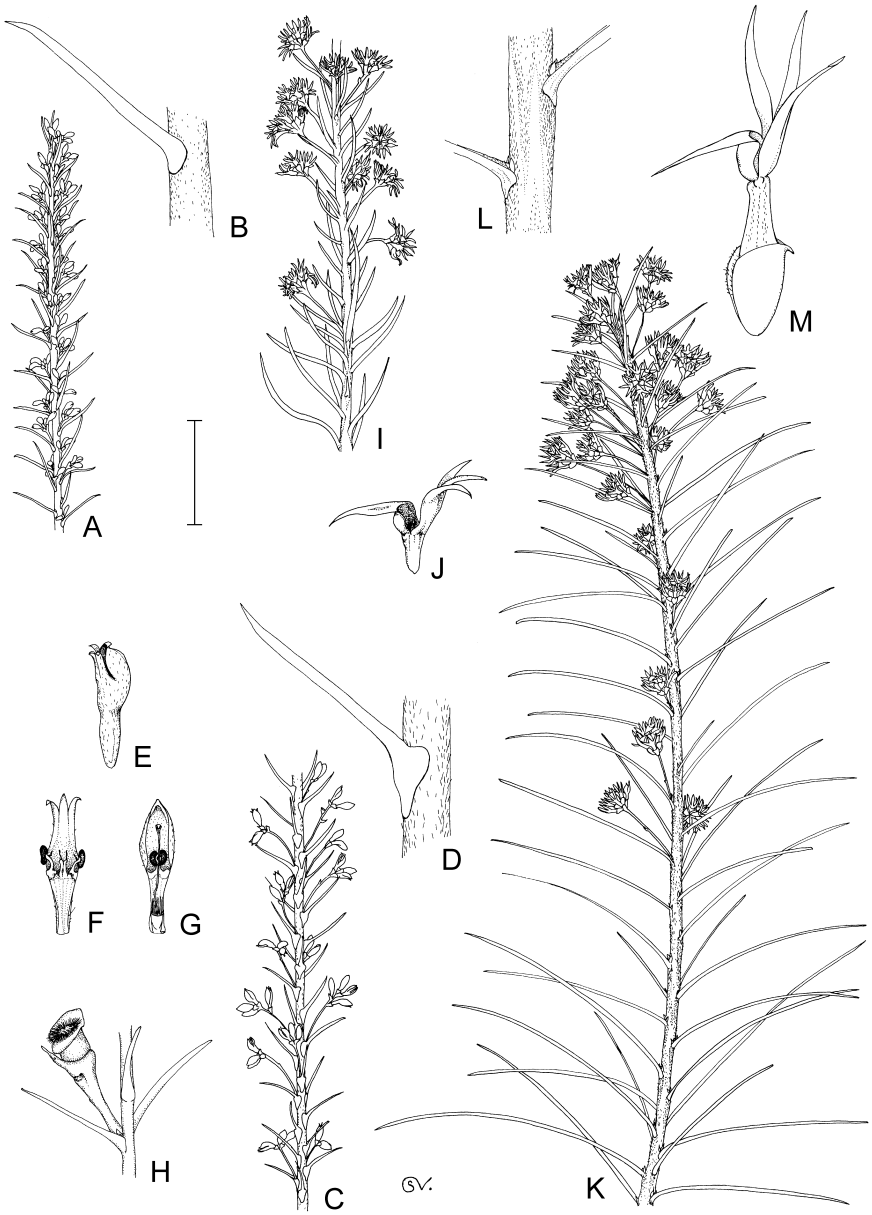



**Figure 110**. *Conospermum*. **A–B**, *C. amoenum* subsp. *cuneatum*. **A**, flowering stem; **B**, stem showing leaf base (**A–B**, E.Bennett 5307, PERTH). **C–H**, *C. amoenum* subsp. *amoenum*. **C**, flowering stem; **D**, stem showing leaf base (**C–D**, L.Preiss 745, MEL); **E**, lateral view of flower; **F**, view of abaxial portion of dissected flower; **G**, view of adaxial portion of dissected flower (**E–G**, E.Bennett 5003, KPBG, PERTH); **H**, nut (E.Bennett 5226, PERTH). **I–J**, *C. acerosum* subsp. *acerosum*. **I**, flowering stem; **J**, flower (**I–J**, E.Bennett 5074, KPBG, PERTH). **K–M**, *C. acerosum* subsp. *hirsutum*. **K**, flowering stem; **L**, stem showing leaf bases; **M**, flower with bracteole (**K–M**, Northampton, W.A., W.Campbell, PERTH). Scale bar: **A**, **C**, **I**, **K** = 3 cm; **B**, **D–G**, **J** = 6 mm; **H**, **L** = 1 cm; **M** = 3 mm. Drawn by C.Vasiliu.

dark brown to black, with a raised midvein and a black, cuspidate apex. Perianth white or pink, glabrous; tube 3.5–5 mm long with short, red hairs; upper lip acute to obtuse, 4.5–5.5 mm long, 1.5–2 mm wide; lower lip united for 1–1.5 mm; lobes 3–3.5 mm long, 0.75–1.25 mm wide, oblong, with an acute apex. Nut 2.5–3.5 mm long, c. 2.8 mm wide, rusty- or golden-velutinous; circumference hairs 2–3 mm long, reddish brown; central tuft, 1–2 mm long, rusty.

Widespread in sandy soil from Murchison River south to Cape Leeuwin, W.A.; there is also one doubtful collection from Norseman. Two subspecies are recognised.

| | |
|---|---|
| Leaves ascending; leaf bases glabrous to puberulous; stems glabrous or with scattered hairs | **20a.** subsp. **acerosum** |
| Leaves spreading or descending; leaf bases and stems densely hairy | **20b.** subsp. **hirsutum** |

### 20a. Conospermum acerosum Lindl. subsp. acerosum

Stems glabrous or with scattered hairs. Leaves curved, ascending; bases decurrent, glabrous or puberulous . Figs 65, 110 I–J.

Occurs from south of Northampton to near Perth, with a few, isolated populations near Busselton and Nannup, W.A. Flowers Aug.–Oct. Map 256.

W.A.: 2 miles [c. 3 km] from Gingin, towards Regans Ford, *M.E.Phillips* (NSW); Maida Vale Rd, Forrestfield, 1 Nov. 1986, *A. & J.Marshall* (KPBG); Haddric Rd, Wanneroo, *H.Demarz 3944* (KPBG); Nannup–Pemberton road, *E.Wittwer 2136* (KPBG); Cape Leeuwin, 1885, *McHard* (MEL).

Plants from the southern extension have many, short, red exudate hairs on the perianth tube and a glabrous stem. Those north of Perth have scattered hairs on the perianth tube and stem while the northernmost specimens are densely hairy. There is also considerable variation in leaf size with younger leaves being longer than mature ones.

### 20b. Conospermum acerosum subsp. hirsutum E.M.Benn., *Fl. Australia* 16: 482 (1995)

T: Northampton (Champion Bay), W.A., Sept. 1901, *W.D.Campbell*; holo: PERTH.

Stems densely tomentose. Leaves spreading or descending; leaf bases decurrent, tomentose. Fig. 110K–M.

Occurs from Northampton north to Kalbarri, W.A. Flowers Sept. and Oct. Map 257.

W.A.: 6 miles [10 km] inland from Kalbarri, *M.E.Phillips* (NSW); Red Bluff, Kalbarri, Aug.–Sept. 1973, *B.Bellairs* (PERTH); 4 km NNW of Yerina Spring, Hutt River Plains, Irwin district, *M.D.Crisp 6314*, *J.Taylor & R.Jackson* (PERTH); Kalbarri–Ajana road, 7 miles [11 km] by road ENE of Kalbarri, *R.V.Smith 66/361* (MEL, PERTH).

Flowers have very few or no red hairs on the perianth tube.

## Sect. 3. Axillaria

**Conospermum** sect. **Axillaria** (Meisn.) E.M.Benn., *Fl. Australia* 16: 481 (1995).

*Conospermum* subsect. *Axillaria* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 318 (1856). T: *C. amoenum* Meisn.; lecto, *fide* E.M.Bennett, *Fl. Australia* 16: 481 (1995).

Stems leafy to the inflorescence. Spikes simple, axillary. Flowers glabrous to sericeous.

A section of 3 species endemic in south-western W.A.

### 21. Conospermum amoenum Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 522 (1845)

T: Darling's Range, Perth, W.A., Sept. 1841, Herb. *L.Preiss 745*; lecto: MEL, *fide* E.M.Bennett, *Fl. Australia* 16: 482 (1995).

*Conospermum suaveolensis* D.A.Herb., *J. & Proc. Roy. Soc. W. Australia* 7: 69 (1921), as *suaveolente*. T: Kelmscott, W.A., 15 Aug. 1920, *D.A.Herbert*; holo: PERTH; iso: MEL.

Shrub to 1 m tall, spreading to 1.5 m. Leaves linear, 9–17 mm long, 0.5–1 mm wide, spreading or ascending, basally auriculate (especially subtending spikes) or not, glabrous or hairy, ciliate. Inflorescence a spike of 4–8 flowers, lengthening in fruit to exceed leaves, hirsute; bracteoles broadly ovate to orbicular, 2–3.5 mm long and wide, blue, ciliate. Perianth blue or white, puberulous or glabrous; tube 2–4 mm long; upper lip broadly ovate, 1.5–2.5 mm long, 2.75–3 mm wide; lower lip united for 0.75–1 mm; lobes oblong, 1–1.5 mm long, 0.5–0.75 mm wide, with a prominent midvein. Nut 1.75–2 mm long, 2–2.5 mm wide, rusty golden-hirsute; circumference hairs 1–1.5 mm long, rusty golden; central tuft of up to 5 hairs, 1.75–2 mm long.

Common in the Darling Scarp and Range from Waroona to York, W.A. Two subspecies are recognised.

Floral and cauline leaves auriculate **21a.** subsp. **amoenum**

Floral and cauline leaves slightly wider at base but not auriculate **21b.** subsp. **cuneatum**

### 21a. Conospermum amoenum Meisn. subsp. amoenum

All floral and most cauline leaves with basal auricles. Fig. 110C–H.

Common in the Darling Scarp, extending from Waroona to Dalwallinu, W.A. Flowers Aug.–Oct. Map 258.

W.A.: Roleystone, *A.S.George 877* (PERTH); near junction of Forty Hollow Rd and Tunnell Rd, Mt Saddleback, *S.Weston 1266* (PERTH); Armadale, *R.Helms* (NSW); Waroona, *F.Ross 1* (NSW); Churchmans Brook Rd, Kelmscott, *A.Travers 9* (PERTH).

### 21b. Conospermum amoenum subsp. cuneatum E.M.Benn., *Fl. Australia* 16: 483 (1995)

T: 41 km E of Midland, on Toodyay road, W.A., 23 Aug. 1987, *E.M.Bennett 5307*; holo: PERTH.

Cauline and floral leaves expanded at base, but without auricles. Fig. 110A–B.

Occurs between Dryandra and York, W.A. This subspecies is not as common as subsp. *amoenum*. Flowers July and Aug. Map 259.

W.A.: Weam Nature Reserve, 7 km E of Brookton, *J.M.Brown 098* (PERTH); Balladon Rd, York, 27 Aug. 1908, *O.H.Sargent* (PERTH); 7 km E of Brookton, *J.M.Brown 030* (PERTH); 63 km NE of Perth on Toodyay road, *E.M.Bennett 5256* (KPBG); Corakin Block, Dryandra Forest, 2 km SSE of Dryandra, *G.J.Keighery 9304* (PERTH).

### 22. Conospermum croniniae Diels, *Bot. Jahrb. Syst.* 35: 143 (1904)

T: hab. in regionibus interioribus loco non indicato flor. [W.A.], 1889, *A.Cronin*; syn: MEL; in distr. Avon pr. Mt. Moore flor. [W.A.], 1889, *S.King & C.Lefroy*; syn: MEL.

Illustrations: F.L.E.Diels & E.Pritzel, *op. cit.* 142; W.R.Elliott & D.L.Jones, *Encycl. Austral. Pl.* 3: 68 (1984), as *C. incurvum*; W.E.Blackall & B.J.Grieve, *How to Know W. Austral. Wildfl.* part 1, 2nd edn, 235 (1988).

Open shrub to 90 cm tall. Cauline leaves terete, 7–10 mm long, 0.3–0.5 mm wide, spreading; floral leaves deltoid, 4–9 mm long, 1–2 mm wide, glabrous. Inflorescence an axillary spike of up to 6 flowers; peduncle 2.5–9 mm long, tomentose; bracteoles obovate, 1.5–2.25 mm long, 2–3.2 mm wide, tomentose, with a cuspidate apex. Perianth pale blue or pink, silky to woolly; tube 3.5–4.5 mm long; upper lobe ovate, 1.25–2 mm long, 1.5–1.75 mm wide, with shorter hairs at apex, recurved; lower lip united for 0.5–0.75 mm; lobes narrowly oblong, 0.6–0.75 mm long, 0.3–0.5 mm wide, recurved. Nut c. 2 mm long, c. 2.25 mm wide, white-sericeous; circumference hairs 0.75–1.25 mm long, golden; central tuft 1.5–1.75 mm long, reddish gold. Fig. 111D–F.

Widespread throughout the wheatbelt from Pingelly south-east to Lake King and east to Kondinin, W.A. Flowers May, Sept.–Oct. Map 260.

W.A.: Newdegate, *A.S.George 332* (NSW, PERTH); 31.4 miles [50 km] E of Dumbleyung, *H.Demarz 1552* (KPBG, PERTH); c. 27 km N of Kondinin, *A.A.Munir 5257* (PERTH); Tutanning Reserve, *M.G.Corrick 8427* (MEL).

This species ranges in habit from an open to a dense shrub. There is considerable variation in the length of the peduncle, the number of flowers in each inflorescence and the hairiness of the stem. It resembles *C. amoenum* from which it differs in the leaf size and the absence of auricles as well as flower colour and pubescence and the number of flowers per spike.

B.L.Rye, *Fl. Perth Reg.* 1: 309–357 (1987), included *C. croniniae* in the synonymy of *C. amoenum*. However, the research undertaken for the current treatment has demonstrated that the two species are distinct in floral and vegetative characters and in distribution.

### 23. Conospermum coerulescens F.Muell., *Fragm.* 1: 157 (1859)

T: Salt River, near Cape Knob [W.A.], *G.Maxwell*; holo: MEL.

Erect shrub to 1 m tall. Leaves filiform to narrowly lanceolate, 4–25 mm long, 0.4–1.5 mm wide, ascending, ±spreading, glabrous, ±velutinous at base. Inflorescence an axillary spike of up to 10 flowers; peduncle 7–60 mm long, tomentose; bracteoles ovate to orbicular, 1.5–3 mm long, 1.5–3 mm wide, blue, tomentose, with a ciliate margin and an acute apex. Perianth grey-blue to deep blue, puberulous or tomentose; tube 1.5–3.5 mm long, tomentose; upper lip ovate, 3–4.6 mm long, 1.5–2.5 mm wide, with a revurved, acute, sparsely pubescent apex; lower lip united for 2.2–3.2 mm; lobes deltoid, 0.5–1.4 mm long, 0.4–0.8 mm wide, with a recurved, acute apex. Nut 2–2.8 mm long, 1.8–2.4 mm wide, tan to orange, puberulous; circumference hairs 0.5–1.25 mm long, cream to orange; apex cream, puberulous; central tuft 1.2–1.8 mm long, rust-coloured or orange.

Widespread in southern W.A., especially in the Albany–Stirling Range area. Three subspecies are recognised.

**1** Vegetative and floral leaves incurved or spreading or sigmoid

- **2** Perianth greyish blue; leaves spreading or sigmoid — **23a.** subsp. **coerulescens**
- **2:** Perianth bright blue; leaves sigmoid, upwardly orientated and overlapping to form a dense leafy stem — **23b.** subsp. **dorrienii**

**1:** Vegetative and floral leaves ascending, sometimes appressed, neither incurved nor recurved — **23c.** subsp. **adpressum**

#### 23a. Conospermum coerulescens F.Muell. subsp. coerulescens

Leaves spreading or sigmoid. Perianth greyish blue, tomentose. Bracteoles densely white-tomentose. Nut with spreading hairs; circumference hairs less than 1 mm long. Fig. 112J–K.

A poorly known subspecies from near Albany and Bremer Bay, W.A. Map 261.

W.A.: c. 30 miles [c. 49 km] W of Bremer Bay, *A.S.George 6915* (PERTH); locality unknown, *J.Drummond* (MEL); King George Sound, near Albany, *G.Maxwell 70* (PERTH); Mungden, Dec. 1884, *Miss Franklyn* (MEL).

#### 23b. Conospermum coerulescens subsp. dorrienii (Domin) E.M.Benn., *Fl. Australia* 16: 484 (1995)

*Conospermum dorrienii* Domin, *Vestn. Král. Ceské Spolecn. Nauk. Tr. Mat.-Prír.* 1921–22(2): 8 (1923). T: Warriup Hill, Stirling Range, W.A., *A.A.Dorrien-Smith*; isosyn: PERTH; Stirling Range, W.A., 1909, *A.A.Dorrien-Smith*; isosyn: PERTH.

Leaves regularly incurved, sigmoid, upwardly orientated and overlapping to form a dense leafy stem. Perianth bright blue, puberulous. Bracteoles with few, short hairs. Nut with spreading hairs; circumference hairs less than 1 mm long. Fig. 112H–I.

Occurs on rocky slopes in the Stirling Range Natl Park, W.A. Flowers July–Nov. Map 262.

W.A.: Bluff Knoll, *A.S.George 3112* (PERTH); Abbey, Stirling Ra., *G.J.Keighery 1146* (PERTH); Ellens [Ellen] Peak, Stirling Ra., *C.A.Gardner 2134* (PERTH); Warriup Hill, *C.A.Gardner* (PERTH); Red Gum Springs, *A.R.Fairall 472* (PERTH).

### 23c. **Conospermum coerulescens** subsp. **adpressum** E.M.Benn., *Fl. Australia* 16: 484 (1995)

T: southern boundary of Stirling Range Natl Park, 115 km N of Albany, on Chester Pass Rd, W.A., 8 Sept. 1985, *E.M.Bennett 5190*; holo: PERTH; iso: CANB, MEL.

Leaves ascending, spreading, neither incurved nor ±appressed nor recurved. Perianth mid-blue. Bracteoles with several short hairs. Nut with appressed hairs; circumference hairs 1–1.25 mm long. Fig. 112F–G.

Occurs between Albany and the Stirling Range Natl Park and east to Mt Manypeaks, W.A. Flowers Sept. and Oct. Map 263.

W.A.: Kalgan, *Oldfield 441* (PERTH); near Albany and King George Sound, *G.Maxwell* (PERTH); Millenup Rd, Porongurup Ra., *K.F.Kenneally 71/251* (PERTH); Porongurup Ra., *T.E.George 487* (MEL).

## Sect. 4. Corymbocephala

### **Conospermum** sect. **Corymbocephala** (Meisn.) E.M.Benn., *Fl. Australia* 16: 481 (1995).

*Conospermum* sect. *Euconospermum* subsect. *Corymbocephala* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 319 (1856), *nom. illeg.* T: *C. ericifolium* Sm.

Stems leafy up to the inflorescence. Spikes corymbose. Flowers glabrous to sericeous.

A section of 10 species; 9 are endemic in eastern Australia and 1 in W.A.

### 24. **Conospermum nervosum** Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 71 (1855)

T: locality unknown [W.A.], *J.Drummond 6: 175*; lecto: MEL; isolecto: NSW, PERTH, *fide* E.M.Bennett, *Fl. Australia* 16: 485 (1995).

*Conospermum nervosum* var. *ovalifolium* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 71 (1855). T: not designated.

*Conospermum nervosum* var. *subspathulatum* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 71 (1855). T: not designated.

*Conospermum diffusum* Benth., *Fl. Austral.* 5: 367 (1870). T: locality unknown [W.A.], *J.Drummond s.n.*; lecto: MEL; isolecto: NSW, PERTH, *fide* E.M.Bennett, *Fl. Australia* 16: 484 (1995).

Erect, much-branched shrub to 1 m tall. Leaves oblong to ovate to obovate, 0.9–5.5 cm long, 1.5–13 mm wide, folded inwards along midvein, glabrous, ±puberulous below; apex apiculate; midvein and 2 marginal veins raised. Inflorescence a capitate spike of up to 20 flowers in upper axils; peduncle 5–8 mm long, tomentose; bracteoles ovate, 2–6 mm long, 2–3 mm wide, green or blue, long-acuminate. Perianth blue to pink, velutinous; tube 2–3 mm long; upper lip elliptic, 3–3.5 mm long, 1.5–2 mm wide, acute, recurved; lower lip united for 2.8–3.5 mm; lobes narrowly deltoid, 0.5–0.75 mm long, c. 0.5 mm wide. Nut c. 2 mm long and wide, cream, velutinous; circumference hairs 0.5–1.5 mm long, yellow; apex brown, with white and red quadrants; central tuft 0.5–1 mm long, yellow. Fig. 111A–C.

Common in lateritic soil north of Perth, between Hill River and Eneabba, W.A. Flowers Aug.–Feb. Map 264.

W.A.: 26 km S of Eneabba, *R.J.Cranfield* (PERTH); Hill R., *C.A.Gardner 9065* (PERTH); 8 km SW of Mt Lesueur, *B.G.Briggs 6367* (NSW); Jurien Bay, *A.R.Fairall 2480* (KPBG); 54 miles [87 km] W of Coorow, *R.V.Smith 66/220* (MEL).

There is considerable variation in the width and infolding of the mature leaves. The juvenile leaves are much broader. The type of *C. diffusum* is a very narrow-leaved form.

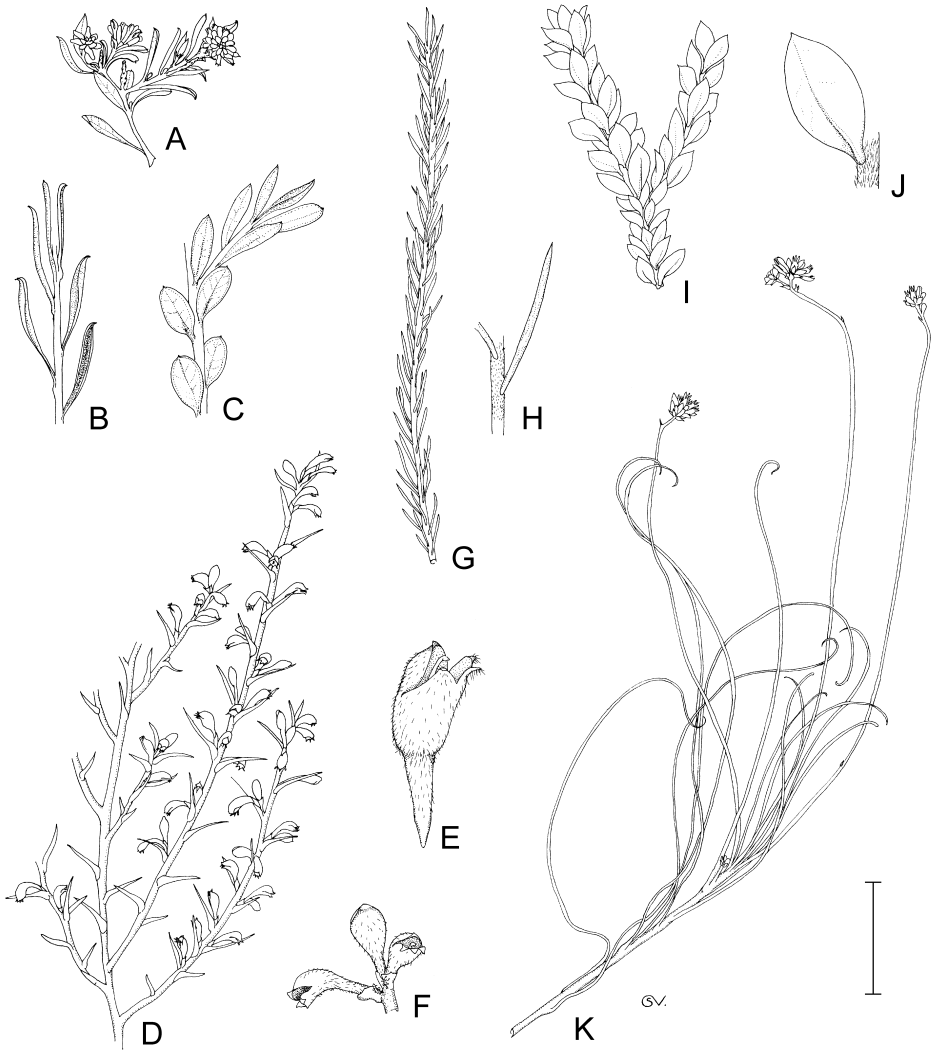



**Figure 111**. *Conospermum*. **A–C**, *C. nervosum*. **A**, flowering branchlet (E.Bennett 5064, KPBG, PERTH); **B–C**, stems with leaf variants (**B**, T.Aplin 1308, PERTH; **C**, C.Gardner 8473, PERTH). **D–F**, *C. croniniae*. **D**, flowering branchlet; **E**, flower; **F**, inflorescence (**D–F**, E.Bennett 5202B, PERTH, KPBG). **G–H**, *C. ericifolium*. **G**, vegetative stem; **H**, stem showing leaf insertion (**G–H**, Cheltenham, N.S.W., H.Rupp, MEL). **I–J**, *C. ellipticum*. **I**, vegetative branchlet; **J**, stem showing leaf insertion (**I–J**, L.Cocole 2766, MEL). **K**, *C. tenuifolium*, flowering branchlet (E.Conabere 351, NSW). Scale bar: **A–D**, **G**, **I** = 3 cm; **E** = 3 mm; **F** = 6 mm; **H**, **J**, **K** = 1 cm. Drawn by C.Vasiliu.

## 25. Conospermum ericifolium Sm. *in* A.Rees, *Cycl.* 9: No. 4 (1808)

T: locality unknown [N.S.W.], 1792, *J.White*; holo: LINN *n. v.*

*Conospermum ericaefolium* Knight, *Cult. Prot.* 95 (1809), *nom. illeg.* T: not designated.

Illustrations: A.Engler & K.Prantl, *Nat. Pflanzenfam.* 3(1): 140 (1894); D.Mackay *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 24 (1991).

Slender shrub to 1.5 m tall. Leaves linear, terete, 8–15 mm long, 0.5–1 mm wide, appressed, pilose, glabrescent; apex acute. Inflorescence a panicle of head-like spikes, or a dense spike; peduncle 14–46 mm long, hirsute; bracteoles 2.8–3.4 mm long, 1.75–2.5 mm wide, with scattered hairs. Perianth white, pilose; tube 4–5 mm long; upper lip saccate, 1.5–1.8 mm long, 1.6–2 mm wide, pilose, with a recurved apex; lower lip united for 0.75–1 mm; lobes 1.2–1.6 mm long, 0.6–0.8 mm wide, pilose. Nut 2.25–2.75 mm long, 2.4–2.75 mm wide, golden-pilose; circumference hairs 1.2–2 mm long, golden; central tuft 2.5–3 mm long. Fig. 111G–H.

Occurs in central and south-eastern coastal areas of N.S.W. from Toukley south to Sydney and in the Nowra–Jervis Bay area. Map 265.

N.S.W.: Berowra, *J.L.Boorman* (NSW); Ku-ring-gai Chase, *R.H.Goode 41a* (NSW); Parramatta, *W.Woolls* (MEL); Cheltenham, *H.M.R.Rupp* (MEL); Elanora, *C.Nysen* (NSW).

Plants growing close to the sea have a coarser texture than those further inland. Intermediates between this species and *C. taxifolium* are found where the two species grow together.

## 26. Conospermum taxifolium C.F.Gaertn., *Suppl. Carp.* 3, 199, t. 215, fig. 7 (1807)

T: habitat in Nova Hollandia [N.S.W.], ex collectione Banksiana; holo: *n.v.*

*Conospermum taxifolium* Sm. *in* A.Rees, *Cycl.* 9(1): No. 3 (1808), *nom. illeg.* T: New South Wales, 1792, *J.White*; holo: LINN *n.v.*

*Conospermum falcifolium* Knight, *Cult. Prot.* 95 (1809); holo: *n.v.* Equated with *C. taxifolium* by R.Brown, *Prodr.* 368 (1810).

*Conospermum affine* Schult. & Schult.f., *Mant.* 3: 274 (1827). T: New South Wales, *F.W.Sieber, Fl. Nov. Holl.* No. 42; *n.v.* Equated with *C. taxifolium* by G.Bentham, *Fl. Austral.* 5: 372 (1870).

*Conospermum lanceolatum* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 10 (1830). T: Five Islands, N.S.W., *A.Cunningham 33*; holo: BM *n.v.*

*Conospermum propinquum* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 10 (1830). T: Port Jackson [N.S.W.], 1803, *Caley*; holo: BM *n.v.*

*Conospermum spicatum* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 10 (1830). T: Port Jackson, N.S.W., *Paterson*; holo: BM *n.v.*

*Conospermum lavandulifolium* A.Cunn. ex Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 519 (1845); *C. taxifolium* var. *lavandulifolium* (A.Cunn. ex Meisn.) Domin, *Biblioth. Bot.* 22: 579 (1921). T: Moreton Bay [Qld], Sept. 1824, *A.Cunningham*; type: G-DC (photo seen).

*Conospermum linifolium* A.Cunn. ex Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 518 (1845); *C. taxifolium* var. *linifolium* (A.Cunn. ex Meisn.) Benth., *Fl. Austral.* 5: 372 (1870). T: Peels Island, Moreton Bay [Qld], Oct. 1824, *A.Cunningham*; type: G-DC (photo seen).

*Conospermum taxifolium* var. *brownii* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 320 (1856). T: *s. loc., R.Brown s.n.*; syn: G-DC (photo seen); *s. loc., F.W.Sieber 42*; syn: G-DC (photo seen); *s. loc., F.W.Sieber, Fl. Mixta 471*; syn: G-DC (photo seen).

*Conospermum taxifolium* var. *smithii* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 319 (1856), *nom. illeg.*

Illustrations: W.R.Elliott & D.L.Jones, *Encycl. Austral. Pl.* 3: 68 (1984), as *C. ericifolium*; D.Mackay *in* G.J.Harden (ed.), *Fl. New South Wales* 2: pl. 2, 24 (1991).

Erect, much-branched shrub to 1.5 m tall. Leaves terete to narrowly ovate, 6–25 mm long, 0.75–4 (–6) mm wide, ascending, spreading, ±recurved, glabrous to scattered-hairy; apex acute. Inflorescence a spike or few-branched panicle; peduncle 20–45 mm long, white-puberulous; bracteoles 2–2.5 mm long, c. 2 mm wide, with an acute to acuminate apex and a few, scattered hairs. Perianth white-pilose; tube 2–2.5 mm long; upper lip saccate, 1–1.5 mm long, c. 2 mm wide, densely pilose with a recurved apex; lower lip united for 1–1.5 mm; lobes 1–1.2 mm long, 0.5–0.75 mm wide, pilose; outer 2 lobes broader than central one. Nut

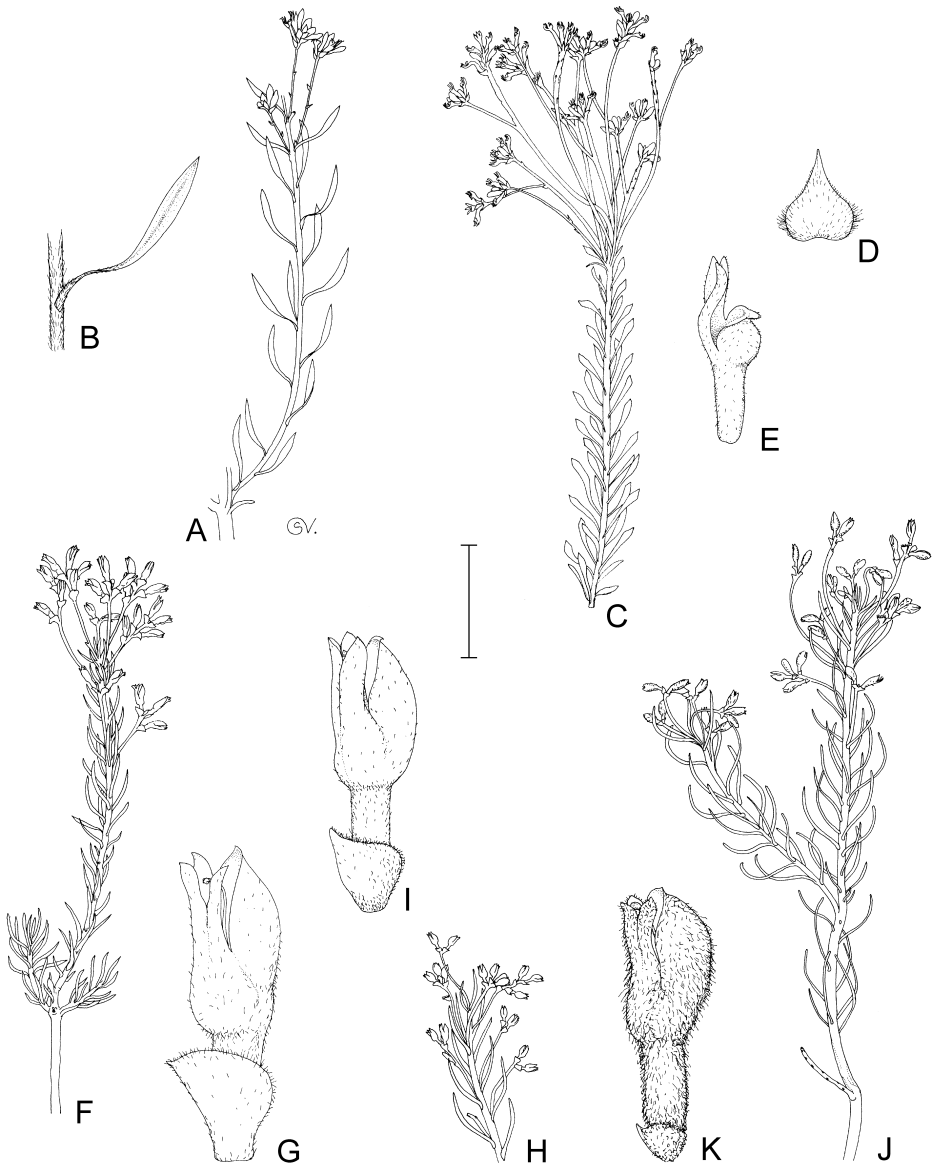



**Figure 112**. *Conospermum*. **A–B**, *C. hookeri*. **A**, flowering branchlet; **B**, stem showing leaf insertion (**A–B**, J.Hemsley 6560, NSW). **C–E**, *C. taxifolium*. **C**, flowering branchlet; **D**, flower bracteole; **E**, lateral view of flower (**C–E**, M.Evans 2676, NSW). **F–G**, *C. coerulescens* subsp. *adpressum*. **F**, flowering branchlet; **G**, flower with bracteole (**F–G**, E.Bennett 5190, PERTH). **H–I**, *C. coerulescens* subsp. *dorrienii*. **H**, flowering branchlet; **I**, flower with bracteole (**H–I**, Stirling Ra., W.A., A.Dorrien-Smith, PERTH). **J–K**, *C. coerulescens* subsp. *coerulescens*. **J**, flowering branchlet; **K**, flower with bracteole (**J–K**, Salt R. near Cape Knob, W.A., G.Maxwell, MEL). Scale bar: **A** = 6 cm; **B** = 1 cm; **C**, **F**, **H**, **J** = 3 cm; **D**, **E** = 3 mm; **G**, **I**, **K** = 2 mm. Drawn by C.Vasiliu.

2–2.25 mm long, 1.3–1.6 mm wide; base golden rusty pilose; circumference hairs 2.5–3 mm long, golden-rusty; central tuft c. 2 mm long. Fig. 112C–E.

Widespread from southern Qld to Vic. Map 266.

Qld: Blackdown Tableland, c. 35 km SE of Blackwater, *R.J.Henderson, L.Durrington & P.Sharpe H970* (NSW). N.S.W.: Sheepwash Ck, c. 1 mile [c. 1.6 km] N of Nraemar, 27 Nov. 1965, *H.Salazoo* (NSW); Charleyong–Tarago road, c. 0.5 mile [c. 0.8 km] from Braidwood–Nerriga road, *W.E.Moore & B.Williams* (NSW). Vic.: 2 miles [c. 5 km] S of Jack Buckland's home, Marshmead, *J.H.Willis* (MEL); 5 km W of Howe Hill, *A.B.Court 894* (MEL).

This is a very variable species with a wide distribution. In Qld some collections from higher altitudes have very much longer leaves than those from lower altitudes. Two early collections had flowers in racemes, matching the type of *C. spicatum* R.Br. This is possibly a distinct species but further collecting would be required to determine its status.

### 27. **Conospermum ellipticum** Sm. *in* A.Rees, *Cycl.* 9: No. 2 (1808)

T: sent from New South Wales, 1792, *J.White*; holo: LINN *n.v.*

*Conospermum rigidum* Knight, *Cult. Prot.* 95 (1809). T: not designated.

*Conospermum imbricatum* Sieber ex Spreng., *Syst. Veg.* 4(2): 46 (1827); *C. ellipticum* var. *imbricatum* (Sieber ex Spreng.) Benth., *Fl. Austral.* 5: 373 (1870). T: New South Wales, *F.W.Sieber, Fl. Nov. Holl. 44*; iso: MEL.

Illustrations: W.R.Elliott & D.L.Jones, *Encycl. Austral. Pl.* 3: 67 (1984); D.Mackay *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 24 (1991).

Shrub to 1.5 m tall. Leaves with petiole 1.6–2 mm long; lamina elliptic, 6.5–23 mm long, 2.2–8.75 mm wide, pilose; apex ±cuspidate. Inflorescence paniculate; peduncle 15–26 mm long, white-tomentose; bracteoles 3–4 mm long, 2.5–3 mm wide, pilose at base and lower sides or ±glabrous, with an acuminate apex. Perianth densely white-pilose; tube 3.5–4 mm long; upper lobe saccate, ovate, 1.5–2.1 mm long, 1.5–1.75 mm wide, densely pilose, with a recurved apex; lower lip united for 1–1.25 mm; lobes 1.25–1.75 mm long, 0.5–0.75 mm wide, pilose; outer 2 lobes twisted, incurved. Nut 2–2.25 mm long, 2.5–3 mm wide; base golden rusty-pilose; circumference hairs 1.5–2 mm long, golden rust-coloured and cream; central tuft 2–2.5 mm long. Fig. 111 I–J.

Occurs from Broken Bay to Jervis Bay, N.S.W. Map 267.

N.S.W.: Loftus Natl Park, *J.N.Samfield* (NSW); Cape Solander, *L.A.S.Johnson* (NSW); Tabbigai, Kurnell Peninsula, *L.A.S.Johnson* (NSW); between Waterfall and Heathcote, *D.J.McGillivray 1511* (NSW).

A species with very variable leaf size. Two collections with leaves shorter than 7 mm have been seen.

### 28. **Conospermum hookeri** (Meisn.) E.M.Benn., *Fl. Australia* 16: 485 (1995)

*Conospermum taxifolium* var. *hookeri* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 320 (1856). T: Spring Bay, Tas., *J.Backhouse*; syn: G-DC (photo seen).

*Conospermum taxifolium* var. *leianthum* Benth., *Fl. Austral.* 5: 372 (1870). T: Tasmania, *Story*; iso: MEL.

Much-branched shrub to 1 m tall. Leaves: petiole 5–10 mm long, densely pilose; lamina spathulate or linear-oblong, 19–32 mm long, 1–3 mm wide, spreading, ±incurved, densely pilose; apex acute. Inflorescence a spike or a few-branched panicle that terminates in a spike of up to 20 flowers; peduncle (10–) 20–25 mm long, white-sericeous; bracteoles 3.5–4 mm long, 2.5–3 mm wide, white-hirsute, with a dark, acuminate, hirsute or glabrous apex. Perianth white, densely tomentose; tube 3.25–4 mm long, sparsely hairy; upper lip 2–2.5 mm long, 1.5–2 mm wide, shortly white-hairy, with an acute, recurved apex; lower lip united for 1.25–1.5 mm; lobes 1–1.4 mm long, 0.5–0.8 mm wide, deltoid, densely white- and red-tomentose. Nut c. 2 mm long, 2–2.25 mm wide, fawn-silky-velutinous; circumference hairs 1.5–2 mm long, reddish brown; apex with pale and dark brown quadrants; central tuft sparse, 1.5–1.7 mm long, golden brown. Fig. 112A–B.

Endemic in Tas. Map 268.

Tas.: Georges Bay, *G.Coghill* (MEL); *loc. id.*, *L.Rodway* (NSW); Butons Bay, *F.Mueller* (MEL); Freycinet Peninsula, *R.A.Black* (MEL).

### 29. **Conospermum patens** Schltdl., *Linnaea* 20: 587 (1847)

T: between Gawler River and Light River [S.A.], *H.H.Behr 58*; iso: MEL.

*Conospermum cucullatum* Gand., *Bull. Soc. Bot. France* 66: 231 (1919). T: Highbury, S.A., 1901, *J.H.Maiden*; holo: LY (photo NSW).

*Conospermum helichrysoides* Gand., *Bull. Soc. Bot. France* 66: 231 (1919). T: N.S.W., 1902 (ex Herb. Walter); holo: LY (photo NSW).

Open shrub to 1 m tall. Leaves terete or spathulate, 1.5–46 mm long, 0.7–2.7 mm wide, erect or spreading, straight or sigmoid, glabrous to velutinous; apex acute. Inflorescence a few-branched panicle or spike in upper leaf axils; peduncle (2.5–) 7–18.2 cm long, tomentose; bracteoles ovate, 2–5 mm long, 0.8–2.5 mm wide, velutinous or glabrous. Perianth white to pale blue, tomentose; tube 2.2–4.5 mm long; upper lip ovate, 2.5–3.5 mm long, 1.5–2.3 mm wide, with an acute, recurved apex; lower lip united for 1–2 mm; lobes oblong to broadly oblong, 1–2 mm long, 0.3–0.9 mm wide, with an acute apex. Nut 1.8–2.3 mm long, 2–2.6 mm wide, yellow-brown-tomentose; circumference hairs 1–1.5 mm long, cream or reddish brown; central tuft 1.2–1.7 mm long, reddish brown. Fig. 114H–K.

Occurs in the Wimmera and the Grampians, Vic.; also in S.A. from the Mt Lofty and Barossa Ranges south to the Eyre Peninsula and Kangaroo Is. Map 269.

S.A.: Eyre Penin., Warrow, *D.J.Smith 126* (MEL); E face, Marble Ra., *D.E.Symon 11824* (AD); D'Estrees Bay Rd, 2 miles [c. 3.2 km] from D'Estrees Bay, Kangaroo Is., *V.Johnson 75/60* (NSW). Vic.: 7 miles [c. 12 km] SW of Casterton, *F.Swindley 1117* (MEL); 4 miles [c. 6.5 km] from Golton Gorge towards Flat Rock, Grampians, *M.E.Phillips 021475* (NSW).

The leaves of this species exhibit considerable variation, ranging from terete to spathulate and slightly flattened and from glabrous to woolly. However, none of the variants are sufficiently distinct to warrant formal recognition.

### 30. **Conospermum burgessiorum** L.A.S.Johnson & McGill., *Telopea* 1: 58 (1975)

T: Gibraltar Ra., 39.5 miles [63 km] by road ENE of Glenn Innes on Gwydir Hwy, N.S.W., 20 Sept. 1966, *D.J.McGillivray 2403 & L.A.S.Johnson*; holo: NSW; iso: MEL, PERTH.

Much-branched, erect to spreading shrub 1.5–3 m tall. Leaves linear, 6–19 cm long, 2–8 mm wide, ascending, glabrous, ±pubescent along midvein and at base; lateral and marginal veins ±raised. Inflorescence a panicle in upper axils, shorter than leaves; peduncle 5.5–18 cm long, sparsely velutinous; bracteoles ovate, 1.8–3 mm long, 1–2 mm wide, blue, sparsely velutinous, with an acute apex. Perianth cream to white, puberulous; tube 1.8–2.5 mm long; upper lip 2.8–4 mm long, 2–2.6 mm wide with an acute, recurved apex; lower lip united for 1.7–2.5 mm; lobes oblong to broadly oblong, 1.6–2 mm long, 0.9–2 mm wide. Nut c. 2.2 mm long and wide; base cream, red-brown-puberulous; circumference hairs c. 0.5 mm long, few, red-brown; central tuft absent.

Occurs in the Darling Downs district of south-eastern Qld and in the Gibraltar Ra. in the northern tablelands of N.S.W. Flowers Sept.–Dec. Map 270.

Qld: Mt Norman, *G.Ward* (NSW); 1/4 mile [0.4 km] from Amiens, on Cottonvale road, *C.R.Frazier* (NSW). N.S.W.: Grassy Ck, Gibraltar Range Natl Park, *R.Paine 54* (NSW); Gibraltar Range Natl Park, c. 39 miles [63 km] NE of Glen Innes on Gwydir Hwy, *H.Wiseman* (NSW).

### 31. **Conospermum sphacelatum** Hook. *in* T.L.Mitchell, *J. Exped. Trop. Austral.* 342 (1848)

T: sub-tropical New Holland [Qld], 6 Oct. 1846, *T.L.Mitchell 324*; iso: MEL, NSW.

Sparingly branched shrub to 70 cm tall. Leaves linear to narrowly obovate, 5–10 cm long, 1–3 mm wide, ascending, sericeous to velutinous or glabrous, but white-hirsute at base; apex conical; midvein prominent. Inflorescence a terminal to subterminal panicle; peduncle 5–10 cm long, sericeous to tomentose; bracteoles 2–2.5 mm long, 3.5–3.75 mm wide, ovate to

cordate, sericeous, with ciliate margins. Perianth white, velutinous to sericeous; tube 6–7 mm long, white-sericeous; upper lip deltoid, 2.75–3 mm long, 2–2.25 mm wide, with an undulate margin and an acute apex; lower lip united for 1.25–1.5 mm; lobes oblong to broadly oblong, 2.5–2.75 mm long, 0.75–1 mm wide with an acute apex. Nut 1.75–2.25 mm long, c. 3 mm wide, white- to cream-velutinous; circumference hairs 3–4 mm long, golden; central tuft absent.

Occurs in the Leichhardt, Maranoa and Mitchell districts of Qld; grows in stony soils on sandstone. Map 271.

Qld: Mt Playfair–Mt Faraday area, *B.O'Keefe* (BRI); Isla Gorge, c. 18 miles [c. 29 km] SW of Theodore, *S.L.Everist 8076* (BRI); upper Maranoa R., W branch, c. 110 km NW of Injune, *I.R.Telford 5843* (BRI).

The collections from Isla Gorge have glabrous leaves which are densely sericeous at the base only, flowers which are less densely hairy and velutinous bracteoles.

## 32. Conospermum longifolium Sm., *Exot. Bot.* 2: 45, t. 82 (1806)

*Conospermum longifolium* var. *intermedium* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 321 (1856), *nom. illeg.* T: Port Jackson [N.S.W.], 1791–1792, *J.White*; holo: NSW.

*Conospermum scolopendrinum* Gand., *Bull. Soc. Bot. France* 66: 232 (1919). T: Port Jackson, N.S.W., *J.R.Tovey*; holo: LY *n.v.*

*Conospermum smithii* Pers., *Syn. Pl.* 1: 116 (1805), *nom. inval.*

Dense shrub to 2.5 m tall. Leaves linear to narrowly oblanceolate, 3.5–19 cm long, 1–27 mm wide, sessile, ascending, glabrous, ±puberulous towards base; apex acute; midvein prominent. Inflorescence a ±terminal, corymbose panicle; peduncle 7.5–36 cm long, ±glabrous; bracteoles ovate, 1.6–3.8 mm long, 1–2.5 mm wide, glabrous, ±puberulous at base, ciliate. Perianth white; tube 1.7–6 mm long, sparsely velutinous; upper lip ovate, 1.5–3.5 mm long, 1.8–2.5 mm wide, acute, sparsely velutinous; lower lip united for 1.2–1.5 mm; lobes elliptic, 1.5–2.6 mm long, 0.8–1 mm wide, acute, recurved, puberulous. Nut 2.3–2.8 mm long, 2–2.5 mm wide, cream to dark brown-velutinous; circumference hairs 1.2–2 mm long, golden-orange; central tuft absent.

Widespread throughout eastern N.S.W.

Hybrids commonly occur between *C. taxifolium*, *C. tenuifolium* and the subspecies of *C. longifolium*. Three subspecies are recognised.

**1** Leaves more than 8 mm wide; margin undulate — **32a.** subsp. **longifolium**

**1:** Leaves less than 8 mm wide; margin flat

**2** Broadest leaves 4–8 mm wide — **32b.** subsp. **mediale**

**2:** Broadest leaves less than 4 mm wide — **32c.** subsp. **angustifolium**

### 32a. Conospermum longifolium Sm. subsp. longifolium

Illustration: D.Mackay *in* G.J.Harden (ed.), *Fl. New South Wales* 2: pl. 2, 25 (1991).

Leaves more than 8 mm wide, 3-veined; cross-veins prominent; margin undulate. Fig. 114A.

Occurs from the northern and eastern parts of the central coast of N.S.W. south to Sydney. Flowers Sept.–Nov. Map 272.

N.S.W.: near Central Mangrove, on road to Wisemans Ferry, near turn-off to Gosford, *M.E.Phillips 510* (NSW); Parramatta R., 11 Jan. 1917, *H.M.R.Rupp* (MEL); West Cambewarra, 8 miles [c. 13 km] from Nowra, *F.A.Rodway 96* (NSW).

### 32b. **Conospermum longifolium** subsp. **mediale** L.A.S.Johnson & McGill., *Telopea* 1: 64 (1975)

T: Balmoral, N of Hill Top, N.S.W., 1 Oct. 1959, *L.A.S.Johnson NSW 47631*; holo: NSW.

*Conospermum scorzonerifolium* Gand., *Bull. Soc. Bot. France* 66: 232 (1919). T: Blue Mountains, N.S.W., Aug. 1899, *W.Bäuerlen*; holo: LY *n.v.*

Illustration: D.Mackay *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 25 (1991).

Broadest leaves 4–8 mm wide; margin entire; venation ±prominent.

Occurs in the central coast, central tablelands and south coast of N.S.W. Flowers Sept.–Nov. Map 273.

N.S.W.: Balmoral, Hill Top–Buxton road, 10 miles [16 km] SSE of Picton, *E.F.Constable 6746* (NSW); 36.5 miles [59 km] from Singleton, on Singleton–Windsor road, *D.J.McGillivray 1518* (NSW); Blaxland, *A.A.Hamilton* (NSW); Big Hill, Mittagong, *K.Mowle* (NSW).

### 32c. **Conospermum longifolium** subsp. **angustifolium** (Meisn.) L.A.S.Johnson & McGill., *Telopea* 1: 64 (1975)

*Conospermum longifolium* var. *angustifolium* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 321 (1856). T: [N.S.W.], *Anderson*; syn: *n.v.*; [N.S.W.], *F.W.Sieber Fl. Nov. Holl.* 40; syn: MEL.

*Conospermum longifolium* var. *lingulatum* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 321 (1856). T: [N.S.W.] *F.W.Sieber Fl. Nov. Holl.* 41, ex parte A.Cunningham; syn: G-DC (photo seen).

*Conospermum acinacifolium* Graham, *Edinburgh New Philos. J.* 1826: 171, 386 (1826); *Conospermum erectum* Graham, *Edinburgh New Philos. J.* 1826: 171 (1826), *nom. inval.* T: cultivated from seed received from Mr Fraser of New Holland; *n.v.*

*Conospermum commutatum* Schult. & Schult.f., *Mant.* 3: 275 (1827). T: *F.W.Sieber Fl. Nov. Holl.* 40; iso: MEL.

Illustration: D.Mackay *in* G.J.Harden (ed.), *Fl. New South Wales* 2: 25 (1991).

Broadest leaves less than 4 mm wide.

Occurs in the central coastal region of N.S.W., mostly south of Sydney. Flowers Aug.–Nov. Map 274.

N.S.W.: Mangrove Mtn, *R.A.Black* (MEL); Ingar Rd, c. 6 miles [c. 10 km] from junction with Kings Tableland Rd, Wentworth Falls, 19 Nov. 1970, *C.Burgess* (MEL, NSW); Bates Drive, Sylvania Heights, *D.J.McGillivray & E.F.Constable C5967* (NSW); between Oatleys platform and Georges R., 27 Aug. 1887, *J.H.Maiden* (NSW).

### 33. **Conospermum mitchellii** Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 320 (1856)

T: interior of eastern New Holland [Vic.], 22 July 1836, *T.L.Mitchell's Expedition 263*; iso: MEL.

*Conospermum mitchellii* var. *dallachii* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 321 (1856). T: Grampian Mountains [Vic.], *F.Mueller*; holo: MEL.

Illustration: W.R.Elliot & D.L.Jones, *Encycl. Austral. Pl.* 3: 69 (1984).

Multistemmed shrub 1–2 m tall. Leaves linear, (2–) 5–20 cm long, 0.8–3.5 mm wide, ascending or ±recurved; margins thickened; apex acute to acuminate; midvein with scattered hairs. Inflorescence a corymbose panicle, ±exceeding leaves; peduncle 4.5–18.5 cm long, sericeous; bracteoles ovate to lanceolate, 2.5–4.5 mm long, 1–2.8 mm wide, sericeous, blue, ciliate, with an acute apex. Perianth white, blue or lilac, sericeous; tube 2–4 mm long; upper lip ovate, 2.5–4 mm long, 1.8–3 mm wide, acute, recurved; lower lip united for 1.5–2.5 mm; lobes narrowly oblong to oblong, 1.5–2.3 mm long, 0.5–1 mm wide, ciliate, acute. Nut c. 2 mm long, c. 2.1 mm wide; base reddish brown, hirsute; circumference hairs 1.3–1.8 mm long, orange to reddish brown; central tuft 1.5–1.8 mm long, fawn and red-brown.

Occurs in the Portland area and the Grampians, Vic. Flowers July–Dec. Map 275.

Vic.: Grampians, Major Mitchell Plateau, 8 Dec. 1962, *J.H.Willis* (MEL); Grampians, Plantation Rd, c. 6 miles [c. 10 km] from Halls Gap, *T.B.Muir 1207* (MEL); N of Moleside Ck, 2–3 miles [c. 3–5 km] E of Glenelg R., *H.I.Aston 764* (NSW).

## Sect. 5. Eriostachya

**Conospermum** sect. **Eriostachya** (Meisn.) E.M.Benn., *Fl. Australia* 16: 482 (1995).

*Conospermum* sect. *Euconospermum* § *Eriostachya* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 316 (1856). T: *C. stoechadis* Endl.

*Conospermum* sect. *Trichantha* Diels & E.Pritz. ex De Wild., *Pl. Nov. Horti Then.* 1: 140, 143 (1905), as *Trichanthae.* T: not designated.

Inflorescence a panicle or corymb. Flowers woolly or silky.

A section of 20 species.

## Subsect. 1. Foliosa

**Conospermum** subsect. **Foliosa** E.M.Benn., *Fl. Australia* 16: 482 (1995).

Type: *C. distichum* R.Br.

Inflorescence of simple spikes arising from upper leaves. Perianth lobes shorter than tube.

A subsection of 6 species.

### 34. Conospermum filifolium Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 523 (1845)

T: Swan River district [W.A.], *J.Drummond 578*; holo: K; iso: MEL.

Shrub to 80 cm tall. Leaves filiform, usually ±sigmoid, 2–8.5 cm long, 0.3–0.7 mm wide, ascending, glabrous, but ciliate towards base; apex mucronate. Inflorescence a narrow, spicate panicle; bracteoles ovate, 2–4 mm long, 0.7–1.8 mm wide, blue, villous at sides and base, with an acute apex. Perianth white, occasionally blue, woolly; tube 2.5–7 mm long; upper lip blue, ovate, 2–3.2 mm long, 0.7–1.8 mm wide, glabrous to velutinous, woolly at base, with an acute apex; lower lip united for 1.5–2.5 mm, pilose; lobes oblong, 0.5–0.8 mm long, 0.15–0.3 mm wide, villous or velutinous, with a ±recurved apex. Nut not seen.

Widespread from south of Perth to Ravensthorpe, W.A. Two subspecies are recognised.

Perianth with upper lip velutinous or puberulous; spike dense **34a.** subsp. **filifolium**

Perianth with upper lip glabrous; spike not dense **34b.** subsp. **australe**

### 34a. Conospermum filifolium Meisn. subsp. filifolium

Illustration: W.R.Elliot & D.L.Jones, *Encycl. Austral. Pl.* 3: 69 (1984), as *C. incurvum.*

Leaves ±appressed. Spike dense. Perianth tube 1–3 mm wide. Upper lip of perianth velutinous or puberulous; lower lip with several short hairs. Fig. 113D–F.

Occurs inland between Perth and Albany, W.A. Flowers Aug.–Nov. Map 276.

W.A.: Tuttaning Reserve, 17 miles [c. 26 km] E of Pingelly, *G.Heinsohn 8* (PERTH); Albany, *J.Galbraith 892* (MEL); Dryandra State Forest, 29 km N of Narrogin, *G.J.Keighery 6263* (PERTH); Boyagin Reserve, *H.Demarz 1847* (KPBG).

### 34b. Conospermum filifolium subsp. australe E.M.Benn., *Fl. Australia* 16: 484 (1995)

T: 3 km N of Hopetoun, W.A., 10 Sept. 1985, *E.M.Bennett 5208*; holo: PERTH; iso: CANB, MEL.

Leaves sigmoid, ±spreading. Spike interrupted. Perianth with glabrous, upper lip; lower lip |with short hairs.

Occurs from the Stirling Range south-east to Ravensthorpe, W.A. Flowers Aug.–Oct. Map 277.

W.A.: between Ravensthorpe and Hopetoun, *S.Paust 751* (PERTH); base of West Mt Barren, Fitzgerald River Natl Park, *D.B.Foreman 1379* (MEL, PERTH); Cranbrook, *J.Scott* (NSW); Fitzgerald Reserve, 8 miles [13 km] NW of Fitzgerald R. estuary, *K.M.Allan 322* (PERTH).

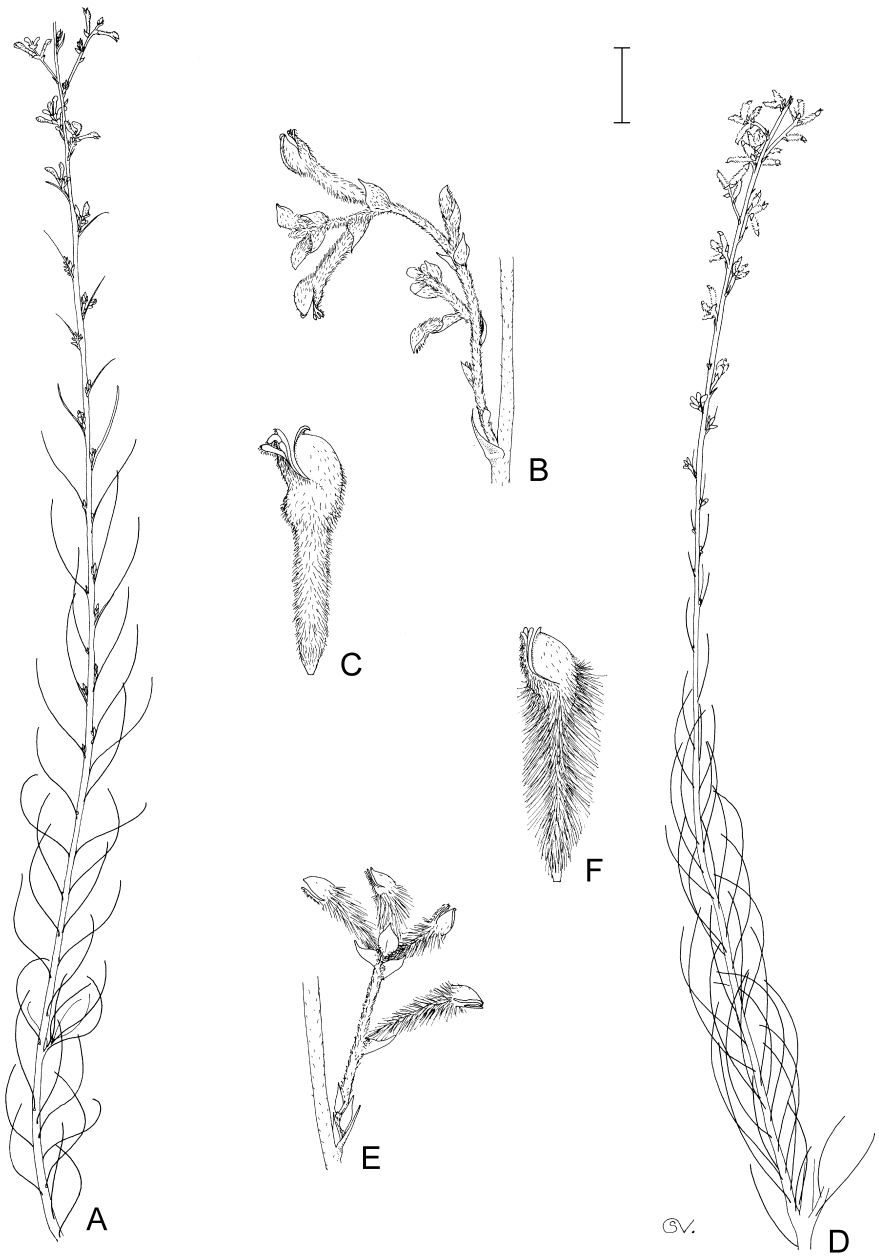



**Figure 113**. *Conospermum*. **A–C**, *C. sigmoideum*. **A**, flowering stem; **B**, spike; **C**, flower (**A–C**, D.Butcher 334, PERTH). **D–F**, *C. filifolium* subsp. *filifolium*. **D**, flowering stem; **E**, spike; **F**, flower (D–F, J.Beard 1803, PERTH). Scale bar: **A**, **D** = 2 cm; **B**, **E** = 4 mm; **C**, **F** = 2 mm. Drawn by C.Vasiliu.

### 35. Conospermum sigmoideum E.M.Benn., *Fl. Australia* 16: 486 (1995)

T: Frank Hann Natl Park, 11 Aug. 1978, *D.Butcher 334*; holo: PERTH; iso: NSW.

Few-branched erect shrub 20–50 cm tall. Leaves sigmoid, terete, 1.5–3.5 cm long, 0.2–0.3 mm wide, with scattered hairs at maturity. Inflorescence terminal; axis extended beyond leaves; spikes 5–10-flowered, distant, arising from leaf-like bracts; bracts terete, ascending, c. 15 mm long at base of inflorescence, c. 5 mm long at apex, 0.3–0.4 mm wide; bracteoles deep blue, 2–2.25 mm long, densely white-tomentose at base. Perianth pale blue; tube 5–6 mm long, 1–1.5 mm wide below lobes; upper lip 2–3 mm long, nearly glabrous except for a puberulous apex; lower lip united for 0.75–1 mm; lobes narrowly oblong to oblong, 0.5–0.75 mm long, 0.2–0.3 mm wide, white-sericeous. Nut not seen. Fig. 113A–C.

Known only from Frank Hann Natl Park, W.A. Flowers Aug.–Sept. Map 278.

W.A.: Frank Hann Natl Park, *D.Monk 377* (PERTH); 59 km E of vermin-proof fence along L. King–Norseman road, Frank Hann Natl Park, *G.F.Craig 2921* (PERTH).

### 36. Conospermum distichum R.Br., *Trans. Linn. Soc. London* 10: 155 (1810)

T: in Novae Hollandiae orâ australi, Lewin's Land [W.A.], *R.Brown s.n.*; iso: MEL.

*Conospermum procerum* F.Muell., *Fragm.* 1: 157 (1859). T: near Gardner River [W.A.], *G.Maxwell*; *n.v.*

Shrub to 80 cm tall. Leaves scattered, ascending, filiform, 3.5–8.5 cm long, 0.4–0.75 mm wide, glabrous; apex ±mucronate; midvein ±prominent. Inflorescence of many spikes in upper leaf axils; peduncle 1.5–7 cm long, white, villous; bracteoles ovate, 2.2–3.2 mm long, 1.7–2.5 mm wide, blue, tomentose at sides and base; margin ciliate; apex acute, ±cuspidate. Flowers white, woolly; tube 4–7.5 mm long; upper lip ovate, 1.8–3 mm long, 1–1.7 mm wide, blue, glabrous above, densely woolly at base; lower lip bearded, united for 1.5–2.5 mm; lobes 0.4–0.8 mm long, 0.15–0.3 mm wide, acute, ±recurved. Nut 1.8–2.8 mm long, 1.6–1.9 mm wide, orange-brown, velutinous; circumference hairs 1.8–2.5 mm long, orange-brown; central tuft 2–2.5 mm long. Fig. 114E–F.

Occurs in sandy soils of the south coast of W.A. from Ravensthorpe east to Mt Ragged. Flowers Aug.–Nov. Map 279.

W.A.: near Esperance Bay, *R.Helms* (NSW); Hopetoun, *J.S.Beard 2226* (NSW, PERTH); Cape Le Grand Natl Park, *N.G.Walsh 1026* (MEL); Cape Le Grand, *F.Lullfitz 3562* (KPBG); near Mt Ragged, *T.E.H.Aplin* 2587 (PERTH).

This species varies considerably over its range; specimens from the western extension have incurved leaves and those from the eastern extension have appressed leaves. A form from Gibson and 90 km east of Esperance has sericeous branches and less interrupted inflorescences similar to those of *C. filifolium.*

### 37. Conospermum multispicatum E.M.Benn., *Fl. Australia* 16: 485 (1995)

T: 2 km E along Toolibin–Tincurrin road, from Toolibin Road South, W.A., 21 Oct. 1985, *E.M.Bennett 5241*; holo: PERTH; iso: K, MEL, NSW.

Dense, rounded shrub to 1 m tall. Leaves closely appressed or ±spreading, rarely incurved, terete and ±4-angled, 9–25 (–40) mm long, 0.5–0.75 mm wide, glabrous; apex acute; margins and midvein raised on undersurface. Inflorescence of many spikes of c. 12 flowers in upper leaf axils; peduncle 10–20 mm long, densely white-woolly; bracteoles deltoid, 1.5–2 mm long, 1.25–2 mm wide, blue; lower base and sides white-woolly; margin and apex white-ciliate; apex acute. Perianth white, woolly; tube 4.5–5.5 mm long; upper lip 0.7–1.25 mm long, densely white-hairy; lower lip united for 0.5–0.8 mm, with a dense beard of hairs; lobes oblong, 0.5–0.6 mm long, 0.25–0.4 mm wide, densely hairy; apex recurved. Nut 2–2.4 mm long, 2–2.5 mm wide, white-hirsute; circumference hairs 1–2.5 mm long, golden-fawn; central tuft 2–3 mm long, golden-brown. Fig. 62.

Recorded from Toolibin, Boyerine, Wagin and the Stirling Range, W.A. Flowers Aug.–Oct. Map 280.

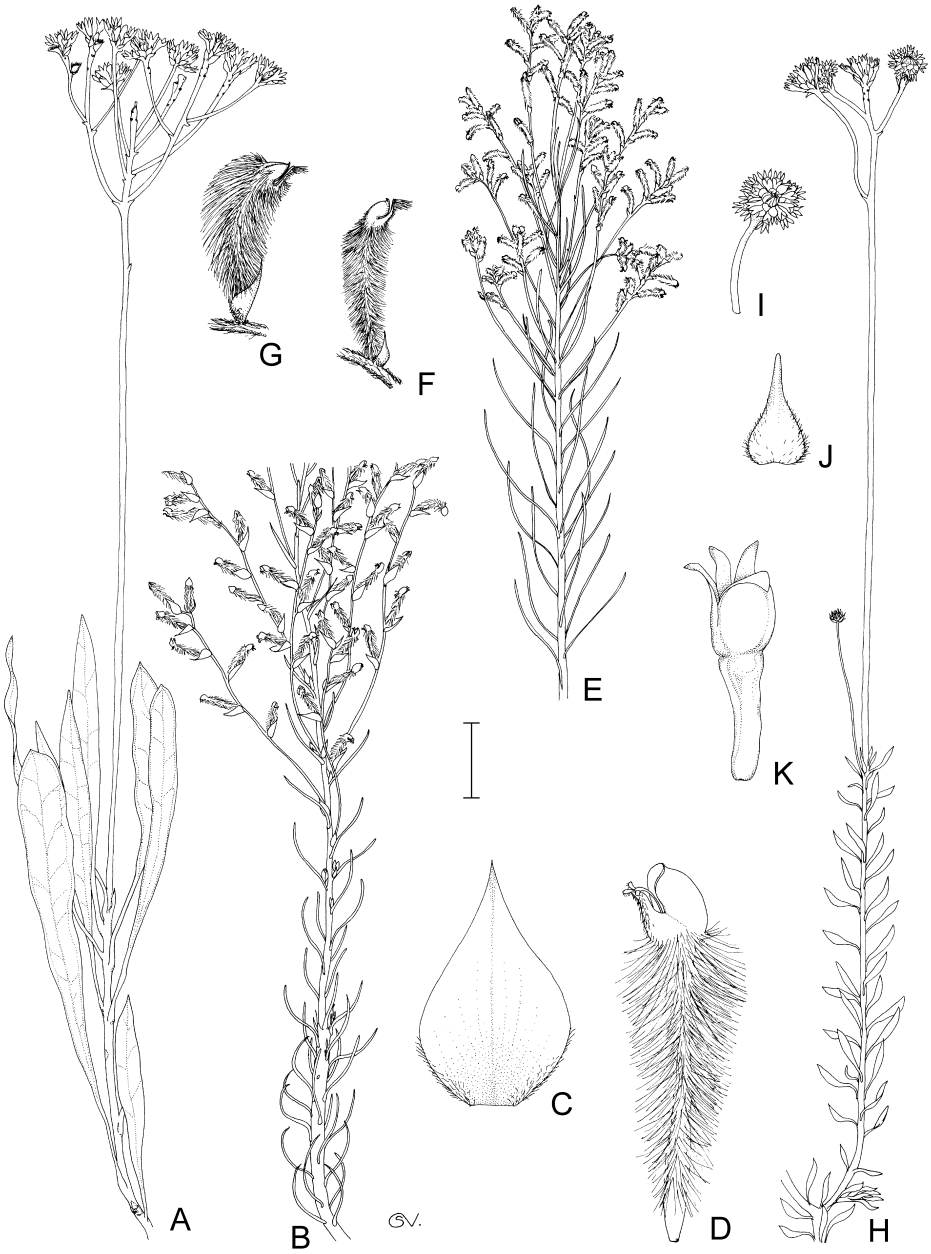



**Figure 114**. *Conospermum*. **A**, *C. longifolium* subsp. *longifolium*, flowering stem (17 Oct. 1965, L.Johnson, NSW). **B–D**, *C. spectabile*. **B**, flowering branchlet; **C**, flower bracteole; **D**, flower (**B–D**, Ross Peak, Stirling Ra., W.A., C.Gardner, PERTH). **E–F**, *C. distichum*. **E**, flowering branchlet; **F**, flower on spike (**E–F**, E.Bennett 5215, PERTH, KPBG). **G**, *C. floribundum*, flower on spike (Stirling Ra. Natl Park, E.Bennett, PERTH). **H–K**, *C. patens*. **H**, flowering stem; **I**, part of inflorescence; **J**, flower bracteole; **K**, flower (**H–K**, drawn from specimen sent to KPBG for 1986 Western Australian Wildflower Festival). Scale bar: **A**, **B**, **E**, **H** = 2 cm; **C**, **D**, **J**, **K** = 2 mm; **F**, **G** = 4 mm; **I** = 1 cm. Drawn by C.Vasiliu.

W.A.: near Boyerine Railway Stn, *A.R.Fairall 386* (KPBG, PERTH); 6.2 km from Tincurrin to Toolibin, *E.M.Bennett 5268* (KPBG); between Wagin and Katanning, *C.A.Gardner 2085* (PERTH); Stirling Ra., 29 Sept. 1928, *W.E.Blackall & C.A.Gardner* (PERTH); between Katanning and Wagin, 13 Oct. 1960, *F.Lullfitz* (PERTH).

### 38. Conospermum floribundum Benth., *Fl. Austral.* 5: 373 (1870)

T: locality unknown [W.A.], *L.Preiss 740*; lecto: MEL, *fide* E.M.Bennett, *Fl. Australia* 16: 485 (1995).

Shrub to 45 cm tall. Leaves terete, 12–22 mm long, 0.5–0.75 mm wide, spreading, ±sigmoid, with groove along underside. Inflorescence a terminal, spicate panicle; spikes arising from axils of leaf-like bracts; bracteoles deltoid, 1.5–3.5 mm long, 1.75–2.5 mm wide, blue; sides and base white, woolly, with an acuminate apex. Flowers white with blue apices, woolly; tube 4.1–5.2 (–7) mm long; upper lip ovate, 1.5–2 mm long, 1.25–1.5 mm wide, white-sericeous, with a recurved apex; lower lip united for 0.75–1.25 mm, bearded; lobes narrowly oblong, 0.5–0.75 mm long, 0.1–0.2 mm wide, villous. Nut not seen. Fig. 114G.

Occurs in sandy soils between Albany and the Stirling Range east to Bremer Bay, W.A. Flowers Sept.–Nov. Map 281.

W.A.: South Stirlings, *F.Lullfitz 4081* (KPBG); Kalgan Plains, *J.H.Maiden* (NSW); near Albany, *G.Maxwell 78* (PERTH); between Chester Pass and Bluff Knoll, *J.S.Beard 7474* (PERTH); Stirling Ra., Nov. 1934, *C.A.Gardner* (PERTH).

### 39. Conospermum spectabile E.M.Benn., *Fl. Australia* 16: 486 (1995)

T: Ross Peak, Stirling Ra., W.A., 27 Nov. 1934, *C.A.Gardner*; holo: PERTH.

Shrub to 80 cm tall. Leaves terete, sigmoid, 15–22 mm long, 0.2–0.4 mm wide, spreading, with scattered hairs especially towards base. Inflorescence a terminal panicle of spikes; bracteoles deltoid, 4.5–7 mm long, 3–4 mm wide, blue, glabrous, ciliate, with an acute apex. Perianth white and blue; tube (5–) 7–10 mm long, woolly; upper lip broadly ovate, 1–1.5 mm long, 2.5–3 mm wide, glabrous, blue, ±recurved; lower lip united for 0.7–1 mm, pilose; lobes narrowly oblong to oblong, 0.25–0.5 mm long, 0.1–0.2 mm wide, recurved, pilose. Nut not seen. Fig. 114B–D.

Restricted to sandy soils in the Stirling Range, W.A. Flowers Oct.–Nov. Map 282.

W.A.: Stirling Ra., *E.M.Canning* (NSW); Redgum Pass, Stirling Ra., *B.G.Briggs* (NSW); Mt Toolbrunup, 14 Oct. 1902, *A.Morrison* (PERTH); Stirling Range Reserve, *F.A.Spratt 13* (PERTH).

*Conospermum spectabile* is restricted to sandy pockets in the western part of Stirling Range Natl Park. It can be readily distinguished from *C. floribundum* by the glabrous upper perianth lip and larger bracteoles.

## Subsect. 2. Sericea

**Conospermum** subsect. **Sericea** E.M.Benn., *Fl. Australia* 16: 482 (1995).

Type: *C. bracteosum* Meisn.

Inflorescence of axillary spikes in the upper leaves. Perianth lobes equal to or longer than the tube.

A subsection of 1 species.

### 40. Conospermum bracteosum Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 518 (1845)

T: in region. interior. Australiae meridionali-occidentalis [W.A.], Feb. 1841, *L.Preiss* 746; *n.v.*

Shrub to 1 m tall. Leaves ovate to obovate, 10–15 (–25) mm long, 6–15 (–20) mm wide; basal leaves petiolate; cauline leaves overlapping, sessile, ±amplexicaul, white-hirsute, ±glabrescent; apex acute; midvein and 2 lateral veins raised. Inflorescence of many, interrupted spikes from upper axils, to 10-flowered; axis white, woolly; bracteoles ovate, 5–7 mm long, 4–5 mm wide, white, densely hirsute. Perianth white, silky-woolly; tube 3.5–4 mm

long; upper lip linear to ovate, 2.75–3.25 mm long, 1–1.25 mm wide; inner surface maroon; apex recurved; lower lip united for 0.75–1 mm; lobes linear, 1.5–2 mm long, c. 0.5 mm wide; inner surface maroon, glabrous. Nut c. 3 mm long, c. 2 mm wide, golden-tomentose; circumference hairs 0.75–1 mm long, golden; central tuft of hairs c. 1.5 mm long, golden.

Widespread from Narrogin south-east to Ravensthorpe, W.A. Flowers Sept.–Nov. Map 283.

W.A.: 33 km W of L. Grace, *H.Demarz D6718* (KPBG); Pingrup, *W.E.Blackall 3099* (PERTH); Salt River Rd, Stirling Ra., *G.J.Keighery 6809* (PERTH); Tarin Rock Reserve, *E.M.Bennett 5196* (KPBG); near L. Wagin, 1895, *N.Cronin* (MEL).

## Subsect. 3. Ramosa

**Conospermum** subsect. **Ramosa** E.M.Benn., *Fl. Australia* 16: 482 (1995).

Type: *C. stoechadis* Endl.

Inflorescence a much-branched panicle axillary in the upper leaves. Flowers widely spaced.

A subsection of 8 species.

### 41. Conospermum microflorum E.M.Benn., *Fl. Australia* 16: 485 (1995)

T: 147.2 km N of Geraldton, W.A., 28 Aug. 1985, *E.M.Bennett 5097*; holo: PERTH; iso: CANB, K, MEL.

Rounded shrub 1–2 m tall. Leaves filiform, terete, 2.5–17 cm long, 0.4–1 mm wide, glabrous; apex brown, acute. Inflorescence a panicle of elongated spikes; peduncle 19–32 cm long, hirsute; bracteoles ovate, 1.3–2.5 mm long, 2–3 mm wide, densely tomentose; margin ciliate; apex cuspidate. Perianth white- or cream-tomentose; tube 2.5–5.5 mm long, swoollen at apex; upper lip ovate, 1.5–2.2 mm long, 0.8–1.2 mm wide, with a brown apex; lower lip united for 1–1.5 mm; lobes oblong, 0.4–0.6 mm long, 0.1–0.2 mm wide, with an acute apex. Nut 2–3 mm long, c. 1.6 mm wide, orange-brown-tomentose; circumference hairs 1.5–1.8 mm long, cream-orange; central tuft 1.8–2 mm long, pale orange.

Occurs between Murchison River Bridge and Shark Bay, W.A., with an isolated collection known from north of Mingenew. Flowers Sept.–Oct. Map 284.

W.A.: Shark Bay, Freycinet estuary, c. 15 km NE of Tamala, *J.Z.Weber 5048* (PERTH); Irwin District, 12 km N of Murchison R. bridge, along Highway 1, *J.Taylor, M.D.Crisp & R.Jackson T998* (CBG, PERTH); 96 km N of Northampton, *R.J.Hnatiuk 760466* (PERTH); 36 km S of Narran-Narran, *H.Demarz 10758* (KPBG).

Intermediate forms between *C. microflorum* and *C. stoechadis* may be seen at Kalbarri where their ranges overlap.

### 42. Conospermum stoechadis Endl., *Stirp. Herb. Hügel.* 3: 20 (1838)

T: in the vicinity of King George Sound [W.A.], *K.A.Hügel*; iso: MEL.

*Conospermum proximum* Gand., *Bull. Soc. Bot. France* 66: 231 (1919). T: Serpentine [W.A.], *Menzel 83*; lecto: LY, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 335 (1973); Albany, W.A., *Walter*; syn: NSW.

*Conospermum elegantulum* Gand., *Bull. Soc. Bot. France* 66: 231 (1919). T: lower Canning River [W.A.], 26 Oct. 1899, *A.Morrison*; holo: LY (photo seen).

Compact shrub to 2 m tall. Leaves filiform, ±linear, 2–17 cm long, 0.6–2.25 mm wide, glabrous or ±puberulous; apex acute. Inflorescence a spicate panicle; bracteoles ovate, 1.7–3 mm long, 1.5–3.2 mm wide, brown, densely velutinous, with a ±glabrous, cuspidate apex. Perianth white, woolly; tube 2.5–5.5 mm long; upper lip ovate, 1.6–3 mm long, 1–1.5 mm wide, tomentose; lower lip united for 1.2–2.2 mm; lobes narrowly oblong to oblong, 0.4–1 mm long, 0.2–0.3 mm wide. Nut 2–3.2 mm long, 2–3.5 mm wide, white-tomentose; circumference hairs c. 2.5 mm long, orange; central tuft 2–2.5 mm long, orange.

Widespread from Kalbarri south to Lake Grace and east to Southern Cross, W.A. Two subspecies are recognised.

Mature leaves glabrous, or with few scattered hairs **42a.** subsp. **stoechadis**

Mature leaves tomentose **42b.** subsp. **sclerophyllum**

### 42a. Conospermum stoechadis Endl. subsp. stoechadis

Illustration: W.R.Elliot & D.L.Jones, *Encycl. Austral. Pl.* 3: 70 (1984).

Leaves tomentose when young, becoming glabrous at maturity.

Widespread throughout south-western W.A., from Kalbarri east to Bungalbin Hill and south to Lake Grace. Flowers Aug.–Nov. Map 285.

W.A.: between No. 7 Pumping Station and Woolgangie, *G.E.Brockway 13* (PERTH); 5 km S of Byford, *G.J.Keighery 7050* (PERTH); 1.5 miles [c. 2.5 km] N of Cadoux, *B.H.Smith 118* (MEL).

Populations of this subspecies may show considerable variation in the thickness and length of the leaf.

### 42b. Conospermum stoechadis subsp. sclerophyllum (Lindl.) E.M.Benn., *Fl. Australia* 16: 486 (1995)

*Conospermum sclerophyllum* Lindl., *Sketch Veg. Swan R.* xxx (1839). T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; syn: CANB; Swan River [W.A.], *Mr Toward*; syn: CANB.

Leaves grey-tomentose at maturity.

Occurs from Jurien Bay east to Kulin and south to Wickepin, W.A. Flowers Sept.–Dec. Map 286.

W.A.: Jurien Bay Rd, N to Dandaragan, 29 Sept. 1951, *N.H.Specht* (PERTH); c. 30 km W of Moora, *D.J.E.Whibley 4868* (PERTH); 17 km E of Brookton, *R.J.Hnatiuk 790139* (PERTH); between Dandaragan and Badgingarra, 6 Oct. 1961, *J.H.Willis* (MEL); near Wundowie, *H.Salasoo 520* (NSW).

### 43. Conospermum canaliculatum Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 250 (1848)

*Conospermum stoechadis* var. *canaliculatum* (Meisn.) Benth., *Fl. Austral.* 5: 374 (1870). T: Swan River district [W.A.], *J.Drummond 2: 307*; holo: K; iso: MEL.

Dense, multistemmed shrub to 1 m tall. Leaves linear, 4–20 cm long, 2–4 mm wide, glabrous or tomentose, distinctly canaliculate above; margins distinct; apex conical; midvein raised on underside. Inflorescence a several-branched, spicate panicle in upper leaf axils; peduncle 10.5–15 cm long, puberulous to grey-sericeous; bracteoles 1.5–2.5 mm long, 1.5–2.25 mm wide, densely woolly at base, glabrous above, with an acuminate apex. Perianth white-woolly, with black or maroon inner surface; tube 3–3.5 mm long; upper lip ovate, 1–1.6 mm long, 1.75–2.25 mm wide, sericeous, woolly at base; lower lip united for 0.5–1 mm; lobes 0.75–1 mm long, 0.2–0.3 mm wide, woolly-tomentose. Nut 2–2.5 mm long, 2–2.25 mm wide, rusty brown-hirsute; circumference hairs 2–2.5 mm long, rusty brown or orange; central tuft 2–2.5 mm long.

Occurs from Perth north to Badgingarra, W.A.

This species regenerates from a lignotuber after fire. The broad-leaved form of this intergrades with the narrow-leaved form of *C. triplinervium.* Two subspecies are recognised.

Leaves glabrous **43a.** subsp. **canaliculatum**

Leaves grey-tomentose **43b.** subsp. **apiculatum**

### 43a. Conospermum canaliculatum Meisn. subsp. canaliculatum

Leaves glabrous, 13–20 cm long.

Occurs near Perth and Yanchep, W.A. Flowers Sept.–Nov. Map 287.

W.A.: Yanchep Natl Park, *A.M.James 6* (PERTH); Cannington, *J.S.Beard 1785* (PERTH); 4 miles [c. 6 km] NW of Gingin, *K.Newbey 1406* (PERTH).

### 43b. **Conospermum canaliculatum** subsp. **apiculatum** E.M.Benn., *Fl. Australia* 16: 483 (1995)

T: Badgingarra, W.A., 10 Sept. 1960, *L.Steenbohm*; holo: PERTH.

Leaves grey-tomentose, 4–7.5 cm long.

Occurs near Badgingarra, W.A. Flowers Sept.–Dec. Map 288.

W.A.: Dinner Hill, *F.Lullfitz 1918* (PERTH); just W of New Badgingarra, *D.J.E.Whibley 4848* (PERTH); Badgingarra Hall, 6 Oct. 1961, *J.H.Willis* (MEL).

### 44. **Conospermum triplinervium** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 11 (1830)

T: ora occid. merid., regio mont., prope King George's Sound [W.A.], 1829, *W.Baxter*; holo: BM.

*Conospermum laniflorum* Endl., *Stirp. Herb. Hügel* 3: 20 (1838). T: York, W.A., *J.S.Roe*; holo: W *n.v.*

Illustrations: A.Engler & K.Prantl, *Nat. Pflanzenfam.* 3(1): 140 (1894); W.R.Elliot & D.L.Jones, *Encycl. Austral. Pl.* 3: 71 (1984).

Small tree to 4 m tall; trunk grey with paler patches. Leaves oblanceolate to elliptic-oblong, 3–14 cm long, 3–13 mm wide, glabrous; apex acuminate; midvein, marginal and cross veins prominent. Inflorescence an elongated, spicate panicle, several from upper axils; peduncle 18–39 cm long, puberulous; bracteoles ovate, 2–2.6 mm long, 2–3 mm wide, velutinous, tomentose at base and sides, with an acuminate apex. Perianth greyish white, woolly, becoming pink in fruit; tube 2.5–4.2 mm long; upper lip ovate, acute, 1.8–2.2 mm long, 1–1.8 mm wide, puberulous at apex, woolly at base; lower lip united for 1–1.5 mm; lobes narrowly oblong, 0.7–1 mm long, 0.2–0.4 mm wide, obtuse. Nut 2.3–2.7 mm long, c. 2.5 mm wide, tan, cream- or orange-tomentose; circumference hairs 1.8–2.2 mm long, orange; central tuft of hairs to 2.5 mm long. Fig. 115C–D.

Previously occurred throughout the south-west from Albany to Yanchep, W.A., with an isolated collection known from Cunderdin; now common around Perth, but not in the far south-west. Flowers Mar., Sept.–Nov. Map 289.

W.A.: Kings Park, *A.R.Fairall 70* (KPBG); Katanning, *J.Scott* (NSW); Blackboy Hill, Cape Riche, 19 Nov. 1973, *C.Porter* (PERTH); 20 miles [32 km] S of Toolbrunup, Stirling Ra., *K.Newbey 1207* (PERTH); 1 km N of Wongonderrah Rd along Cowalla Peak Rd, Badgingarra, 15 Oct. 1978, *J.Dodd* (PERTH).

Most plants of this species lack a lignotuber and, while they are killed by fire, they readily regenerate from seed. Following the 1989 fire at Kings Park, a few plants were found to regenerate from lignotubers.

### 45. **Conospermum cinereum** E.M.Benn., *Fl. Australia* 16: 484 (1995)

T: 4.3 km E of Toolibin South Rd on Toolibin–Tincurrin road, W.A., 21 Oct. 1985, *E.M.Bennett 5240*; holo: PERTH; iso: CANB, MEL.

*Conospermum triplinervium* var. *minus* Meisn. ex Benth., *Fl. Austral.* 5: 375 (1870). T: locality unknown [W.A.], *J.Drummond 5: 401*; iso: MEL.

Spindly shrub to 1.5 m tall. Leaves ovate to lanceolate, 1.1–6.3 cm long, 1–10 mm wide, ascending, puberulous or glabrescent at maturity; apex deltoid; midvein and 2 lateral veins prominently raised. Inflorescence a loose, spicate panicle, exceeding leaves; peduncle 5.5–18 cm long, tomentose; bracteoles ovate, 2–2.6 mm long, 1.2–1.6 mm wide, velutinous at base and lower sides. Perianth white; tube 2.5–3.5 mm long, villous-woolly; upper lip 1.5–2.3 mm long, c. 1 mm wide, woolly, puberulous in upper half; lower lip united for 0.6–1.2 mm; lobes oblong, 0.8–1 mm long, 0.2–0.4 mm wide, tomentose to velutinous, with an acute apex. Nut 2.2–2.7 mm long, 2.2–2.4 mm wide, orange-brown-tomentose; circumference hairs c. 1.6 mm long, whitish pink; central tuft c. 2 mm long, red. Fig. 115A.

Occurs in sandy soils from Toolibin east to Kellerberrin and south to the Stirling Range, W.A. Flowers June–Oct. Map 290.

W.A.: 7 miles [c. 11.5] NE of Ongerup, *K.Newbey 1717* (PERTH); Dumbleyung, Nov. 1935, *C.A.Gardner* (PERTH); Toolibin, *E.M.Bennett 5250* (KPBG); Kellerberrin, Sept. 1897, *R.B.Leake* (PERTH).

Juvenile leaves are ovate, but become lanceolate at maturity. However, the collection from Kellerberrin has only ovate leaves. The degree of pubescence varies markedly between the collections. One plant collected in the Toolibin area is a hybrid between this species and *C. stoechadis*.

### 46. **Conospermum undulatum** Lindl., *Sketch Veg. Swan R.* xxxi (1839)

T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; holo: CBG (photo seen).

Erect, compact shrub to 1.5 m tall. Leaves ascending, oblanceolate to spathulate, 1.4–12 cm long, 4–38 mm wide, glabrous; margin undulate; apex acute; central and marginal veins prominent. Inflorescence an interrupted, spicate panicle; peduncle 25.5–40 cm long, puberulous to villous; bracteoles ovate, 2–3.1 mm long, 2–3 mm wide; base and sides densely tomentose; apex ±velutinous. Perianth white-woolly; tube 2.8–4.5 mm long; upper lip ovate, 1.8–2.4 mm long, 1–1.2 mm wide, glabrous, with an acute apex; lower lip united for 1–1.8 mm, woolly; lobes narrowly oblong, 0.5–1 mm long, 0.2–0.3 mm wide, woolly, with an acute apex. Nut c. 2.5 mm long, c. 3 mm wide, dark tan, velutinous; circumference hairs c. 1.8 mm long, orange; central tuft 1.8–2 mm long, pale orange. Fig. 115B.

Occurs in the foothills of the Darling Scarp, east of Perth, W.A. Flowers June–Oct. Map 291.

W.A.: Hardy Rd, Forrestfield, *R.J.Cranfield 123* (PERTH); Welshpool Rd, Cannington, *R.D.Royce 2631* (PERTH); Maida Vale, *T.E.H.Aplin 857* (PERTH); Boundary Rd, Wattle Grove, *R.G.Coveny 8072* (PERTH).

### 47. **Conospermum wycherleyi** E.M.Benn., *Fl. Australia* 16: 486 (1995)

T: Eneabba Creek, W.A., 27 Aug. 1948, *C.A.Gardner 9125*; holo: PERTH; iso: MEL, NSW.

Shrub to 1.1 m tall (when flowering), to 50 cm when vegetative. Leaves ±dense at base of inflorescence, oblanceolate to spathulate, 2–13 cm long, 3–21 mm wide, ascending, glabrous to velutinous or puberulous; apex acute; midvein and 2 lateral veins raised. Inflorescence a panicle of elongated spikes; peduncle 19–57 cm long, white, silky-velutinous and puberulous, occasionally glabrous; bracteoles 3–8.5 mm long, 2.4–6 mm wide, densely puberulous; apex cuspidate, dark brown, glabrous. Perianth white, woolly; tube 2–5.5 mm long; upper lip ovate, 2.25–3.5 mm long, 1.5–2.5 mm wide, puberulous, with a ±recurved apex; lower lip united for 1.5–2.5 mm; lobes narrowly oblong, 1–1.5 mm long, 0.2–0.3 mm wide, silky-villous. Nut 3–3.2 mm long, 2.5–2.75 mm wide, cream-coloured, hairy; circumference hairs to 2.5 mm long, cream to orange; central tuft 2.5–3 mm long, orange and cream.

Occurs in the vicinity of Badgingarra and Eneabba and north to Walkaway, W.A. There are 2 subspecies.

| | |
|---|---|
| Leaves puberulous to scattered-hairy; bracteoles 3–8.5 mm long | **47a.** subsp. **wycherleyi** |
| Leaves glabrous to velutinous; bracteoles 3–3.8 mm long | **47b.** subsp. **glabrum** |

### 47a. **Conospermum wycherleyi** E.M.Benn. subsp. **wycherleyi**

Leaves puberulous to scattered-hairy. Bracteoles 3–8.5 mm long. Upper lip of perianth c. 3.2 mm long; lower lip united for 2–2.5 mm.

Occurs near Eneabba, W.A. Flowers Sept. Map 292.

W.A.: 7 km S of Eneabba, *A.E.Griffin 953* (PERTH); Eneabba–Coorow area, *J.S.Beard 1923* (PERTH); Greenhead, *R.Edmiston 317* (PERTH).

### **47b. Conospermum wycherleyi** subsp. **glabrum** E.M.Benn., *Fl. Australia* 16: 486 (1995)

T: 6 km S of Lake Indoon turn-off on Brand Hwy, W.A., 27 Aug. 1985, *E.M.Bennett 5071*; holo: PERTH; iso: MEL, NSW.

Leaves glabrous to velutinous. Bracteoles 3–3.8 mm long. Upper lip of perianth 2.25–2.5 mm long; lower lip united for 1.25–1.5 mm. Fig. 66.

Occurs between Lake Logue and Walkaway, W.A. Flowers July–Oct. Map 293.

W.A.: South Arrowsmith R., c. 15 miles [c. 24 km] N of Eneabba, *A.C.Burns 128* (PERTH); 12 km N of Eneabba, *H.Demarz 7769* (PERTH); N of Arrowsmith R., 31 km N of Eneabba, *R.J.Hnatiuk 760260* (PERTH).

### **48. Conospermum boreale** E.M.Benn., *Fl. Australia* 16: 483 (1995)

T: c. 5 km S of Kalbarri on Northampton road at turn-off to Eagle Point, W.A., 17 July 1987, *E.M.Bennett 5300*; holo: PERTH; iso: CANB, MEL.

Much-branched, erect shrub 1–1.5 m tall. Leaves ascending or spreading, ovate to elliptic to oblanceolate, 5.7–9.6 cm long, 6–10 mm wide, thin, glabrous, narrowing to a ±petiolate base; apex conical; midvein and 2 lateral veins ±prominent. Inflorescence a panicle of interrupted spikes; peduncle 8–12 cm long, glabrous or with short, scattered hairs; bracteoles deltoid, 2.5–3 mm long, 2–2.5 mm wide; base and sides woolly; apex acute to acuminate, glabrous or with short scattered hairs ±velutinous. Perianth white-woolly; tube 3.5–4 mm long; upper lip rotund, 1.5–2 mm long, 1.75–2 mm wide; white-tomentose, woolly at base; apex acute; lower lip united for 0.75–1 mm; lobes narrowly oblong to oblong, 0.5–0.75 mm long, 0.1–0.2 mm wide. Mature fruit not seen.

Occurs from Kalbarri south to Badgingarra, W.A.

This species most closely resembles *C. triplinervium* but differs in the plants being multistemmed and in its ability to regenerate from a lignotuber after fire. Two subspecies are recognised.

| | |
|---|---|
| Leaves spreading | **48a.** subsp. **boreale** |
| Leaves ascending | **48b.** subsp. **ascendens** |

### **48a. Conospermum boreale** E.M.Benn. subsp. **boreale**

Leaves soft, spreading, with 3 obvious nerves. Peduncle and primary inflorescence branches glabrous or puberulous.

Occurs between Eneabba and Kalbarri, W.A. Flowers Aug.–Nov. Map 294.

W.A.: 24 miles [40 km] NW of Kalbarri turn-off on North-West Coastal Hwy, *A.C.Beauglehole 11959* (MEL, NSW, PERTH); 28.2 km from Port Gregory along Yerina Springs road, *N.Sammy* (PERTH); Meannarra Drive, Kalbarri, *J.D'Alonzo 646* (PERTH); Howatharra Hill, *D. & N.McFarland 1019* (PERTH).

### **48b. Conospermum boreale** subsp. **ascendens** E.M.Benn., *Fl. Australia* 16: 483 (1995)

T: 11 km from Great Northern Highway on Tathra–Carnamah road, W.A., 30 Aug. 1985, *E.M.Bennett 5143*; holo: PERTH.

Leaves ascending, with a persistent conical apices. Peduncle and first inflorescence branches glabrous.

Occurs from Eneabba north to Geraldton, W.A. Flowers Aug.–Oct. Map 295.

W.A.: Central Greenough, *M.Koch 2141* (PERTH); 16 miles [26 km] W of Winchester on road to Eneabba, *E.M.Bennett 1396* (PERTH); Three Springs, S of L. Logue, *C.A.Gardner 9396* (PERTH).

## Subsect. 4. Multibracteata

**Conospermum** subsect. **Multibracteata** E.M.Benn., *Fl. Australia* 16: 482 (1995).

Type: *C. incurvum* Lindl.

Inflorescence terminal, exceeding leaves. Peduncle with numerous sterile bracts.

A subsection of 4 species.

### 49. Conospermum incurvum Lindl., *Sketch Veg. Swan R.* xxx (1839)

T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; holo: CGE *n.v.*

Sparsely branched, ±prostrate shrub to 1 m tall. Leaves densely arranged, terete, 7–30 mm long, 0.5–0.8 mm wide, incurved, sigmoid; apex acute. Inflorescence a terminal panicle of elongated spikes; peduncle 5–40 cm long, tomentose; bracts numerous; bracteoles deltoid, 2.2–3.5 mm long, 2–3 mm wide, dark blue, glabrous but woolly at base; midvein raised; apex acute. Perianth white, woolly; tube 4–7 mm long; hairs ±spreading, retrorse; upper lip ovate, 2–3 mm long, 1–1.5 mm wide, blue, glabrous but woolly at base; lower lip united for 1.2–2 mm; lobes narrowly oblong to oblong, 0.5–0.7 mm long, 0.15–0.2 mm wide, acute, recurved. Nut not seen . Figs 67, 115E.

Common in the sandplains between Perth and Eneabba, W.A. Flowers July–Nov. Map 296.

W.A.: Moore River Natl Park, *R.D.Royce 9484* (PERTH); between Yanchep and L. Pindar, Sept. 1934, *K.Barker* (PERTH); 25 miles [40 km] W of Winchester, towards Eneabba, *E.M.Bennett 1401* (PERTH); Moore River Natl Park, *R.J.Cranfield 9205* (PERTH); near Regans Ford, *J.S.Beard 1819* (KPBG).

Although there is variation in the regularity of the incurving and density of the leaves, this species is more densely-leaved than *C. brachyphyllum.*

### 50. Conospermum brachyphyllum Lindl., *Sketch Veg. Swan R.* xxxi (1839)

T: Swan River district [W.A.], *J.Drummond 35*; iso: K.

*Conospermum brachyphyllum* var. *laxiflorum* Benth., *Fl. Austral.* 5: 374 (1870). T: Swan River district [W.A.], 1839, *J.Drummond*; holo: K.

*Conospermum brachyphyllum* var. *rigidum* Benth., *Fl. Austral.* 5: 374 (1870). T: Swan River district [W.A.], *J.Drummond 35*; holo: K

Open shrub to 1 m tall. Leaves filiform, 2.2–5.5 cm long, 0.4–0.75 mm wide, ascending, ±incurved, occasionally sigmoid, canaliculate, acuminate. Inflorescence a panicle of spikes; axis an extension of the branch; peduncle 1.5–8 cm long, tomentose; bracteoles ovate, 2.5–4 mm long, 1.8–3 mm wide, bluish brown, glabrous but woolly at base and sides; apex cuspidate. Perianth white, woolly, with retrorse hairs; tube 3–9 mm long; upper lip ovate, 2–3 mm long, 0.8–1.3 mm wide, blue, glabrous; base woolly with an acute, recurved apex and usually with tuft of hairs at margin; lower lip united for 1.5–2.8 mm; lobes oblong, 0.3–0.7 mm long, 0.2–0.4 mm wide, acute, recurved. Nut not seen. Fig. 115F.

Occurs between Moora and Geraldton, W.A. Flowers Aug.–Oct. Map 297.

W.A.: Burma Rd, SE of Geraldton, *A.C.Burns 44* (PERTH); Arrino, Arrowsmith R., *W.D.Campbell 23* (PERTH); Badgingarra Natl Park, 1.4 km W on Cadda Rd, *N.Hoyle 740* (PERTH); 155 mile peg on Mullewa–Morawa road, *A.R.Fairall 1389* (KPBG); 60 km N of Moora, *E.M.Bennett 5145* (KPBG).

The panicle often has several main branches arising from the main inflorescence axis. These branches are commonly racemose but occasionally paniculate. Plants with varying flower density may grow adjacent to one another.

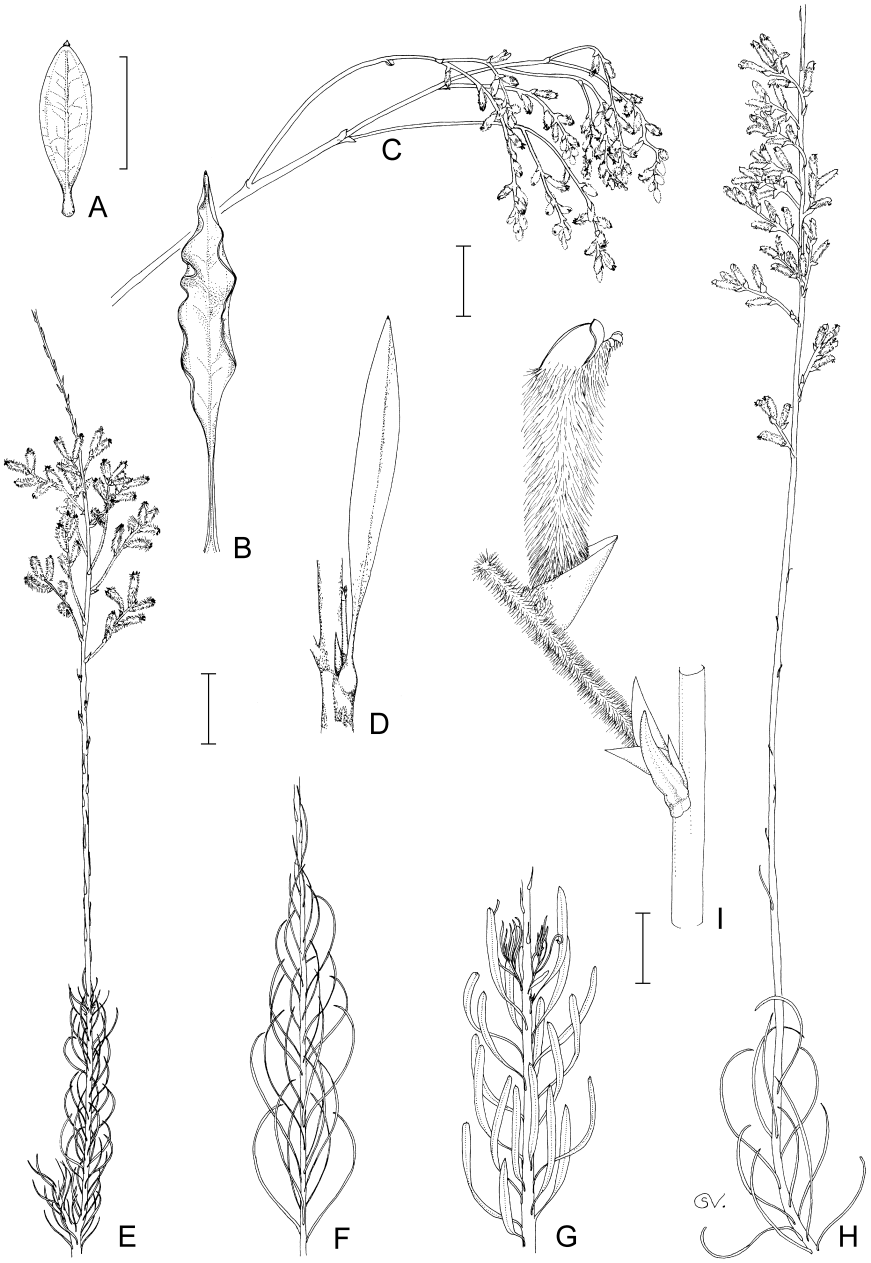



**Figure 115**. *Conospermum*. **A**, *C. cinereum*, leaf (E.Bennett 5249, PERTH). **B**, *C. undulatum*, leaf (E.Bennett 5227, PERTH, KPBG). **C–D**, *C. triplinervium*. **C**, inflorescence; **D**, leaf (**C–D**, E.Bennett 5252, PERTH, KPBG). **E**, *C. incurvum*, flowering stem (J.Havel 133, PERTH). **F**, *C. brachyphyllum*, stem with leaves (R.Royce 9535, PERTH). **G**, *C. unilaterale*, stem with leaves (E.Bennett 5066, PERTH, KPBG). **H–I**, *C. galeatum*. **H**, flowering stem; **I**, flower on spike (**H–I**, between Bruce Rock and Narembeen, W.A., W.Blackall, PERTH). Scale bars: **A** = 4 cm; **B**, **C**, **E–H** = 2 cm; **D** = 1 cm; **I** = 2 mm. Drawn by C.Vasiliu.

**51. Conospermum unilaterale** E.M.Benn., *Fl. Australia* 16: 486 (1995)

T: 1.2 km N from Lake Indoon turn-off on Brand Hwy, W.A., 27 Aug. 1985, *E.M.Bennett 5073*; holo: PERTH; iso: CANB, MEL.

Compact or open shrub to 70 cm tall. Leaves spathulate, 1.2–4.8 cm long, 0.7–2.5 mm wide, ascending, ±incurved; apex acute; margin and midvein raised. Inflorescence a panicle of spikes; rachis a continuation of the branch; peduncle 8–35 cm long, tomentose; bracts numerous; bracteoles ovate, 2.2–4 mm long, 2–3 mm wide, glabrous, woolly at base; midvein raised; apex acute. Perianth white, woolly; tube 6–10.5 mm long; hairs spreading; upper lip ovate, 2–2.6 mm long, 1–1.5 mm wide, blue, glabrous, woolly at base, acute, recurved; lower lip united for 1.5–1.8 mm; lobes narrowly oblong to oblong, 0.4–0.7 mm long, 0.2–0.3 mm wide, recurved. Nut 1.8–2.7 mm long, 1.6–2.8 mm wide, golden-tomentose; circumference hairs 1.5–2 mm long, golden; central tuft, c. 2 mm long, golden-cream. Fig. 115G.

Occurs in the Badgingarra–Eneabba area of the northern sandplain, W.A. Flowers Aug.–Oct. Map 298.

W.A.: 2.2 miles [4 km] W turn-off from Brand Hwy, on Jurien Bay road, near Mt Benia, *G.J.Keighery 2196* (PERTH); Irwin District, 16 km N of Hill River Bridge, along Brand Hwy, *J.Taylor 942, M.D.Crisp & R.Jackson* (PERTH); c. 2 km E of L. Indoon, *R.J.Hnatiuk 771031* (PERTH); 40–45 km SW of Three Springs, on Eneabba road, *D.B.Foreman 542* (MEL, NSW).

**52. Conospermum galeatum** E.M.Benn., *Fl. Australia* 16: 485 (1995)

T: between Bruce Rock and Narembeen, W.A., Sept. 1929, *W.E.Blackall*; holo: PERTH.

Open shrub to 70 cm tall. Leaves filiform, 4–5 cm long, c. 0.5 mm wide, curved, canaliculate, acute. Inflorescence a panicle of spikes; axis an extension of the branch; peduncle 16–20 cm long, glabrous, striate; rachis glabrous; bracteoles ovate, 2.5–3 mm long, 2–3 mm wide, blue, woolly at base and sides, acute. Perianth white, woolly; tube 5–8 mm long; upper lip ovate, 1–1.5 mm long, c. 2 mm wide, blue, glabrous, with ±scattered white hairs on midline, woolly at base; apex acute, recurved; lower lip united for c. 1 mm; lobes oblong, 0.75–1 mm long, 0.25 mm wide, short- woolly, recurved. Nut not seen. Fig. 115H–I.

Occurs between Bruce Rock, Narembeen and Kellerberrin, W.A. However, this species has not been collected since 1966. Flowers Aug.–Sept. Map 299.

W.A.: Kellerberrin, Sept. 1897, *R.B.Leake* (PERTH); Goldfields, 200 miles [c. 320 km] from York, *leg. ign.* (MEL); 2.5 miles [c. 4 km] W of Tammin, *K.Newbey 1944* (PERTH).

## Subsect. 5. Pedunculata

**Conospermum** subsect. **Pedunculata** E.M.Benn., *Fl. Australia* 16: 482 (1995).

Type: *C. crassinervium* Meisn.

Inflorescence terminal, arising from basal leaves. Peduncle with few sterile bracts.

A subsection of 1 species.

**53. Conospermum crassinervium** Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 317 (1856)

T: Swan River district [W.A.], *J.Drummond 4: 270*; iso: MEL, PERTH.

Low, tufted shrub to 1.5 m tall in flower, c. 50 cm tall when vegetative. Leaves basal, clustered, spreading; petiole 1.5–16 cm long; base ciliate; lamina linear, 3.8–30 cm long, 1.5–15 mm wide, tomentose; midvein, lateral and interconnecting veins raised on undersurface, depressed on upper. Inflorescence a corymb of spikes; peduncle 60–130 cm long, tomentose; bracteoles lanceolate, 5–9 mm long, 1–2.5 mm wide, white-tomentose. Perianth white, villous; tube 1.3–3.5 mm long; upper lip villous; inner surface maroon-brown, glabrous; apex with tuft of longer hairs; lower lip united for 2–3.75 mm; lobes

narrowly oblong to oblong, 1–1.6 mm long, 0.25 mm wide; apex with tuft of hairs. Nut 2.5–3 mm long, 2–2.75 mm wide; circumference hairs c. 1 mm long, tan; apex white-tomentose with a red exudate. Fig. 68.

Occurs in the sandplain area from Bullsbrook north to Eneabba, W.A. Flowers Nov.–Jan. Map 300.

W.A.: 4 km S of Cockleshell Gully, *G.J.Keighery 4605* (PERTH); W of Badgingarra, *A.S.George 141* (PERTH); Moora, *C.H.Ostenfeld 687* (NSW); 40 mile peg, Great Northern Hwy, N of Perth, *J.S.Beard 2509* (KPBG); inland from Jurien Bay, *R.Filson 84* (MEL).

## 13. SYNAPHEA

*A.S.George*

*Synaphea* R.Br., *Trans. Linn. Soc. London* 10: 155 (1810); from the Greek *synaphe* (a connection), in reference to the column connecting the stigma and the sterile filament.

Type: *S. polymorpha* R.Br.; lecto, *fide* A.S.George, *Fl. Australia* 16: 487 (1995).

Small shrubs. Adult leaves usually pinnatipartite, sometimes pinnate, simple or little-divided; petiole with sheathing base; secondary venation a fine reticulum. Flowers bisexual, in terminal or axillary spikes, each solitary, subtended by a bract. Perianth tubular, zygomorphic, yellow, opening in upper third to half; adaxial tepal longest and broadest, hooded; lateral 2 falcate; abaxial smallest, usually with a small, reflexed tip. Stamens on short, thick filaments; adaxial sterile; 2 lateral 1-locular; abaxial 2-locular; pollen ejected mechanically. Stigma plate-like or narrow, usually 2-lobed and with a narrow, semitranslucent border, dorsally attached from its base to sterile filament by a narrow column; ovary 1-locular, sessile, in all but 1 species with an apical ring of large, translucent glands; ovule 1. Fruit an obovoid, ellipsoidal or cylindrical, crustaceous nut.

Endemic in south-western W.A. A genus of 50 species here recognised, but research is continuing towards resolving several species complexes as well as the infrasectional classification in sect. *Synaphea*.

Plants sometimes with fire-tolerant rootstock, sometimes suckering. Leaf morphology is extraordinarily varied whereas flower colour is relatively uniform. First seedling and regrowth leaves (in species for which these stages are known) are always simple and entire. In many species, particularly those with inflorescences greatly exceeding the foliage, the spikes elongate markedly during development; in the descriptions below, length of spike and flower density are taken at an early- to mid-flowering stage. The flowers are scentless or in some species possibly faintly scented. At anthesis the anthers and stigma are held tightly together under tension; on being touched, the stigma flicks across and the pollen is ejected (as in *Conospermum*). Thus the style end is not a passive pollen presenter as in many Proteaceae. The purpose of the translucent glands on the apex of the ovary is unknown. Pollinators are also unknown. Seed set in most species, even fire-sensitive ones, is low.

For the leaves, only those of flowering stems are described. Upper leaves are usually smaller than lower. In addition to general shape and division, the three-dimensional form of the leaf varies between species: the terms 'flat', 'undulate' and 'multiplanar' are used, the last for leaves in which the lobes (which may be flat or concave) are held in various planes. The appearance of the reticulate leaf venation is described from the dried state when differences between species are more marked than in the fresh state. The tip of the abaxial tepal is usually reflexed and is described only when there is a significant difference from that state. Measurements of floral parts were taken from pickled or soaked flowers. The length of the stigma includes the apical lobes or horns.

A.S.George, *Intr. Proteaceae W. Australia* 104–107 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 532–536 (1989).

## KEY TO SECTIONS

**1** Stigma divided to half-way or more into 2 narrow, erect or incurved horns; leaves cuneate, obovate or oblanceolate, entire or acutely dentate or shortly lobed — sect. 2. **BICORNIS**

**1:** Stigma entire, 2-lobed or emarginate at apex, sometimes 2-horned but then either less than half-way and with leaves deeply divided with obtuse (rarely acute) lobes or the horns divergent

**2** Leaves pinnatisect — sect. 4. **PINNATA**

**2:** Leaves pinnatipartite, cuneate or simple

**3** Ovary with apical ring of translucent glands — sect. 1. **SYNAPHEA**

**3:** Ovary without apical glands — sect. 3. **OULOPHA**

## KEY TO SPECIES

**1** Stigma divided to half-way or more into 2 narrow horns

**2** Leaf lamina deeply divided into linear to lanceolate, obtuse (rarely acute) lobes

**3** Shrub to 60 cm tall; petiole to 20 cm long; peduncle to 35 cm long; fruit 5–6 mm long [Perth to Busselton and E to Cape Arid] — **38. S. petiolaris**

**3:** Shrub to 1 m tall; petiole often 20–30 cm long; peduncle to 60 cm long; fruit 8–9 mm long [Scott R.] — **37. S. nexosa**

**2:** Leaf lamina entire to dentate or shortly lobed with triangular lobes

**4** Leaves obovate to oblanceolate

**5** Adaxial tepal 4.2 mm long; spikes greatly exceeding leaves [Busselton area] — **38. S. petiolaris**

**5:** Adaxial tepal 6–6.5 mm long; spikes not or only shortly exceeding leaves

**6** Leaves finely pitted; bracts 1.5 mm long; stigma 1.2–1.5 mm long [Rocky Gully to Bremer Bay] — **46. S. favosa**

**6:** Leaves shallowly reticulate; bracts 3–3.5 mm long; stigma 1.5–2 mm long [Yallingup to Kojonup] — **48. S. floribunda**

**4:** Leaves cuneate

**7** Stigmatic horns divergent [York to Collie] — **42. S. cuneata**

**7:** Stigmatic horns erect or incurved

**8** Leaves concolorous; bracts 2.5–3 mm long; stigma 1.5–2 mm long [Albany to Stirling Ra. and Fitzgerald R.] — **45. S. reticulata**

**8:** Leaves discolorous; bracts 3–6 mm long; stigma 1.7–2.5 mm long [Busselton, Collie] — **47. S. hians**

**1:** Stigma entire to emarginate or 2-lobed to less than a half

**9** Leaves pinnatisect [Darling Scarp E of Perth] — **50. S. pinnata**

**9:** Leaves pinnatipartite, deeply forked, cuneate or flabelliform, sometimes simple

**10** Ovary without apical glands [NE of Eneabba] — **49. S. oulopha**

**10:** Ovary with an apical ring of translucent glands

**11** Leaves once or twice bifurcate [E of Hyden] — **14. S. bifurcata**

**11:** Leaves otherwise

**12** Leaves cuneate, flabelliform, narrowly obovate or lanceolate in outline, entire or dentate or lobed to less than one third lamina length

**13** Adaxial tepal 6.5–7.5 mm long; abaxial tepal 6–6.5 mm long **8. S. incurva**

**13:** Adaxial tepal 3–6.5 mm long; abaxial tepal 2.8–5.5 mm long

**14** Leaves entire or 2–3-lobed, obtusely rounded, not mucronate or pungent [S of Wickepin] **36. S. platyphylla**

**14:** Leaves dentate or multi-lobed, the lobes acute or obtuse, usually mucronate or pungent

**15** Adaxial tepal 3–3.5 mm long [Toodyay to Narrogin and Wickepin] **40. S. flabelliformis**

**15:** Adaxial tepal 5–6.5 mm long

**16** Stigma 1.5 mm long [N of L. Muir] **44. S. decumbens**

**16:** Stigma 0.7–1.1 mm long

**17** Leaves broadly cuneate in outline but 3-lobed; primary lobes also with 2 or 3 dentate lobes; stigma lunate [Nannup area] **39. S. otiostigma**

**17:** Leaves flabelliform, dentate to shortly lobed across apex; stigma trapeziform or transversely oblong

**18** Leaf lamina to 10 cm long; peduncle to 12 cm long; stigma shallowly notched [Armadale to Dryandra and Collie] **41. S. damopsis**

**18:** Leaf lamina to 18 cm long; peduncle to 30 cm long; stigma prominently 2-lobed [lower Blackwood R.] **43. S. macrophylla**

**12:** Leaves pinnatipartite or tripartite or widely forked or divided

**19** Inflorescence not or shortly exceeding foliage; peduncles all or mostly less than 10 cm long, often less than 5 cm

**20** Stems usually less than 20 cm long; at least some petioles 7 cm or longer

**21** Stigma 1.5–2 mm long

**22** Leaf lobes ±triangular to lanceolate, acute; abaxial tepal 6 mm long [Albany to Stirling Ra.] **34. S. preissii**

**22:** Leaf lobes broadly linear, usually obtusely rounded; abaxial tepal 5–5.5 mm long [Collie to Walpole and Albany, also Lort R.] **35. S. obtusata**

**21:** Stigma 0.6–1.1 mm long

**23** Stigma 0.3–0.4 mm wide [Moora area] **7. S. quartzitica**

**23:** Stigma 0.7–1.2 mm wide

**24** Leaves 3–5 times forked, the lobes curved to flexuose; perianth ±horizontal [Kulin, Nyabing] **16. S. flexuosa**

**24:** Leaves pinnatipartite or once or twice tripartite, the lobes usually straight; perianth ascending

**25** Adaxial tepal 4.8–6 mm long; abaxial tepal 3.5–4.2 mm long

**26** Leaves mostly tripartite, the primary lobes also often tripartite, ±flat [S of Hyden] **12. S. tripartita**

**26:** Leaves pinnatipartite, ±multiplanar or very undulate

**27** Ultimate leaf lobes linear to lanceolate; adaxial tepal 1.5–2 mm wide; stem appressed-tomentose [Wubin to Frank Hann Natl Park] **18. S. interioris**

**27:** Ultimate leaf lobes broadly triangular; adaxial tepal 2–2.3 mm wide; stem hirsute and spreading-tomentose [Quairading, Corrigin and Katanning] **24. S. drummondii**

**25:** Adaxial tepal 3.5–4.8 mm long; abaxial tepal 2.8–3.1 mm long

**28** Inflorescence few-flowered, well within foliage [S coast E from Fitzgerald R.] **15. S. oligantha**

**28:** Inflorescence many-flowered, at least partly exserted beyond foliage

**29** Leaves multiplanar; peduncle 1–3 cm long; adaxial tepal 4–4.2 mm long [Tarin Rock to Lake Grace] **11. S. parviflora**

**29:** Leaves ±flat; peduncle 2.5–12 cm long; adaxial tepal 4.4–4.8 mm long [Frank Hann Natl Park to Israelite Bay] **17. S. divaricata**

**20:** Stems usually 30–50 cm long; petiole usually less than 4 cm long, rarely some to 8 cm

**30** All leaf lobes 0.5–1.5 mm wide, very concave or channelled above

**31** Perianth glabrous; stigma oblong, 0.4 mm wide [S of Rocky Gully] **10. S. intricata**

**31:** Perianth hairy at least in lower half; stigma ovate, obovate, elliptic, transversely oblong or square, 0.7–1 mm wide

**32** Adaxial tepal 5 mm long [Eneabba to Dowerin] **1. S. spinulosa**

**32:** Adaxial tepal 3.8–4.6 mm long [E of Newdegate] **5. S. canaliculata**

**30:** At least primary leaf lobes 2–7 mm wide, if narrower then flat or almost so

**33** Stigma 0.5–0.6 mm wide, constricted in middle; rachis glabrous or sparsely puberulous [Wongan Hills to Bendering] **13. S. constricta**

**33:** Stigma 0.7–1.7 mm wide, not or slightly constricted; rachis clearly hairy

**34** Stigma 1.4–1.8 mm long [Albany to Fitzgerald River Natl Park] **9. S. polymorpha**

**34:** Stigma 0.7–1.2 mm long

**35** Stigma minutely emarginate [Mt Lesueur area] **21. S. lesueurensis**

**35:** Stigma broadly and shallowly emarginate to 2-lobed

**36** Leaves ±flat, with flat lobes; perianth glabrous, glabrous in upper half only, or sparsely pilose [S of Hyden]

**37** Leaf lobes prominently acuminate; adaxial tepal 1.5–1.8 mm wide; stems silky, glabrescent **6. S. cervifolia**

**37:** Leaf lobes shortly acute to obtuse; adaxial tepal 2–2.2 mm wide; stems tomentose **12. S. tripartita**

**36:** Leaves multiplanar to undulate with concave lobes; perianth pubescent to puberulous, sometimes glabrous towards apex

**38** Peduncle 4–9 cm long [Coomallo to Badgingarra] **2. S. endothrix**

**38:** Peduncle 1–3.5 cm long

**39** Stigma ovate to obovate or transversely elliptic [widespread, Kalbarri to Esperance] **1. S. spinulosa**

**39:** Stigma oblong-trapeziform with slight median constriction [S coast, Cheyne Beach to Howick Hill] **3. S. media**

**19:** Inflorescence much exceeding foliage; peduncle elongated, usually more than 10 cm long

**40** Stigma horned, deeply lobed or broadly V-shaped

**41** Stigmatic lobes reflexed; adaxial tepal 6–6.5 mm long [Northampton area] **28. S. recurva**

**41:** Stigmatic lobes erect; adaxial tepal 3.5–5.5 mm long

**42** Leaf lobes rounded [Darling Ra.] **38. S. petiolaris**

**42:** Leaf lobes acute

**43** Leaf lobes concave; adaxial tepal 4.5–5 mm long [Pinjarra] **26. S. stenoloba**

**43:** Leaf lobes flat; adaxial tepal 3.5–4 mm long [Byford, Serpentine and S of Bunbury] **27. S. odocoileops**

**40:** Stigma emarginate to entire

**44** Stigma 1.3–2.2 mm long

**45** Stigma not incurved at apex; spikes 2–3 cm long [Whicher Ra.] **33. S. whicherensis**

**45:** Stigma incurved at apex; spikes longer than 3 cm

**46** Stigma 1.6–1.7 mm wide; abaxial tepal 4.5 mm long [Boyagin] **32. S. boyaginensis**

**46:** Stigma 1–1.3 mm wide; abaxial tepal 5–6.5 mm long

**47** Abaxial tepal 5 mm long; all leaves pinnatipartite; stems pubescent [Muchea to Bindoon] **29. S. grandis**

**47:** Abaxial tepal 6–6.5 mm long; usually pinnatipartite and simple and/or few-lobed leaves present; stems pilose and pubescent [Albany area] **8. S. incurva**

**44:** Stigma 0.7–1.2 mm long

**48** Ovary glabrous or with a few hairs at base [Mogumber to Calingiri] **20. S. rangiferops**

**48:** Ovary hairy throughout or in lower half

**49** Perianth ±horizontal; stigmatic lobes reflexed [Northampton area] **28. S. recurva**

**49:** Perianth ascending; stigmatic lobes erect [S of Mt Adams]

**50** Petiole always 7 cm long or less

**51** Stigma ovate, minutely emarginate; adaxial tepal 3.8–5 mm long [Mt Lesueur area] **21. S. lesueurensis**

**51:** Stigma obovate, broadly and shallowly emarginate; adaxial tepal 5.5–6 mm long [Coomallo–Badgingarra] **2. S. endothrix**

**50:** At least some petioles 8–20 cm long or more

**52** Bracts 2.5–3 mm long [near Eneabba and Gillingarra] **4. S. sparsiflora**

**52:** Bracts 0.8–2 mm long

**53** Abaxial tepal 2.3–2.5 mm long; stigma 0.7–0.8 mm wide [Darling Scarp E of Perth] **25. S. acutiloba**

**53:** Abaxial tepal 3–4.5 mm long; stigma 0.9–1.6 mm wide

**54** Leaves somewhat flabelliform or cuneate in outline; stem and petiole hirsute

**55** Stigma ±orbicular to ovate, emarginate [between Quairading, Corrigin and Katanning] **24. S. drummondii**

**55:** Stigma broadly lunate, the lobes somewhat bent back [Nannup area] **39. S. otiostigma**

**54:** Leaves not flabelliform or cuneate in outline; stem and petiole pubescent, puberulous, tomentose or ±glabrous

**56** Leaves finely and deeply reticulate; fruit c. 2 mm long [rare, Tammin area] **19. S. tamminensis**

**56:** Leaves broadly and shallowly reticulate; fruit (where known) 4–7 mm long

**57** Stigma almost square to obtrapeziform, 0.9–1.1 mm long, 1.5–1.6 mm wide; adaxial tepal 5.5–6 mm long, 2.5 mm wide; abaxial tepal 4 mm long; leaves glaucous [Chittering to Collie] **30. S. decorticans**

**57:** Flowers not as above; leaves not glaucous

**58** Leaf lobes rounded at apex [Walpole to E of Esperance] **38. S. petiolaris**

**58:** Leaf lobes acute to pungent, or if obtuse then not rounded

**59** Stigma orbicular to broadly ovate, 1 mm long, 0.9–1 mm wide; adaxial tepal 2–2.2 mm wide; bracts 1.5–1.8 mm long; leaves drying yellowish [Eneabba to Gillingarra] **22. S. aephynsa**

**59:** Stigma transversely oblong-lunate or obtrapeziform; adaxial tepal 1.5–2 mm wide; bracts 1–1.5 mm long; leaves not drying yellowish

**60** Ultimate leaf lobes linear to narrowly lanceolate, obtuse to acute; stigma transversely oblong-lunate, 0.8–1 mm long, 1–1.5 mm wide; abaxial tepal 3.5–4.5 mm long [common, Bindoon to Margaret R. and Albany] **23. S. gracillima**

**60:** Ultimate leaf lobes triangular, acute to pungent; stigma obtrapeziform, 0.7–0.9 mm long, 0.9–1 mm wide; abaxial tepal 3 mm long [Bindoon to Mogumber] **31. S. panhesya**

## Sect. 1. Synaphea

**Synaphea** R.Br. sect. **Synaphea**.

Leaves commonly pinnatipartite but in some taxa deeply lobed or simple, sometimes dentate or shortly lobed. Stigma variously ovate, oblong, trapeziform or elliptic, usually emarginate or 2-lobed to less than a third, in some taxa entire, sometimes 2-horned but then either less than half-way or the horns divergent; ovary with an apical ring of large, translucent glands.

A section of 44 species of diverse form, loosely united in having an entire to emarginate or shortly horned stigma.

## 1. Synaphea spinulosa (Burm.f.) Merr., *Proc. Linn. Soc. New South Wales* 44: 354 (1919)

*Polypodium spinulosum* Burm.f., *Fl. Indica* 233, t. 67, fig. 1 (1768). T: from Java (in error), by deduction, from near Swan R., [south-western W.A.], date and coll. unknown, *possibly from the Vlaming voyage, 1697*; holo: G.

Illustration: A.S.George, *Intr. Proteaceae W. Australia* 105, pl. 156 (1984).

Stems several, to 50 cm long, appressed- or spreading-pubescent, often also loosely hirsute, glabrescent. Leaves widely tripartite, very undulate or multiplanar; petiole usually 0.5–2 cm long; lamina 2–7 cm long, 3–7 cm wide, puberulous or pilose, often glabrescent; primary lobes usually tripartite; ultimate lobes triangular, 1.5–5 mm wide, usually pungently 1–3-dentate, shallowly to deeply concave; reticulation open, shallow. Spikes in upper axils, 2–5 cm long; flowers ±crowded; peduncle 1–3 cm long, usually branched, tomentose to pubescent; rachis pubescent; bracts ovate, 1.5–4.5 cm long, ascending, acute, hirsute to pubescent or pilose. Perianth usually opening narrowly, puberulous to pubescent; adaxial tepal 4.4–7 mm long, 1.4–3 mm wide; abaxial tepal 3.5–5.5 mm long. Stigma ±broadly ovate or obovate to transversely elliptic, shallowly emarginate, 0.7–1 mm long and wide, ±flat; ovary pubescent or silky. Fruit ellipsoidal to cylindrical, prominently beaked, 3.5–5 mm long, hirsute.

Widespread between Kalbarri and Bunbury and inland through the central and southern wheatbelt to Esperance, W.A.

One of the first 2 species of Australian plants named under the Linnaean binomial system. Although Robert Brown recognised that Burman's name applied to a species of *Synaphea* he placed it in synonymy under *S. petiolaris* and it remained for Merrill to make the combination. For many years the name was placed in synonymy under *S. polymorpha*.

Very variable; 3 subspecies are recognised but a number of collections remain to be critically studied, e.g. *A.S.George 14384* from South Stirling (PERTH) with widely spaced flowers and narrow fruit with a very short beak; *B.H.Smith 906* from Hindmarsh (PERTH) with short spikes and narrow leaves (also collected near Eneabba and Indarra), and *R.H.Kuchel 1908*, east of Cranbrook (PERTH), with small leaves and flowers, the latter almost glabrous (also from Two Peoples Bay).

**1** Adaxial tepal 4.4–5.5 mm long; abaxial tepal 3.5–4.5 mm long

**2** Perianth pubescent throughout; stems often hirsute as well as pubescent; fruit 4–5 mm long

**2:** Perianth ±glabrous towards apex; stems appressed-tomentose, glabrescent; fruit 3.5 mm long

**1:** Adaxial tepal 6.5–7 mm long; abaxial tepal 5.3–5.5 mm long **1c.** subsp. **major**

### 1a. Synaphea spinulosa (Burm.f.) Merr. subsp. spinulosa

*Synaphea brachystachya* Lindl., *Sketch Veg. Swan R.* xxxii (1839). T: Swan River district, W.A., 183-, *J.Drummond s.n.*; lecto: CGE, *fide* A.S.George, *Fl. Australia* 16: 488 (1995); Swan River district, W.A., 183-, *per J.Mangles*; syn: CGE.

Illustrations: A.S.George, *Intr. Proteaceae W. Australia* 105, pl. 156 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 519 (1989).

Stems pubescent, often also hirsute. Bracts acute, 2–3 mm long, silky-pubescent. Perianth finely pubescent; adaxial tepal 4.4–5 mm long, 1.4–2 mm wide; abaxial tepal 3.5–4 mm long. Stigma transversely elliptic to squarish obovate, 0.9–1 mm long and wide, ±flat or margins reflexed. Fruit 4–5 mm long . Figs 73, 116A.

Common north of Perth as far as the Eneabba district and south along the coastal plain to Bunbury, W.A.; one inland record near York. Grows in sand and sandy gravel in *Banksia* woodland and kwongan. Flowers July–Oct. Map 301.

W.A.: N of Cockleshell Gully, *A.S.George 7826* (CANB, K, MEL, PERTH); Fremantle, 1 Sept. 1897, *R.Helms* (PERTH); Australind, *G.J.Keighery 1800* (PERTH); 24 km NE of York, *S.Patrick 17* (PERTH); c. 8 km SE of Coorow, *P.S.Short 2197* (AD, CANB, MEL, PERTH).

Rootstock fire-tolerant. Very variable. Welshpool, *F.M.C.Schock*, has the adaxial tepal 6.5 mm long and 2.5 mm wide, and the abaxial tepal 5.5 mm long. Collections from as far north as Geraldton and from the central wheatbelt may belong here.

### 1b. Synaphea spinulosa subsp. borealis A.S.George, *Fl. Australia* 16: 494 (1995)

T: Howatharra, W.A., 19 Aug. 1966, *A.M.Ashby 1907*; holo: PERTH; iso: CANB, MEL.

Stems much-branched, appressed-tomentose, glabrescent. Bracts broadly ovate, usually acuminate, 2–4.5 mm long, hirsute-pilose. Perianth puberulous, ±glabrous towards apex; adaxial tepal 5–5.5 mm long, 2 mm wide; abaxial tepal 4–4.5 mm long, with narrow, erect point. Stigma broadly obovate, 0.8–1 mm long, 1–1.1 mm wide, ±flat. Fruit c. 3.5 mm long. Fig. 116B–D.

Occurs from Kalbarri National Park south almost to Geraldton, W.A. Grows in sand and sandy clay in kwongan. Flowers Aug.–Sept. Map 302.

W.A.: c. 3 km W of Eurardy Stn HS, *A.S.George 9521* (PERTH); 20 km N of Geraldton, *J.W.Green 435* (PERTH); 18 km E of Kalbarri, *S.D.Hopper 1297* (PERTH).

Generally has longer spikes with more crowded, less hairy flowers and smaller fruit than the other subspecies. The only *Synaphea* recorded north of the Murchison River.

### 1c. Synaphea spinulosa subsp. major A.S.George, *Fl. Australia* 16: 495 (1995)

T: just N of Wongan Hills on road to Ballidu, W.A., 8 July 1988, *A.S.George 16918*; holo: PERTH; iso: CANB, K.

Stems silky-pubescent. Bracts acute, 2–3.5 mm long, silky-pubescent. Perianth: adaxial tepal 6.5–7 mm long, 3 mm wide; abaxial tepal 5.3–5.5 mm long, with reflexed tip. Stigma transversely elliptic to squarish obovate, 0.9–1 mm long and wide, ±flat to margins reflexed. Fruit 4–5 mm long. Fig. 116E.

Occurs from Ballidu and Calingiri south-east to Southern Cross, south to Hopetoun and east to Israelite Bay, W.A., with outliers east to Twilight Cove. Grows in sandy loam over laterite in kwongan. Flowers July–Oct. Map 303.

W.A.: 13–16 km E of Calingiri on road to Wongan Hills, *T.E.H.Aplin 105* (PERTH); 30 km NE of Esperance, *D.B.Foreman 1224* (CANB, MEL, NSW, PERTH); SE side of Mt Ragged, *A.S.George 16067* (PERTH); c. 33 km S of Ravensthorpe, *A.S.George 5766* (PERTH); Ghooli Hill, c. 16 km E of Southern Cross, *K.Newbey 5734* (PERTH).

Petiole and perianth are longer than in other subspecies. A few hairs are present inside the perianth and the tips of the lateral and abaxial tepals are strongly reflexed. The subspecies shows some variation especially in north-western populations, e.g. *T.E.H.Aplin 3035* from near Tammin has smaller flowers, an adaxial tepal 6 mm long, abaxial 4.5 mm long, and the stigma is cordate and c. 0.9 mm long and 1 mm wide; *B.H.Smith 885* from Wongan Hills is almost typical but has narrow leaf lobes; *C.A.Gardner 653* from Dowerin has a very curved adaxial tepal 5.5 mm long (all collections at PERTH).

### 2. Synaphea endothrix A.S.George, *Fl. Australia* 16: 489 (1995)

T: c. 5 km W of Brand Hwy on Jurien Rd, W.A., 12 Aug. 1993, *A.S.George 17044*; holo: PERTH; iso: AD, CANB, K, MEL, NSW.

Stems to 30 cm long, pubescent, glabrescent. Leaves pinnatipartite, somewhat undulate; lowest pair of lobes again pinnatipartite; petiole 1.5–6 cm long; lamina 4–7 cm long, 6–11 cm wide; ultimate lobes lanceolate to triangular, 3–6 mm wide, acute, pungent, gently undulate, concave; reticulation open. Spikes 3–8 cm long; flowers openly spaced; peduncle 4–9 cm long, branched, puberulous to pubescent; rachis puberulous to pubescent; bracts 2–2.5 mm long, pubescent to almost glabrous. Perianth ascending, opening moderately

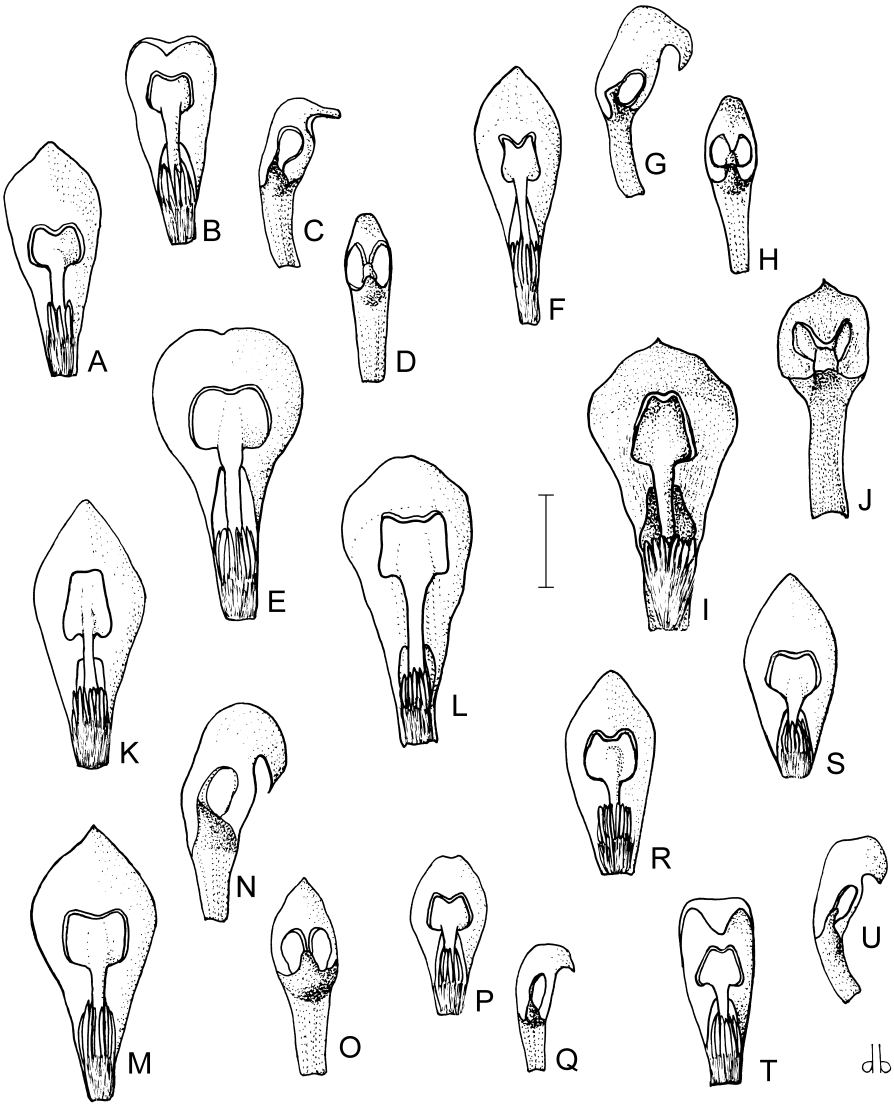



**Figure 116**. *Synaphea*. **A**, *S. spinulosa* subsp. *spinulosa*, adaxial tepal and pistil (A.George 12909, PERTH). **B–D**, *S. spinulosa* subsp. *borealis*. **B**, adaxial tepal and pistil; **C**, lateral tepal; **D**, abaxial tepal (**B–D**, A.George 9521, PERTH). **E**, *S. spinulosa* subsp. *major*, adaxial tepal and pistil (A.George 10998, PERTH). **F–H**, *S. media*. **F**, adaxial tepal and pistil; **G**, lateral tepal; **H**, abaxial tepal (**F–H**, A.George 10960, PERTH). **I–J**, *S. polymorpha*. **I**, adaxial tepal and pistil; **J**, abaxial tepal (**I–J**, A.George 16890, PERTH). **K**, *S. grandis*, adaxial tepal and pistil (A.George 11158, PERTH). **L**, *S. decorticans*, adaxial tepal and pistil (A.George 9652, PERTH). **M–O**, *S. tripartita*. **M**, adaxial tepal and pistil; **N**, lateral tepal; **O**, abaxial tepal (**M–O**, A.George 9885, PERTH). **P–Q**, *S. bifurcata*. **P**, adaxial tepal and pistil; **Q**, lateral tepal (**P–Q**, A.George 10465, PERTH). **R**, *S. tamminensis*, adaxial tepal and pistil (A.George 10088, PERTH). **S**, *S. acutiloba*, adaxial tepal and pistil (A.George 9868, PERTH). **T–U**, *S. oligantha*. **T**, adaxial tepal and pistil; **U**, lateral tepal (**T–U**, A.George 11020, PERTH). Scale bar = 2 mm. Drawn by D.Boyer.

widely, puberulous outside, hairy inside about middle; adaxial tepal 5.5–6 mm long, 2.2–2.7 mm wide, gently hooded; abaxial tepal 4.2–4.3 mm long. Stigma broadly obovate, shallowly emarginate, almost flat, 0.9–1.2 mm long, 1–1.3 mm wide; ovary hirsute. Fruit obovoid on thick neck, 7 mm long, hirsute.

Occurs in the Coomallo–Badgingarra area, W.A. Grows on lateritic rises in kwongan. Flowers Aug.–Sept. Map 304.

W.A.: Yerramullah Rd, WSW of Badgingarra, *A.S.George 17050* (PERTH); Koonah Rd, S of Badgingarra, *A.S.George 17051* (PERTH); N of Mt Benia and E of Mt Lesueur, *E.A.Griffin 2289* (PERTH).

Similar to *S. spinulosa* but of coarser habit. The petiole is usually longer, the perianth more widely flared, sparsely puberulous outside and more hairy inside, and the fruit is larger. At two of the known localities it is sympatric with *S. spinulosa* subsp. *spinulosa*.

### 3. Synaphea media A.S.George, *Fl. Australia* 16: 492 (1995)

T: near Howick Hill, 5.5 km E of woolsheds of Mt Howick Stn, W.A., 18 Sept. 1968, *A.E.Orchard 1057*; holo: PERTH.

Stems to 35 cm long, appressed-pubescent, glabrescent. Leaves tripartite, multiplanar; lobes also tripartite; petiole 1.5–4 cm long; lamina 3–5 cm long, 7–9 cm wide; ultimate lobes triangular to lanceolate, 3–5 mm wide, obtuse to acute, mucronate, concave; reticulation fine, shallow. Spikes 2–5 cm long; flowers moderately crowded; peduncle to 3.5 cm long, appressed-pubescent; rachis appressed-puberulous; bracts ovate, obtuse, 1.5–2.5 mm long, puberulous. Perianth opening narrowly, sparsely and shortly appressed-puberulous; adaxial tepal 5.5–5.7 mm long, 2–2.3 mm wide, gently convex; abaxial tepal 4.5–5 mm long. Stigma oblong-trapeziform, slightly constricted, shallowly emarginate, thick, concave, 0.8–1 mm long, 0.7–1 mm wide; ovary pubescent. Fruit obovoid, c. 5 mm long, pilose. Fig. 116F–H.

Occurs along the south coast of W.A. from Cheyne Beach to Howick Hill (east of Esperance), and in the Stirling Range. Grows in sand (often granitic) in kwongan. Flowers Sept.–Oct. Map 305.

W.A.: c. 10 km ESE of Howick Hill, *N.N.Donner 2629* (PERTH); old telegraph line track, between Middle Mt Barren and Whoogarup Ra., *A.S.George 10959* (PERTH); Channel Point, 2 km SE of Cheyne Beach, *N.G.Marchant 71/706* (PERTH); c. 12 km W of Pabelup L., *K.Newbey 489* (PERTH); 1 km N of Thistle Cove, *P.G.Wilson 5631* (PERTH).

Intermediate between *S. polymorpha* and *S. spinulosa*.

### 4. Synaphea sparsiflora A.S.George, *Fl. Australia* 16: 494 (1995)

T: First North Rd, just N of Three Springs–Eneabba road, W.A., 12 Aug. 1993, *A.S.George 17040*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Stems to 25 cm long, pubescent, glabrescent. Leaves pinnatipartite, undulate; lowest lobes again pinnatipartite; petiole 5–10 cm long; lamina 5–9 cm long, 10–15 cm wide; ultimate lobes ±triangular-ovate, 5–8 mm wide, acute, pungent; reticulation open. Inflorescence much exceeding foliage; spikes 5–12 cm long; flowers widely spaced; peduncle 8–15 cm long, branched, puberulous to pubescent; rachis pubescent; bracts 2.5–3 mm long, pubescent. Perianth ascending, opening moderately widely, appressed-pubescent but glabrous towards apex, inside hairy about middle; adaxial tepal 5.8–7 mm long, 2.3–2.6 mm wide, gently convex; abaxial tepal 4.6–5.5 mm long. Stigma ±broadly ovate, shallowly emarginate, ±flat, 1.1 mm long and wide; ovary silky. Fruit ellipsoidal on thick neck, 7 mm long, hirsute.

Recorded from two localities: one north-east of Eneabba and the other west of Gillingarra, W.A. Grows in sandy loam over laterite in kwongan. Flowers Aug.–Sept. Map 306.

W.A.: W of Gillingarra, *A.S.George 17213* (CANB, PERTH).

Distinctive in the widely spaced flowers. Differs from *S. spinulosa* also in the longer petiole and peduncle.

### 5. Synaphea canaliculata A.S.George, *Fl. Australia* 16: 488 (1995)

T: between Newdegate and Lake King, W.A., 33°05'S, 119°31'E, 11 Oct. 1994, *A.S.George 17239*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Stems several, to 30 cm long, branched, with imbricate scales and leaf bases, tomentose. Leaves divaricately pinnatipartite, multiplanar; lowest lobes also pinnatipartite; upper lobes 3-lobed; petiole 1.5–2.5 cm long, channelled, glabrous except tomentose-villous sheath; lamina 2.5–3.5 cm long, glabrous; ultimate lobes linear, acute, prominently channelled, 1–1.5 mm wide; reticulation fine. Spikes 1–5 cm long, terminal and in upper axils; flowers crowded; peduncle to 0.5 cm long, villous; rachis pubescent; bracts broad, obtuse, 1.5–2.8 mm long, villous. Perianth ascending, opening narrowly, pubescent with glabrous apex; adaxial tepal 3.8–4.6 mm long, 2–2.2 mm wide, very convex; abaxial tepal 3–3.5 mm long. Stigma transversely oblong to ±square, 2-lobed, 0.7–0.8 mm long, 0.9–1 mm wide; ovary pubescent. Fruit ellipsoidal, 2.5 mm long, pilose. Fig. 72.

Occurs between Newdegate and Lake King, W.A. Grows in sandy loam in kwongan. Flowers Aug.–Oct. Map 307.

W.A.: between Newdegate and L. King, *A.S.George 16729* (CANB, MEL, PERTH).

Locally common but within a small area. The narrow, channelled leaf lobes and short, compact spikes are distinctive. The indumentum of the perianth may include scattered dark red hairs. Old rachises and bracts persist for 2–3 years.

### 6. Synaphea cervifolia A.S.George, *Fl. Australia* 16: 488 (1995)

T: S of Hyden, W.A., 32°34'S, 118°50'E, 30 June 1970, *A.S.George 9887*; holo: PERTH; iso: CANB, K, MEL, NSW.

Stems several, to 30 cm long, branched, silky, glabrescent. Leaves divaricately bipinnatipartite, ±flat but rather flexuose; petiole 2.5–5 cm long, glabrous except pubescent sheath; lamina 4–8 cm long, to 10 cm wide; ultimate lobes linear, tapering, 1.5–2.5 mm wide, acuminate, prominently pungent, ±flat, glabrous; reticulation fine, shallow. Spikes 2.5–7.5 cm long; flowers moderately crowded; peduncle 1–5 cm long, branched, shortly silky; rachis pubescent; bracts 2–2.5 mm long, acute to obtuse, puberulous with ciliate margins. Perianth opening narrowly, puberulous in lower half, glabrous above; adaxial tepal very convex, 5–5.2 mm long, 1.5–1.8 mm wide; abaxial tepal 3.5–3.6 mm long. Stigma transversely oblong-elliptic to trapeziform, broadly emarginate, flat, 0.7–0.8 mm long, 0.9 mm wide; ovary pubescent. Fruit not seen. Fig. 117A.

Occurs south of Hyden, W.A. Grows in sandy clay and gravel, in mallee kwongan. Flowers June–Oct. Map 308.

W.A.: 31 km E of Pingaring, *A.S.George 17235* (AD, BRI, CANB, NSW, PERTH); L. Biddy–Hyden road, S of Varley–Pingaring road, *M.Pieroni 18* (PERTH).

Differs from related species in the narrow, ±flexuose, flat leaf lobes, the perianth puberulous in the lower half only, the adaxial tepal strongly convex and the abaxial tepal with a very thick, reflexed apex. Appears reluctant to set fruit; even the collection *A.S.George 17235*, collected late in the season, has set no fruit.

### 7. Synaphea quartzitica A.S.George, *Fl. Australia* 16: 494 (1995)

T: N of Moora, W.A., c. 30°33'S, 116°02'E, 13 Aug. 1993, *A.S.George 17055*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Stems several, to 7 cm long, branched, silky but covered by leaf bases. Leaves pinnatipartite with 2 or 3 pairs of lobes, gently undulate; petiole 6–15 cm long, pilose, glabrescent; lamina 6.5–8 cm long, 8–9 cm wide, pilose to pubescent, glabrescent; primary lobes 3–6 mm wide, tripartite, the upper ones simple; ultimate lobes triangular, abruptly pungent; reticulation very fine, shallow. Inflorescence not or shortly exceeding foliage; spikes 6–18 cm long; flowers rather openly spaced; peduncle 2–10 cm long, branched, tomentose to puberulous, prominently striate; rachis puberulous; bracts ascending, 1–2 mm long, broad, acute,

puberulous to hirsute in lower half. Perianth spreading, opening moderately widely, glabrous; adaxial tepal 4.5–5 mm long, 1.5–2 mm wide, strongly curved; abaxial tepal 2.5–3.5 mm long. Stigma narrowly oblong, slightly broadened at base, emarginate, 0.8–1 mm long, 0.3–0.4 mm wide, straight to gently sigmoid, thick; ovary pubescent. Fruit narrowly obovoid, 4 mm long, pubescent.

Known from a single locality on a quartzite hill, growing in tall open shrubland. Flowers July–Aug. Map 309.

W.A.: Moora, Oct. 1908, *J.B.Cleland* (NSW).

Distinguished by the leaf shape, long spikes, prominently curved adaxial tepal with much shorter abaxial tepal and very narrow stigma. The tip of the abaxial tepal is slightly recurved.

### 8. Synaphea incurva A.S.George, *Fl. Australia* 16: 491 (1995)

T: near Albany Airport, W.A., 23 Oct. 1993, *A.S.George 17147*; holo: PERTH; iso: CANB, K, NSW, PERTH.

Stems decumbent, to 26 cm long, pilose and pubescent. Leaves with petiole 3.5–6.5 cm long, pilose and pubescent; sheath prominent, red-brown; lamina either lanceolate and entire, 7–15 cm long, 6–12 mm wide, obtuse to acute, or 3-lobed to pinnatipartite, with intramarginal veins in lower half, concave, sparsely pilose to glabrous; lobes when present linear to lanceolate, obtuse to acute; reticulation open, prominent. Spikes 2.5–6 cm long; flowers moderately crowded; peduncle simple or branched, 5–21 cm long, appressed-puberulous, glabrous above; rachis puberulous; bracts spreading, ovate-rhombic, 1.5–2 mm long, almost acute, glabrous except ciliate margins. Perianth ascending, opening widely, glabrous; adaxial tepal 6.5–7.5 mm long, 2.3–2.5 mm wide, ±straight; abaxial tepal 6–6.5 mm long. Stigma ovate, emarginate with incurved lobes, 1.3–1.6 mm long, 1–1.3 mm wide, thick; ovary glabrous except a few short, apical hairs. Fruit ellipsoidal on narrow neck, 5–8 mm long, glabrous or sparsely pilose.

Occurs just west and north-west of Albany, W.A. Grows in gravelly loam in Jarrah-Marri woodland or shrubland. Flowers Sept.–Oct. Map 310.

W.A.: Redhen Rd, W of Albany, c. 24 Sept. 1992, *per E.J.Croxford* (PERTH); Redmond West Rd, *D.Davidson s.n.* (PERTH 01559915).

Somewhat resembles *S. polymorpha*, but very different in the shape of the leaf and stigma. Even the adult leaves are highly variable.

### 9. Synaphea polymorpha R.Br., *Trans. Linn. Soc. London* 10: 156 (1810)

T: probably King George Sound [W.A.], Dec. 1801, *R.Brown Iter Australiense (Britten 3263)*; lecto: BM; isolecto: BM, K, *fide* A.S.George, *Fl. Australia* 16: 494 (1995).

Illustration: A.S.George, *Intr. Proteaceae W. Australia* 104, pl. 155 (1984).

Stems 1–several, to 35 cm tall, appressed-pubescent, glabrescent. Leaves tripartite; petiole 4–6 mm long, ±reduced to sheathing base; lower leaves with petiole to 6 cm long; lamina 2–3 cm long, 3–5 cm wide, very undulate and multiplanar, sparsely puberulous, glabrescent; primary lobes 3–4 mm wide, very concave; secondary lobes tripartite, concave, pungently 1–3-dentate. Spikes 1–3 cm long; flowers ±crowded; peduncle 1–2 cm long, pubescent; rachis puberulous; bracts 2 mm long, obtuse, ±glabrous except puberulous base and margins. Perianth opening narrowly, sparsely puberulous; adaxial tepal 5–6.5 mm long, 1.8–2.8 mm wide, ±straight but convex over stigma; abaxial tepal 5 mm long with ±erect, narrow apex. Stigma ±ovate to oblong with broadened base, minutely emarginate, concave, very thick, incurved at apex, 1.4–1.8 mm long, 0.9–1.1 mm wide; ovary pubescent. Fruit ellipsoidal, beaked, 5 mm long, pilose . Figs 116 I–J, 117E.

Occurs mainly within 30 km of Albany, W.A., but recorded also from Kamballup, the Green Range and Thumb Peak. Grows in sandy loam and lateritic soil, in woodland and kwongan. Flowers Aug.–Nov. Map 311.

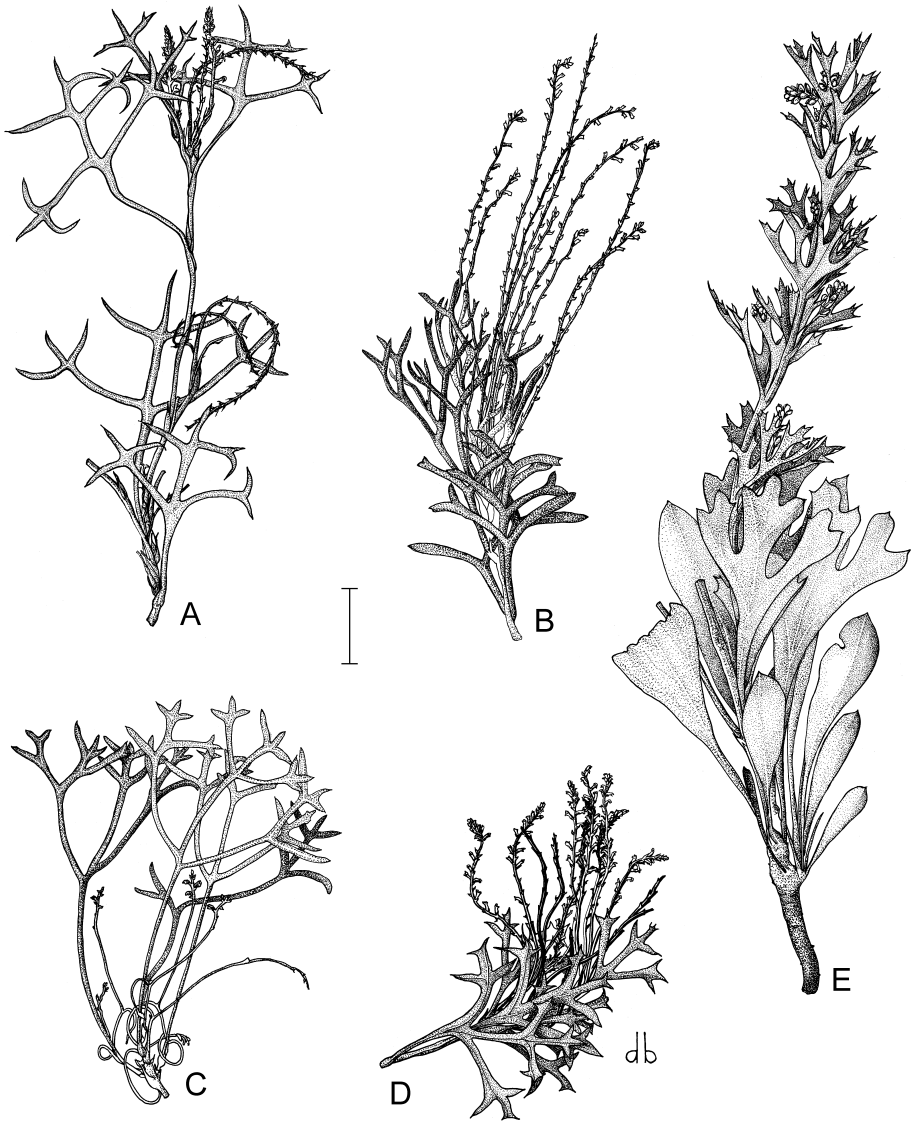



**Figure 117**. *Synaphea*. **A**, *S. cervifolia*, flowering branchlet (A.George 9887, PERTH). **B**, *S. bifurcata*, flowering branchlet (A.George 10465, PERTH). **C**, *S. oligantha*, flowering branchlet (A.George 9467a, PERTH). **D**, *S. constricta*, flowering branchlet (A.George 80, PERTH). **E**, *S. polymorpha*, flowering branchlet (A.George 9485, PERTH). Scale bar = 3 cm. Drawn by D.Boyer.

W.A.: Thumb Peak, *A.S.George 7175* (PERTH); near Redmond, N of Albany, *A.S.George 9485* (PERTH); 1 km W of Kamballup, *G.J.Keighery 9878* (PERTH); c. 15 km N of Albany on road to Borden, *P.S.Short 1671a* (MEL, PERTH).

For many years this name has been used in a broad sense to include *S. spinulosa* and several taxa separated here, such as *S. media*. *Synaphea polymorpha* can be distinguished readily by its longer, oblong stigma with incurved apex. The stems are usually red, in contrast to the pale yellow or green stems of *S. spinulosa* and *S. media*. Rootstock probably fire-tolerant.

### 10. Synaphea intricata A.S.George, *Fl. Australia* 16: 491 (1995)

T: c. 19 km S of Muir Hwy on Nornalup Rd, W.A., 22 Oct. 1993, *A.S.George 17139*; holo: PERTH; iso: AD, CANB, K, MEL, NSW.

Stems to 50 cm long, appressed-pubescent, glabrescent. Leaves thrice pinnatipartite, divaricate, multiplanar; petiole 0.5–1.5 cm long; lamina 2–4 cm long, 4–7 cm wide, puberulous, glabrescent; ultimate lobes linear, 0.5–1.5 mm wide, pungently 2–3-dentate, concave; reticulation open, shallow. Spikes to 7 cm long; flowers crowded; peduncle to 1 cm long, appressed-pubescent; rachis puberulous; bracts ovate, obtuse, 1.5–2 mm long, almost glabrous. Perianth opening narrowly, glabrous; adaxial tepal 4.9–5.2 mm long, 2.2 mm wide; abaxial tepal 4–4.5 mm long. Stigma oblong, slightly constricted in middle, emarginate, thick, erect, 0.9 mm long, 0.4 mm wide; ovary pubescent. Fruit broadly ellipsoidal on narrow neck, 4.5–5.5 mm long, pilose.

Occurs south of Rocky Gully, W.A. Grows in sand in Jarrah open woodland and in winter-wet peaty sand in swamps with *Melaleuca*, *Hakea* etc. Flowers Sept.–Oct. Map 312.

W.A.: North Northumberland Rd, off Rocky Gully Rd, *E.J.Croxford 1176* (PERTH); Boronia Rd, N of Bow Bridge, *A.S.George 17143* (CANB, K, MEL, NSW, PERTH).

Related to *S. polymorpha* but very slender, the leaves more divided with much narrower lobes, smaller flowers and a flatter stigma.

### 11. Synaphea parviflora A.S.George, *Fl. Australia* 16: 493 (1995)

T: Tarin Rock, W.A., 23 Sept. 1964, *A.R.Fairall 1647*; holo: PERTH; iso: CANB, K.

Stems to 20 cm long, tomentose. Leaves ±divaricately pinnatipartite, multiplanar; petiole 1.5–8 cm long; leaf sheath appressed-tomentose; lamina 4–5 cm long, 6–9 cm wide; ultimate lobes linear to triangular, 2–5 mm wide, acute, flat to concave, thick; reticulation fine with thick ridges. Spikes 2–10 cm long; flowers moderately crowded; peduncle 1–3 cm long, tomentose; rachis tomentose; bracts 1–1.5 mm long, obtuse, puberulous. Perianth ascending, opening moderately, sparsely puberulous to almost glabrous; adaxial tepal 4–4.2 mm long, 1.8 mm wide, curved; abaxial tepal 2.8–3 mm long. Stigma transversely oblong, broadly 2-lobed, 0.7 mm long, 1 mm wide; ovary silky. Fruit obovoid, 5 mm long, beaked, hirsute.

Restricted to the Tarin Rock–Lake Grace area, W.A. Grows in gravel in kwongan. Flowers July–Oct. Map 313.

W.A.: Tarin Rock Reserve, *M.G.Corrick 10992* (MEL, PERTH); near Tarin Rock, 6 Sept. 1976, *A.S.George s.n.* (PERTH).

Distinguishing features are the small flowers and the thick-ridged reticulum of the leaves. *Synaphea tripartita* is related, and the distinguishing characters are discussed under that species.

### 12. Synaphea tripartita A.S.George, *Fl. Australia* 16: 495 (1995)

T: E of Pingaring, W.A., 11 Oct. 1994, *A.S.George 17234*; holo: PERTH; iso: CANB, K, MEL.

Stems to 20 cm long, closely tomentose. Leaves ±flat, usually with 3 primary lobes, sometimes these also shortly 3-lobed towards apex, occasionally 2 further lobes towards apex of leaf; petiole 4–8 cm long; leaf sheath closely silky, sometimes upper third glabrous; lamina 3–6 cm long, 4–10 cm wide, gradually tapered to petiole, silky, glabrescent; ultimate lobes linear to triangular, 3–5 mm wide, acute to obtuse but shortly pungent, flat; reticulation

fine, shallow. Spikes 3–8 cm long; flowers rather crowded; peduncle to 7 cm long, pubescent; rachis stout, pubescent; bracts ±acute, 2 mm long, pubescent. Perianth erect, glabrous or sparsely pilose; tepals separating almost to base; adaxial tepal 5 mm long, 2–2.2 mm wide, gently convex, with recurved margins; abaxial tepal 3.5 mm long. Stigma broadly oblong, 2-lobed, very concave, 1 mm long, 0.8–1.1 mm wide; ovary silky. Fruit ellipsoidal, 4–4.5 mm long, beaked, pilose. Fig. 116M–O.

Occurs south of Hyden, W.A. Grows in lateritic gravel in kwongan. Flowers July–Oct. Map 314.

W.A.: near Dragon Rocks, *A.S.George 9894* (PERTH).

Related to *S. parviflora* but the leaves are less divided, shorter and flatter, the peduncle longer, the flowers are larger and more crowded in the spike, and the rachis and bracts are more hairy.

### 13. Synaphea constricta A.S.George, *Fl. Australia*16: 488 (1995)

T: N of Wongan Hills on road to Ballidu, W.A., 8 July 1988, *A.S.George 16917*; holo: PERTH; iso: CANB, K, MEL, NSW.

Stems to 30 cm long, caespitose, sparingly branched, pubescent, soon glabrous. Leaves divaricately pinnatipartite, ±flat; lowest lobes also often pinnatipartite; upper lobes 2- or 3-dentate towards apex, hirsute-pubescent but soon glabrous; petiole 1.5–6 cm long, glabrous except hirsute inner face of sheath; lamina 3–8 cm long, 6–8 cm wide; ultimate lobes triangular, almost flat, 2–6 mm wide, pungent; reticulation fine but thick. Spikes 2–12 cm long; flowers moderately crowded; peduncle 2–4 cm long, branched just above base, glabrous; rachis sparsely appressed-puberulous to glabrous; bracts spreading, broad, obtuse, 1.5–2 mm long, ±glabrous. Perianth ascending, opening narrowly, glabrous; adaxial tepal 3.7–4.5 mm long, 1.5 mm wide, gently curved; abaxial tepal 2.5–2.9 mm long, with a prominently reflexed apex. Stigma oblong but constricted in middle, emarginate to shortly 2-lobed, straight, angled at base, 0.7–0.9 mm long, 0.5–0.6 mm wide; ovary pubescent. Fruit not seen. Fig. 117D.

Occurs in the Wongan Hills area, near Manmanning, Minnivale, Kellerberrin and Bendering, W.A. Grows in sand or sandy clay-loam over laterite, in kwongan and mallee-kwongan. Flowers June–Sept. Map 315.

W.A.: 8 km NE of Dowerin, *M.D.Crisp 6537* (CBG, NSW, PERTH); c. 8 km NE of Manmanning, *A.S.George 15764* (PERTH); Bendering Reserve, 23 km NNE of Kondinin, *B.G.Muir 273(3.1)* (PERTH); Minnivale, *B.H.Smith 850* (CANB, HO, K, MEL, PERTH).

Readily recognised by the mainly glabrous habit including the small flowers, and by the oblong stigma constricted at the middle.

### 14. Synaphea bifurcata A.S.George, *Fl. Australia* 16: 488 (1995)

T: 14 km N of Newdegate–Lake King road on Holt Rock South Rd, W.A., 32°58'S, 119°23'E, 11 Oct. 1994, *A.S.George 17237*; holo: PERTH; iso: AD, CANB, K, MEL, NSW.

Stems to 50 cm tall, branched, densely appressed-pubescent. Leaves twice bifurcate with arched lobes, ±flat; petiole 2–4 cm long; lamina 1–3 cm long, 2.5–8 cm wide; ultimate lobes linear to ±triangular, obtuse with thick, blunt mucro, 1–2.5 mm wide, finely reticulate with impressed abaxial midrib, tomentose but soon glabrous except short sheathing base. Spikes in upper axils, to 15 cm long; flowers crowded; peduncle 0.5–3 cm long, puberulous; rachis sparsely puberulous; bracts spreading, ovate, obtuse, almost glabrous except ciliate margins. Perianth opening narrowly, glabrous; adaxial tepal 3–3.5 mm long, 1.3 mm wide, slightly hooded; lateral tepals shortly recurved; abaxial tepal 2.5 mm long. Stigma trapeziform, broadly retuse, 0.7–0.8 mm long and wide; ovary velvety. Fruit narrowly ellipsoidal, 4 mm long, pubescent . Figs 116P–Q, 117B.

Occurs between Newdegate and Lake King, W.A., and a short distance eastwards. Grows in clay-loam or sand over laterite, in mallee kwongan. Flowers Sept.–Nov. Map 316.

W.A.: Cascades Rd, 4 km S of L. King–Norseman Rd, *M.G.Corrick 11002* (MEL); 38 km E of Newdegate, *R.Filson 9377* (MEL, PERTH); 40 km E of Newdegate, *A.S.George 10465* (CANB, MEL, PERTH); c. 20 km E of Newdegate, *J.W.Green 4496* (PERTH).

Distinguished especially by the densely appressed-pubescent stems, twice bifurcate leaves and small glabrous flowers.

### 15. Synaphea oligantha A.S.George, *Fl. Australia* 16: 492 (1995)

T: 1 mile [c. 1.6 km] N of Mt Le Grand, W.A., 11 Sept. 1971, *A.S.George 11020*; holo: PERTH; iso: CANB, K, MEL.

Stems few to many, simple or branched, to 9 cm long, pubescent. Leaves deeply dichotomously or trichotomously partite, multiplanar; petiole 3–9 cm long, glabrous except for pubescent sheath; lamina 5–13 cm long, 8–12 cm wide; lobes linear to triangular, 1.5–3 mm wide, obtuse to acute, very shallowly reticulate, sparsely appressed-pubescent when young, soon glabrous. Spikes enclosed within foliage, to 5 cm long; flowers few, widely spaced; peduncle branched, to 11 cm long, sparsely puberulous; rachis pubescent to puberulous; bracts ovate, almost acute, 1–1.5 mm long, puberulous. Perianth ascending, opening narrowly, sparsely puberulous; adaxial tepal 3.5–4 mm long, 1.4–1.8 mm wide; lateral tepals recurved; abaxial tepal 3 mm long, minutely hooded. Stigma trapeziform, emarginate, 0.6–0.8 mm long, 0.7–0.8 mm wide, ±flat; ovary pubescent. Fruit obovoid, with apical beak, 5–6 mm long, sparsely pilose . Figs 116T–U, 117C.

Occurs from the Fitzgerald River National Park east to Twilight Cove, W.A. Grows in white or grey sand, sometimes over quartzite, in kwongan and mallee kwongan. Flowers July–Sept. Map 317.

W.A.: near Howick Hill, *Hj.Eichler 19838* (AD, PERTH); Mt Bland, *A.S.George 10066* (AD, PERTH); East Mt Barren, *A.S.George 9467a* (MEL, NSW, PERTH); Toolinna, *E.C.Nelson 17163* (PERTH); 19 km S of Cocklebiddy, *K.Newbey 11774* (PERTH).

Recognisable by the small habit with tangled leaves and small, few-flowered spikes on usually curved slender scapes.

### 16. Synaphea flexuosa A.S.George, *Fl. Australia* 16: 490 (1995)

T: SE of Kulin, W.A., 32°43'S, 118°17'E, 11 Oct. 1994, *A.S.George 17231*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Much-branched, tangled, small shrub. Stems to 15 cm long, covered by silky leaf bases. Leaves deeply 3–5 times forked, multiplanar; petiole 5–11 cm long; lamina 5–11 cm long, 8–20 cm wide; lobes linear, curved to flexuose, 1.5–3 mm wide, flat, acute; reticulation fine, shallow. Spikes 4–15 cm long, several together, terminal; flowers rather widely spaced; peduncle 3–7 cm long, slender, appressed-pubescent; rachis appressed-pubescent; bracts widely spreading, acute, 1.5 mm long, pubescent. Perianth ±horizontal, slightly curved, opening moderately widely, glabrous; adaxial tepal 4.5 mm long, 2 mm wide; abaxial tepal 3.5 mm long. Stigma ±transversely oblong, 2-lobed, 0.8 mm long, 1 mm wide, setose in lower centre; ovary silky. Fruit ellipsoidal, 4 mm long, spreading-pubescent.

Occurs south-east of Kulin and near Nyabing, W.A. Grows in sandy loam in tall open shrubland. Flowers Sept.–Oct. Map 318.

W.A.: 14 km SE of Kulin, *R.J.Hnatiuk 770204* (PERTH); N of Nyabing, *M.Pieroni 93/8* (PERTH).

Distinguished by the deeply forked leaves with flexuose, narrow lobes and by the small, widely spaced, horizontal flowers.

### 17. Synaphea divaricata (Benth.) A.S.George, *Fl. Australia* 16: 489 (1995)

*Synaphea favosa* var. *divaricata* Benth., *Fl. Austral.* 5: 361 (1870). T: Eyre's Relief, W.A., *G.Maxwell*; lecto: K; isolecto: MEL, *fide* A.S.George, *loc. cit.*

Stems to 7 cm long, silky to villous. Leaves divaricately pinnatipartite, ±flat; lowest pair of lobes tripartite to pinnatipartite; second simple or 1–3-lobed; apical lobe 3–5-lobed; petiole


**Figure 118**. *Synaphea*. **A**, *S. whicherensis*, flowering branchet (A.George 11741, PERTH). **B**, *S. acutiloba*, flowering branchlet (A.George 9868, PERTH). **C**, *S. divaricata*, flowering branchlet (A.George 16053, PERTH). Scale bar = 3 cm. Drawn by D.Boyer.

5–16 cm long, glabrous except puberulous sheath; lamina 4–9 cm long, 5–14 cm wide; ultimate lobes linear, lanceolate or triangular, straight, 3–4 mm wide, acute, flat, shallowly reticulate, glabrous. Spikes 1–5 cm long; flowers moderately crowded; peduncle 2.5–12 cm long, branched, sparsely appressed-puberulous; rachis angular, sparsely puberulous; bracts broadly ovate, obtuse, 1.2–1.4 mm long, glabrous except a few hairs on margins and base. Perianth ascending, opening narrowly, glabrous; adaxial tepal 4.4–4.8 mm long, 1.5–2 mm wide; abaxial tepal 3–3.1 mm long. Stigma ±ovate, shallowly emarginate, dorsally thickened, 0.8–0.9 mm long and wide; ovary villous. Fruit not seen. Fig. 118C.

Occurs in the Nuytsland Wildlife Sanctuary and Frank Hann National Park, south-western W.A. Grows in sand in kwongan, among quartzite rocks and in limestone soil. Flowers Aug.–Sept. Map 319.

W.A.: Frank Hann Natl Park, *D.Butcher 324* (MEL, PERTH); Mt Ragged, *A.S.George 16053* (PERTH).

Closely related to the following but has straight leaf lobes and smaller flowers that do not open as widely.

### 18. Synaphea interioris A.S.George, *Fl. Australia* 16: 491 (1995)

T: Kokardine, W.A., 30°41'S, 117°10'E, 3 Aug. 1987, *B.H.Smith 872*; holo: PERTH; iso: CANB, MEL.

Stems tufted, to 10 cm long, appressed-tomentose. Leaves pinnatipartite, ±multiplanar; lowest 2 pairs of lobes also usually pinnatipartite; petiole 4–12 cm long, glabrous except tomentose sheath; lamina 7–11 cm long, 7–16 cm wide; ultimate lobes linear to lanceolate, 2.5–10 mm wide, usually curved, flat, acute, pungent; reticulation fine, shallow. Spikes 5–14 cm long, mostly within foliage; flowers moderately crowded; peduncle to 12 cm long, branched, sparsely appressed-puberulous; rachis puberulous; bracts broadly ovate, obtuse, spreading, 1.3–2 mm long, glabrous outside except ciliate margin, tomentose inside. Perianth ascending, opening moderately widely, glabrous or sparsely puberulous outside, hairy inside; adaxial tepal 5–6 mm long, 1.5–2 mm wide, curved; abaxial tepal 3.5–4 mm long. Stigma oblong to narrowly trapeziform, emarginate, slightly flared at base, 0.8–1 mm long, 0.7–1 mm wide; ovary pubescent. Fruit obovoid with short, obtuse beak, 3.5–4 mm long, spreading-pilose.

Widespread from Wubin to Frank Hann National Park, W.A. Grows in sandy loam and gravelly sand in kwongan. Flowers Aug.–Oct. Map 320.

W.A.: 15 km NW of Jitarning, *R.J.Cranfield 4736* (PERTH); c. 6 km SSE of Wubin, *R.E.Melville 4303 & J.H.Calaby* (HO, K, MEL, PERTH); 18.5 km S of Mt Hampton, *K.Newbey 5963* (PERTH); 16 km S of Bruce Rock, *R.D.Royce 7887* (PERTH); Dingo Well, *B.H.Smith 869* (MEL, PERTH).

Similar to *S. divaricata* but larger throughout; the leaf lobes usually curved and the perianth opening more widely.

### 19. Synaphea tamminensis A.S.George, *Fl. Australia* 16: 495 (1995)

T: Charles Gardner Flora Reserve, S of Tammin, W.A., 31°47'S, 117°28'E, 29 Aug. 1971, *A.S.George 10888*; holo: PERTH; iso: CANB, K, MEL, NSW.

Stems to 5 cm long, pubescent but hidden by leaf bases. Leaves pinnatipartite, multiplanar; lowest pair of lateral lobes once or twice tripartite; second pair tripartite or simple; third pair simple; petiole 6–15 cm long; lamina 5–10 cm long, 6–14 cm wide; ultimate lobes linear to lanceolate, 2–3 mm wide, acute, finely and deeply reticulate, probably pubescent, glabrescent except petiole sheath. Spikes 4–8 cm long; flowers somewhat crowded; rachis sparsely appressed-puberulous; peduncle openly branched, 12–20 cm long, glabrous; bracts rhombic, obtuse, divergent, 1.5–2 mm long, almost glabrous. Perianth ascending, ±narrow, opening narrowly, glabrous; adaxial tepal 4–5 mm long, 2 mm wide, ±straight with slightly recurved margins; abaxial tepal 3.2 mm long. Stigma trapeziform, ±flat, broadly emarginate, 0.8 mm long, 1 mm wide; ovary pubescent. Fruit barrel-shaped, c. 2 mm long, pilose. Fig. 116R.

Recorded only near Tammin, W.A. Grows in sandy-loam over laterite, in open kwongan. Flowers Aug.–Sept. Map 321.

Recognised by the multipartite, finely reticulate leaves, glabrous perianth and small fruit.

### 20. Synaphea rangiferops A.S.George, *Fl. Australia* 16: 494 (1995)

T: 10 km SW of Calingiri, W.A., 31°09'S, 116°23'E, 29 Aug. 1976, *A.S.George 14331*; holo: PERTH; iso: CANB.

Stems to 19 cm long, branched, villous, glabrescent. Leaves pinnatipartite, somewhat multiplanar; lowest and second pairs of lobes also 1- or 2-partite; uppermost simple; petiole 5–11 cm long, glabrous except inside of sheath; lamina 9–18 cm long, 5–13 cm wide; ultimate lobes linear to narrowly triangular, 1.5–4 mm wide, acute, sparsely puberulous, glabrescent; reticulation shallow. Spikes to 12 cm long; flowers openly spaced; peduncle branched, 12–28 cm long, very sparsely puberulous; rachis puberulous; bracts ovate, obtuse, spreading, 1–2 mm long, glabrous except puberulous base and ciliate margins. Perianth opening moderately widely, glabrous; adaxial tepal 4.5–5.5 mm long, 1.5 mm wide, strongly curved; abaxial tepal 2.5 mm long. Stigma oblong, shallowly emarginate, 0.7–0.8 mm long, 0.5 mm wide; ovary glabrous except for few hairs at base. Fruit ellipsoidal, beaked, 5–6.5 mm long, finely puberulous at base.

Occurs between Mogumber, Gillingarra and Calingiri, W.A. Grows in gravelly loam in kwongan. Flowers Aug.–Sept. Map 322.

W.A.: Mogumber, *C.A.Gardner 84 [584]* (MEL, PERTH); Mogumber, Moore R., 19 Aug. 1904, *A.Morrison* (K); S of Gillingarra Rd, Moora–Bindoon road, *M.Pieroni 5* (PERTH).

Similar to *S. tamminensis* but with pinnatipartite leaves having a shallow, open reticulation, much longer spikes, a narrower perianth with shorter abaxial tepal, an oblong stigma, the ovary glabrous or almost so and longer fruit.

### 21. Synaphea lesueurensis A.S.George, *Fl. Australia* 16: 491 (1995)

T: Mt Lesueur, W.A., 30°16'S, 115°11'E, 13 Oct. 1974, *A.S.George 12891*; holo: PERTH; iso: CANB, MEL.

Stems many, to 50 cm long, few-branched, pubescent. Leaves tripartite, multiplanar; primary lobes bi- or tripartite; petiole 2–7 cm long, pilose, soon glabrescent except pubescent sheath; lamina 5–6 cm long, 6–8 cm wide; ultimate lobes linear to lanceolate, 2.5–5 mm wide, acute, flat, shallowly reticulate, pilose and pubescent, soon glabrescent. Spikes to 10 cm long; flowers openly spaced; peduncle branched, to 18 cm long, pubescent at base, glabrous above; rachis puberulous; bracts ovate, obtuse, 1–1.5 mm long, spreading. Perianth ascending, opening widely, glabrous or sparsely puberulous; adaxial tepal 3.8–5 mm long, 1.5–2.5 mm wide; abaxial tepal 2.5–3.5 mm long. Stigma ovate, minutely emarginate, very concave, 1–1.2 mm long, 0.7–0.8 mm wide; ovary pubescent. Fruit obovoid, 5–6 mm long, pilose. Fig. 69.

Occurs on and close to Mt Lesueur, W.A. Grows in laterite and in sandy loam over laterite or sandstone in kwongan. Flowers Aug.–Oct. Map 323.

W.A.: Mt Lesueur, *J.S.Beard 7818* (NSW, PERTH); W of Mt Lesueur, *B.G.Briggs 6352* (NSW); 21 km W of Brand Hwy on Jurien Rd, *A.S.George 17047* (CANB, K, MEL, NSW, PERTH); 1 km NW of Mt Lesueur, *E.A.Griffin 1994* (PERTH).

New growth pink. Tepals separating almost to base at anthesis. Fruit sometimes galled.

### 22. Synaphea aephynsa A.S.George, *Fl. Australia* 16: 487 (1995)

T: Mt Adams Rd, just W of intersection with Sundalara Rd, N of Eneabba, W.A., 12 Aug. 1993, *A.S.George 17034*; holo: PERTH; iso: CANB, K, NSW.

Stems tufted, to 7 cm long, appressed-tomentose. Leaves pinnatipartite, multiplanar; lowest pair also sometimes pinnatipartite; petiole 4–18 cm long, glabrous; sheath tomentose inside; lamina 5–10 cm long, 5–15 cm wide; ultimate lobes lanceolate, 3–8 mm wide, ±flat, rounded to obtuse but shortly mucronate, pubescent, soon glabrous; reticulation fine, shallow, with rounded veins. Spikes 5–12 cm long; flowers crowded, becoming open; peduncle branched, 10–30 cm long, puberulous at base, glabrous above; rachis puberulous; bracts spreading,

obtuse, 1.5–1.8 mm long, puberulous to almost glabrous. Perianth ascending, opening widely, sparsely puberulous to glabrous, hairy inside; adaxial tepal 4.5–5 mm long, 2–2.2 mm wide, curved; abaxial tepal 3.5–4 mm long. Stigma orbicular to broadly ovate, shallowly emarginate, 1 mm long, 0.9–1 mm wide, thickened in basal third, ±concave above; ovary tomentose. Fruit (immature) narrowly obovate, 4 mm long, spreading-puberulous.

Occurs from north of Eneabba south to Gillingarra, W.A. Grows in lateritic soil and in sand over laterite, in kwongan. Flowers July–Oct. Map 324.

W.A.: Tathra Natl Park, *J.Coleby-Williams 302* (PERTH); 6 km W of junction of Eneabba–Three Springs road and Kangaroo Rd, *E.A.Griffin 2182* (PERTH); Bundarra Nature Reserve, Gillingarra Rd, *E.A.Griffin 4796* (BOL *n.v.*, PERTH); c. 5 km S of Mimegarra, *B.J.Keighery 129B* (BOL *n.v.*, PERTH).

Close to *S. gracillima* but the leaves are thicker, with a finer reticulum, drying yellowish. The leaves resemble those of typical *S. petiolaris* subsp. *petiolaris*.

### 23. Synaphea gracillima Lindl., *Sketch Veg. Swan R.* xxxii (1839)

*Synaphea petiolaris* var. *gracillima* (Lindl.) Benth., *Fl. Austral.* 5: 362 (1870). T: Swan River district, W.A., 183-, *J.Drummond s.n.*; holo: CGE; iso: K.

Stems several to many, to 8 cm long, branched, pubescent, glabrescent. Leaves pinnatipartite, multiplanar; lowest lobes also pinnatipartite; upper lobes less divided; petiole 10–17 cm long, glabrous except pubescent sheath base; lamina 6–19 cm long, 6–15 cm wide; ultimate lobes broadly linear to lanceolate, 3–9 mm wide, ±flat, obtuse to acute, openly and shallowly reticulate, sparsely appressed-puberulous when young, glabrescent. Inflorescence much exceeding foliage; spikes 6–15 cm long; flowers ±openly spaced; peduncle 10–17 cm long, simple to little-branched, sparsely puberulous; rachis sparsely puberulous; bracts spreading, obtuse, 1–1.5 mm long. Perianth ascending, opening widely, glabrous; adaxial tepal 4.5–6 mm long, 1.5–2 mm wide, curved; abaxial tepal 3.5–4.5 mm long. Stigma transversely oblong-lunate to 2-lobed, lateral edges recurved, 0.8–1 mm long, 1–1.5 mm wide; ovary puberulous. Fruit narrowly obovoid, 5.5–7 mm long, very sparsely puberulous. Fig. 119A.

Occurs on the Darling Plateau from Bindoon to Manjimup, west to Margaret River and east to Albany, W.A. Grows in lateritic soil in Jarrah-Marri woodland. Flowers Aug.–Oct. Map 325.

W.A.: 19 km NE of Bullsbrook, *R.G.Coveny 3098 & B.R.Maslin* (NSW, PERTH); Forrestfield, 5 Oct. 1978, *R.J.Cranfield* (PERTH); c. 6 km N of Karridale, *A.S.George 17111* (CANB, PERTH); c. 16.5 km S of Nannup, *A.S.George 17131* (MEL, NSW, PERTH); between Dardanup and Boyanup, *G.J.Keighery 6820* (PERTH).

Widespread and variable. Several collections from the Darling Scarp and a short distance eastwards have smaller flowers and may warrant formal recognition, e.g. Forrestfield, *R.J.Cranfield 165* (PERTH); Armadale, 16 Aug. 1902, *A.Morrison* (PERTH). *A.S.George 17152* from NW of Chorkerup, N of Albany (PERTH) is a possible hybrid with typical *S. petiolaris* subsp. *petiolaris*.

One of the syntypes of *S. acutiloba* (Preiss 777) is probably referable to this species.

### 24. Synaphea drummondii Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 315 (1856)

T: south-western W.A., [c. 1844], *J.Drummond 3: 259*; syn: BM, K, MEL.

Stems to 6 cm long, hirsute and tomentose. Leaves somewhat flabelliform but pinnatipartite, very undulate; main lobes dentate to pinnatipartite, glabrous; petiole 7–20 cm long, hirsute towards base; lamina 4–8 cm long, 6–10 cm wide; ultimate lobes broadly triangular, 5–10 mm wide, obtuse but mucronate; reticulation fine, shallow. Spikes 3–10 cm long; flowers rather openly spaced; peduncle 7–10 cm long, branched, pilose to glabrous; rachis shortly pilose; bracts obtuse, 1–1.5 mm long, pubescent to almost glabrous except ciliate margins. Perianth ascending, opening widely, glabrous or sparsely pilose; adaxial tepal 4.8–5.5 mm long, 2–2.3 mm wide, curved; abaxial tepal 3.5–4.2 mm long. Stigma ±orbicular to ovate, emarginate, 0.9–1 mm long, 1–1.2 mm wide, ±flat; ovary silky. Fruit not seen.

Occurs in the central wheatbelt of W.A. Grows in sand over laterite in kwongan. Flowers July–Sept. Map 326.

W.A.: c. 12 km SE of Yealering, *A.S.George 9404* (PERTH); 37 km N of Katanning on road to Dumbleyung, *G.J.Keighery 6938* (PERTH); NW of Corrigin, *M.Pieroni 9* (PERTH).

This name is still not applied confidently. The type has lost its perianths but the above collections approximate it closely in leaf and inflorescence morphology as well as long hairs on the stem and petiole. It is likely that some specimens from Drummond's Third Collection came from the same general area as the cited specimens.

### 25. Synaphea acutiloba Meisn. *in* J.G.C.Lehmann, *Pl. Preiss*. 1: 528 (1845)

T: Darling Ra., W.A., 25–26 July 1839, *L.Preiss 782*; lecto: P; isolecto: B, L, MEL, MO, P, *fide* A.S.George, *Fl. Australia* 16: 487 (1995).

Illustrations: A.S.George, *Intr. Proteaceae W. Australia* 106, pls 157, 158 (1984).

Stems many, to 28 cm long, sparsely branched or simple, pubescent, glabrescent. Leaves pinnatipartite, very undulate; lowest lobes 2–3-lobed; petiole 5–20 cm long, glabrous except villous sheath margins; lamina 3–7 cm long, 4–8 cm wide; ultimate lobes triangular, recurved, 2–4 mm wide, pungent, ±concave, shallowly reticulate, glabrous. Inflorescence much exceeding foliage; spikes to 15 cm long; flowers crowded but axis elongating; peduncle branched, to 35 cm long, glabrous except puberulous towards base; rachis puberulous; bracts ovate, obtuse, 0.8–1 mm long, spreading-puberulous. Perianth ascending, opening narrowly, glabrous; adaxial tepal 3.5–4 mm long, 1.5–1.8 mm wide, very convex; lateral tepals recurved; abaxial tepal 2.3–2.5 mm long. Stigma ±obtrapeziform to cordate, shallowly emarginate, 0.7–0.8 mm long and wide, ±flat; ovary pubescent in lower half. Fruit ±cylindrical, 5–6 mm long, glabrous . Figs 116S, 118B.

Occurs along and just east of the Darling Scarp, near Perth, W.A. Grows in granitic and lateritic soil in kwongan and woodland. Flowers June–Sept. Map 327.

W.A.: Bellevue, Aug. 1939, *W.E.Blackall* (PERTH); Helena Valley, *R.G.Coveny 8236* (NSW, PERTH); c. 50 km SE of Perth, Albany Hwy, *A.S.George 11143* (CANB, MEL, PERTH); Cannington, 10 Aug. 1899, *A.Morrison* (PERTH).

Distinguished by the very undulate leaves and small flowers. Of the other two syntypes cited by Meisner in the protologue, *Drummond 589* (MEL) is typical *S. acutiloba* but *Preiss 777* (B, MEL, P) is probably *S. gracillima*.

### 26. Synaphea stenoloba A.S.George, *Fl. Australia* 16: 495 (1995)

T: NE of Pinjarra, W.A., 32°37'S, 115°54'E, 12 Oct. 1993, *A.S.George 17060*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Stems many, to 3 cm long, pubescent. Leaves tripinnatipartite, multiplanar; each primary lobe twice tripartite; petiole 5–27 cm long, glabrous except pubescent sheath; lamina 5–18 cm long, 2.5–9 cm wide; ultimate lobes erect, linear, 1–2 mm wide, acute, concave, shallowly reticulate, glabrous (not seen young). Inflorescence much exceeding foliage; spikes 10–15 cm long; flowers crowded; peduncle simple or sparsely branched, glabrous but puberulous towards base, 10–18 cm long; rachis very sparsely puberulous; bracts ovate, obtuse, spreading, 1–1.5 mm long, glabrous except ciliate margins. Perianth opening ±widely, glabrous; adaxial tepal 4.5–5 mm long, 2 mm wide; abaxial tepal 3.5 mm long. Stigma ovate, lobed to less than a third, 1 mm long, 1–1.2 mm wide, ±convex; ovary pubescent. Fruit obovoid, 6 mm long, shortly pilose.

Known from several small populations at a single locality near Pinjarra, W.A. Grows on winter-damp sandy flats with low heath sedgeland. Flowers Sept.–Oct. Map 328.

W.A.: N of Pinjarra, 5 Oct. 1960, *B.G.Briggs s.n.* (NSW); Perth, *J.Gilbert 78* (K); Pinjarra, *E.Pritzel 115* (MO); Pinjarra, 1910, *J.Sheath* (NSW).

The multipartite leaves with narrow, concave lobes are distinctive. Lateral tepals are slightly falcate. The clumped, many-stemmed habit is reminiscent of some taxa of Restionaceae. The locality 'Perth' of the Gilbert collection is probably a general locality.

### 27. Synaphea odocoileops A.S.George, *Fl. Australia* 16: 492 (1995)

T: near Elgin railway siding, S of Bunbury, W.A., 19 Oct. 1993, *A.S.George 17072*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Tufted, sprawling shrub without lignotuber. Stems 2–7 cm long, simple or branched, closely pubescent. Leaves tripartite to pinnatipartite, ±flat to multiplanar; petiole 2–9 cm long, sparsely long-pilose; lamina 6–12 cm long, 7–15 cm wide; ultimate lobes erect, linear but tapering, 1–2 mm wide, acute, openly reticulate, very sparsely appressed-puberulous, soon glabrous. Spikes 3–13 cm long; flowers openly spaced; peduncle 15–30 cm long, sparingly branched, glabrous except sparsely appressed-pubescent towards base; rachis appressed-puberulous; bracts spreading, obtuse, 1 mm long, glabrous to puberulous. Perianth opening ±widely, glabrous; adaxial tepal 3.5–4 mm long, 1.5 mm wide, gently curved; abaxial tepal 2.8 mm long. Stigma transversely obovate-elliptic with prominent lobes, 0.8–1 mm long, 1.2–1.3 mm wide; ovary sparsely pilose. Fruit obovoid, shortly beaked, 4–5 mm long, shortly pilose.

Recorded from near Byford, Serpentine and Elgin, W.A. Grows in winter-wet sandy clay and in sandy clay over granite, in kwongan. Flowers Aug.–Oct. Map 329.

W.A.: 5 km E of Byford on Nettleton Rd, *G.J.Keighery 7047* (CANB, PERTH); 1 km N of Elgin, *G.J.Keighery 6781* (PERTH); Serpentine, *E.Pritzel 196* (PERTH).

Similar to *S. stenoloba* but has less-divided leaves with longer, flatter lobes and a long-pilose petiole, and slightly smaller flowers.

### 28. Synaphea recurva A.S.George, *Fl. Australia* 16: 494 (1995)

T: E of Northampton, W.A., 28°21'E, 114°42'E, 10 Aug. 1993, *A.S.George 17019*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Tangled shrub to 1 m tall and wide. Stems branched, pubescent or villous, glabrescent. Leaves openly tripartite or pinnatipartite, multiplanar; lowest pair of lobes shortly tripartite towards apex; upper pair(s) usually simple; petiole 4–15 cm long; lamina 5–10 cm long, 6–12 (–14) cm wide; ultimate lobes linear to narrowly triangular, 2–8 mm wide, acute or obtuse but mucronate, shallowly reticulate, puberulous to villous, glabrescent. Spikes elongating to 14 cm long; flowers ±crowded; peduncle openly branched, to 30 cm long, glabrous or pilose; rachis pubescent; bracts ovate, ±acute, spreading, 1.1–1.6 mm long, puberulous or glabrous except ciliate margins. Perianth ±horizontal, narrow, opening moderately widely, glabrous except a few hairs about middle; adaxial tepal 6–6.5 mm long, 2–2.5 mm wide, strongly curved; abaxial tepal 3.5–4.5 mm long. Stigma ±obovate to broadly V-shaped, deeply emarginate with reflexed tips, 0.7–1 mm long, 0.9–1 mm wide; ovary velvety. Fruit ellipsoidal, beaked, 4–5 mm long, shortly pilose. Fig. 119B.

Occurs between Northampton and Yerina, W.A.; grows on granitic and sandstone rises and flats, in kwongan. Flowers July–Sept. Map 330.

W.A.: near Mt Fairfax, near Geraldton, *A.M.Ashby 3633* (PERTH); near Northampton, *W.E.Blackall 2736* (PERTH); c. 38 km NW of Northampton on Yerina Springs road, *D.B.Foreman 607* (MEL, NSW, PERTH); c. 8 km E of Northampton, *M.Wittwer S3596* (PERTH).

Distinguishing characters are the openly pinnatipartite, shallowly reticulate leaves, long inflorescence, narrow perianth with strongly curved adaxial tepal and obovate to V-shaped stigma.


**Figure 119**. *Synaphea*. **A**, *S. gracillima*, flowering branchlet (A.George 17184, PERTH). **B**, *S. recurva*, leaf (A.George 17020, PERTH). **C**, *S. damopsis*, flowering branchlet (A.George 17174, PERTH). Scale bar = 2 cm. Drawn by M.Pieroni.

### **29. Synaphea grandis** A.S.George, *Fl. Australia* 16: 490 (1995)

T: c. 1 mile [c. 1.6 km] E of Muchea turn-off from Great Northern Hwy on Chittering road, W.A., 1 Nov. 1971, *A.S.George 11158*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Stems to 30 cm long, pubescent. Leaves pinnatipartite; lowest 1 or 2 pairs of lobes also pinnatipartite, multiplanar; petiole 5–25 cm long, glabrous except pubescent base; lamina 7–13 cm long, 8–20 cm wide; ultimate lobes lanceolate to triangular, 3–8 mm wide, flat to concave, obtuse to acute, openly reticulate, glabrous or sparsely puberulous. Spikes to 9 cm long, elongating; flowers ±crowded; peduncle to 100 cm long, branched, glabrous or sparsely puberulous; rachis sparsely puberulous; bracts ovate, obtuse, spreading, 1.5 mm long, puberulous. Perianth curved, opening widely, glabrous; adaxial tepal 5.5–7 mm long, 2.5 mm wide; abaxial tepal 5 mm long. Stigma ±oblong but slightly narrowed upwards, incurved at apex, thick, shallowly emarginate, 1.5–2 mm long, 1.1–1.2 mm wide; ovary pubescent. Fruit ?obovoid (not seen mature), pilose. Fig. 116K.

Occurs in the Muchea–Bindoon area, north of Perth, W.A. Grows in laterite on hills, in *Eucalyptus wandoo* woodland. Flowers Oct.–Nov. Map 331.

W.A.: c. 105 km N of Perth on Geraldton Hwy (Great Northern Hwy), *C.A.Gardner 8649* (PERTH).

Distinguished by the large habit, large perianth and oblong, strongly incurved stigma. Leaves sparsely puberulous when young.

### **30. Synaphea decorticans** Lindl., *Sketch Veg. Swan R.* xxxii (1839)

T: Swan River district, W.A., 183-, *J.Drummond s.n.*; lecto: CGE, *fide* A.S.George, *Fl. Australia* 16: 489 (1995).

Stems few to many, to 9 cm long, simple or little-branched, tomentose. Leaves pinnatipartite, multiplanar, rather undulate, glaucous; lowest lobes also 2- or 3-lobed; petiole to 28 cm long, glabrous, becoming puberulous towards base; lamina 10–14 cm long, to 20 cm wide; ultimate lobes lanceolate, flat, 5–10 mm wide, obtuse to acute, openly and shallowly reticulate, pubescent, sometimes glabrescent. Spikes 5–10 cm long; flowers moderately crowded; peduncle to 40 cm long, puberulous at base, glabrous above, openly branched; rachis puberulous; bracts spreading, obtuse, 1–1.2 mm long, glabrous outside, pubescent inside. Perianth ascending, opening widely, glabrous outside, somewhat hairy inside; adaxial tepal 5.5–6 mm long, 2.5 mm wide, curved; abaxial tepal 4 mm long. Stigma almost square to obtrapeziform, shallowly to moderately emarginate, 0.9–1.1 mm long, 1.5–1.6 mm wide, ±flat; ovary puberulous. Fruit ellipsoidal on a short neck, shortly beaked, 5–6 mm long, pilose . Figs 116L, 121A.

Locally common in the Jarrah-Marri forest of the Darling Plateau between Chittering and Collie, W.A. Grows in lateritic soil. Flowers Sept.–Oct. Map 332.

W.A.: c. 65 km SE of Perth, Dale Rd [Brookton Hwy], *A.R.Fairall 342* (PERTH); c. 100 km SSE of Perth on Albany Hwy, *A.S.George 9652* (PERTH); just E of The Lakes, York Rd, *A.S.George 17067* (CANB, K, PERTH); 35 km E of Collie, *A.S.George 17177* (MEL, NSW, PERTH).

The broad, obtuse leaf lobes and almost square stigma are distinguishing characters. The application of this name has been a problem for many years. The epithet is unintentionally inappropriate, since it refers to a piece of bark of an arborescent species of *Persoonia* that accompanies the type specimen.

### **31. Synaphea panhesya** A.S.George, *Fl. Australia* 16: 493 (1995)

T: near NW corner of Bindoon Military Firing Range, W.A., c. 31°09'S, 116°15'E, 28 Aug. 1976, *A.S.George 14326*; holo: PERTH.

Stems many, to 13 cm long, branched, pubescent. Leaves pinnatipartite, multiplanar; lowest lobes 2–4-partite; petiole 7–20 cm long, glabrous except pubescent sheath; lamina 5–9 cm long, 5–10 cm wide; ultimate lobes ±triangular, 3–10 mm wide, acute to pungent, widely reticulate, glabrous or sparsely pilose. Spikes 5–10 cm long; flowers ±crowded; peduncle to 30 cm long, branched, glabrous to sparsely puberulous; rachis sparsely puberulous; bracts

ovate, obtuse, 1–1.5 mm long, almost glabrous to appressed-pubescent, with ciliate margins. Perianth ascending, curved, opening ±widely, glabrous; adaxial tepal 4.5–5.5 mm long, 1.8–2 mm wide with recurved margins; abaxial tepal 3 mm long. Stigma obtrapeziform, shallowly emarginate, 0.7–0.9 mm long, 0.9–1 mm wide, somewhat concave; ovary villous. Fruit not seen. Fig. 70.

Occurs in the Bindoon–Mogumber area, W.A. Grows in gravelly loam and sandy gravel, in eucalypt woodland. Flowers Aug.–Sept. Map 333.

W.A.: 6 km NNE of South Bindoon, *R.J.Cranfield 4239* (PERTH); West Mogumber Rd, *M.Pieroni 3* (PERTH).

Closely related to *S. decorticans* but has smaller flowers, a narrower adaxial tepal and stigma, the primary leaf lobes are wider and the ultimate ones usually shorter and pungent.

### 32. Synaphea boyaginensis A.S.George, *Fl. Australia* 16: 488 (1995)

T: Boyagin [Nature] Reserve, W.A., c. 32°29'S, 116°56'E, 7 Oct. 1973, *A.S.George 11714*; holo: PERTH; iso: CANB, MEL.

Stems to 15 cm long, sparsely branched, appressed-pubescent, glabrescent. Leaves divaricately pinnatipartite into 3–7 pairs of lobes or upper one single, multiplanar; lower 1 or 2 pairs often 1–5-lobed; petiole 5–15 cm long; lamina 4–10 cm long, 10–18 cm wide; ultimate lobes linear, 2–6 mm wide, straight, obtuse, shallowly reticulate, pubescent, soon glabrous except petiole sheath. Inflorescence much exceeding foliage; spikes in upper axils, 3–6 cm long, elongating to 25 cm; flowers ±crowded; peduncle 12–20 cm long, sparsely branched, puberulous to almost glabrous; rachis appressed-puberulous; bracts broadly obcordate-rhombic, obtuse, spreading, 1.5–2.5 mm long, sparsely puberulous with ciliate margins. Perianth ±swollen, opening widely, very sparsely appressed-puberulous on tube; adaxial tepal 5–5.5 mm long, 2–3 mm wide, ±straight with recurved margins; abaxial tepal 4.5 mm long. Stigma ovate-rhombic, truncate to shallowly emarginate, 2–2.2 mm long, 1.6–1.7 mm wide; apex incurved; ovary pubescent. Fruit not seen. Fig. 120D.

Recorded only at Boyagin Nature Reserve, south-west of Brookton, W.A. Grows in gravelly clay-loam, in *Eucalyptus wandoo* woodland. Flowers late Sept.–Oct. Map 334.

Known only from the type. Resembles *S. whicherensis* but may be distinguished especially by the more divided long-petiolate leaves with straighter lobes and finer reticulation, shorter adaxial tepal and pubescent ovary.

### 33. Synaphea whicherensis A.S.George, *Fl. Australia* 16: 495 (1995)

T: Sabina Rd, Whicher Ra., W.A., 20 Oct. 1993, *A.S.George 17086*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Stems to 60 cm long, sparsely branched, appressed-pubescent, soon glabrous. Leaves mostly crowded at annual increment apex, pinnatipartite into 3–6 arched lobes, ±flat; petiole 3–5 cm long; lamina 3–15 cm long, 5–12 cm wide; ultimate lobes linear, 1.2–4 mm wide, acute, reticulate, pubescent but soon glabrous except petiole sheath which is velvety adaxially. Spikes in upper axils, simple or sparsely branched, 2–3 cm long; flowers crowded; peduncle to 28 cm long, glabrous; rachis puberulous; bracts broadly ovate, acute, spreading, sparsely puberulous; margins shortly ciliate. Perianth swollen, opening widely, glabrous except a few hairs behind anthers; adaxial tepal 6 mm long, 2.5 mm wide; abaxial tepal 4–4.2 mm long. Stigma ovate, concave, thick, 2 mm long, 1.1–1.2 mm wide; ovary glabrous to pilose. Fruit obovoid to ellipsoidal on short neck, 6 mm long . Figs 118A, 120C.

Occurs on the edge of the Whicher Range, south-east of Busselton, W.A. Grows in white sand and gravelly soil, in *Eucalyptus marginata–Banksia attenuata* forest and in shrubland. Flowers Oct.–Nov. Map 335.

W.A.: Acton Park Rd, Whicher Ra., *A.S.George 11741* (K, MEL, PERTH); SE of Busselton, *M.Pieroni 16* (PERTH); Yoongarillup, *R.D.Royce 4865* (PERTH); Chapman Hill, *R.D.Royce 5640* (PERTH).

The narrowly pinnatipartite leaves with arching lobes, short crowded spikes on long peduncles, large flowers, ovate stigma and glabrous to pilose ovary are distinguishing characters.

### **34. Synaphea preissii** Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 529 (1845)

T: Princess Royal Harbour [Albany], W.A., 30 Sept. 1840, *L.Preiss 779*; syn: B, L, MEL, MO, P.

Stems stout, branched, to 13 cm long, appressed-tomentose. Leaves tripartite, multiplanar; lobes also usually tripartite; petiole 2–7 cm long, glabrous except sheath; lamina 3–8 cm long; ultimate lobes triangular to lanceolate, ±flat, 1.5–4 mm wide, acute to pungent, openly and shallowly reticulate. Spikes 2–6 cm long; flowers widely spaced; peduncle 1–4 cm long, pubescent to puberulous; rachis pubescent; bracts spreading, 2 mm long, pubescent. Perianth opening widely, sparsely appressed-puberulous; adaxial tepal 6–6.5 mm long, 2.3 mm wide; abaxial tepal 6 mm long. Stigma oblong to narrowly obcordate, slightly constricted in middle, thick, erect to incurved at apex, emarginate, 1.5–1.6 mm long, 1 mm wide; ovary pubescent. Fruit obovoid, 5–6 mm long, pilose.

Occurs in the Albany district and near Two Mile Lake in the eastern Stirling Range National Park, W.A.; apparently rare. Grows in sand over clay or in gravel, in shrubland and kwongan. Flowers Aug.–Sept. Map 336.

W.A.: near Salmon Holes, Torndirrup Natl Park, *A.S.George 17145* (PERTH); King George Sound, Sept. 1898, *B.T.Goadby* (PERTH); Torndirrup Natl Park, *G.J.Keighery 8209* (PERTH).

This species has shorter, more robust stems and leaves than *S. obtusata*, as well as shorter, more acute leaf lobes, usually shorter spikes, and nearly equal tepals, the lateral 2 only slightly falcate. A collection from north-west of Frankland (*A.S.George 17167*, PERTH) has larger, more deeply divided leaves, longer spikes and larger fruit.

### **35. Synaphea obtusata** (Meisn.) A.S.George, *Fl. Australia* 16: 492 (1995)

*Synaphea preissii* var. *obtusata* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 315 (1856). T: Swan R., W.A., 1844, *J.Drummond 3: 257*; syn: BM, K (2 sheets).

Stems to 4 cm long, several to many from taproot, pubescent. Leaves deeply divided 2–4 times, multiplanar; lamina 5–14 cm long, 5–12 cm wide; lobes linear, usually 1.5–3 mm wide, obtuse, openly reticulate, glabrous, passing into 4–14 cm long petiole. Spikes 7–14 cm long, usually exceeding leaves; flowers openly spaced; peduncle 3–9 cm long, glabrous to sparsely appressed-puberulous, branched; rachis glabrous to appressed-puberulous; bracts broad, 2–2.5 cm long, obtuse. Perianth opening ±widely, glabrous; adaxial tepal gently curved, 6–7 mm long, 2.5–3.2 mm wide; abaxial tepal 5–5.5 mm long, acute, with apex straight or slightly recurved. Stigma ovate to obcordate, very concave, incurved at apex, entire or emarginate, 1.5–2 mm long, 1.1–1.2 mm wide; ovary puberulous. Fruit obovoid on short neck, obtusely beaked, 6–9 mm long, puberulous. Fig. 120F–I.

Occurs from Broke Inlet to Albany and inland almost to Collie and Tunney, with an outlier at the Lort River west of Esperance, W.A. Grows in sand and gravelly soil, in woodland and mallee kwongan. Flowers July–Oct. Map 337.

W.A.: Camfield, Broke Inlet, *A.S.George 9732* (PERTH); Lort R., Ravensthorpe–Esperance road, *A.S.George 10996* (PERTH); 10 km SE of Yornup, *G.J.Keighery 3993* (PERTH); Albany, *C.T.White 5350* (PERTH); Frankland R. bridge [Muir Hwy], *E.Wittwer 2237* (CANB, K, NSW, PERTH).

Closely related to *S. preissii*. A collection from east of Mayanup (*A.S.George 11622*, PERTH) has a broader (obcordate) stigma and a petiole to 20 cm long. *A.S.George 14949* from Tunney (PERTH) also has a broader stigma but typical leaves. *A.R.Annels*, Frankland Natl Park (PERTH), has very narrowly lobed leaves with the lamina to 30 cm long.

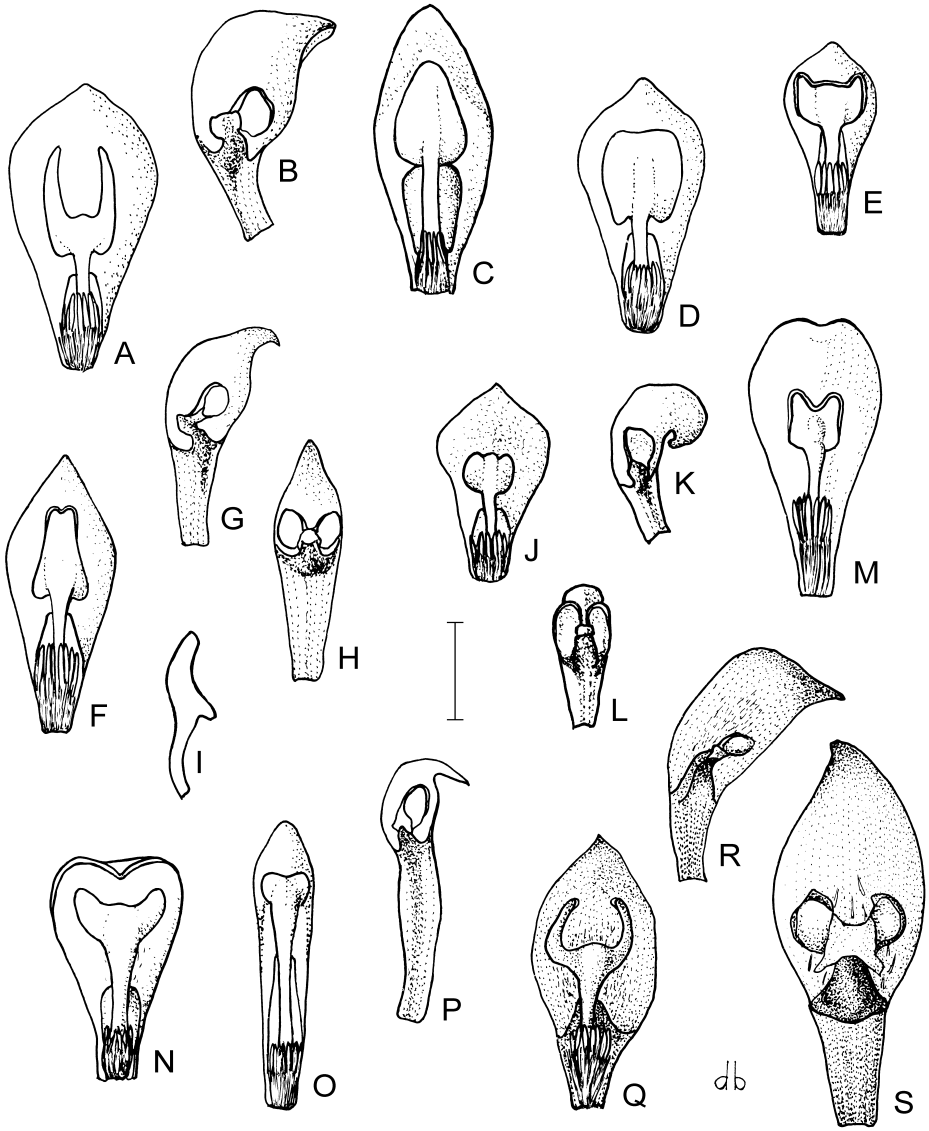



**Figure 120**. *Synaphea*. **A–B**, *S. floribunda*. **A**, adaxial tepal and pistil; **B**, lateral tepal (**A–B**, A.George 11737, PERTH). **C**, *S. whicherensis*, adaxial tepal and pistil (A.George 11741, PERTH). **D**, *S. boyaginensis*, adaxial tepal and pistil (A.George 11714, PERTH). **E**, *S. otiostigma*, adaxial tepal and pistil (V.Mann 53, PERTH). **F–I**, *S. obtusata*. **F**, adaxial tepal and pistil; **G**, lateral tepal; **H**, abaxial tepal; **I**, stigma in side view (**F–I**, A.George 10996, PERTH). **J–L**, *S. flabelliformis*. **J**, adaxial tepal and pistil; **K**, lateral tepal; **L**, abaxial tepal (A.George 11715, PERTH). **M**, *S. petiolaris* subsp. *petiolaris*, adaxial tepal and pistil (A.George 10442, PERTH). **N**, *S. cuneata*, adaxial tepal and pistil (A.George 9651, PERTH). **O–P**, *S. pinnata*. **O**, adaxial tepal and pistil; **P**, lateral tepal (**O–P**, A.George 11160, PERTH). **Q–S**, *S. favosa*. **Q**, adaxial tepal and pistil; **R**, lateral tepal; **S**, abaxial tepal (**Q–S**, A.George 16889, PERTH). Scale bar: **A–R** = 2 mm; **S** = 1 mm. Drawn by D.Boyer.

### **36. Synaphea platyphylla** A.S.George, *Fl. Australia* 16: 493 (1995)

T: Dongolocking Nature Reserve, W.A., 13 Oct. 1994, *A.S.George 17248*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Caespitose shrub. Stems many, to 12 cm long, branched, pubescent. Leaves simple or 2- or 3-lobed, obovate, obtuse, flat, glabrous; lamina 15–22 cm long overall, to 2 cm wide (simple), to 6 cm wide (3-lobed), narrowed to petiole 5–8 cm long; reticulation fine, very shallow; leaf base sparsely silky. Spikes to 10 cm long; flowers rather widely spaced; peduncle to 30 cm long, branched, glabrous; rachis glabrous; bracts broad, obtuse, 1.5 mm long, glabrous except ciliate upper margin. Perianth ascending, expanded above middle, opening widely, glabrous; adaxial tepal 5–5.5 mm long, 2–2.2 mm wide; abaxial tepal 3.2 mm long. Stigma ±square to obtrapeziform, lobed to a third or a little further, 0.8–0.9 mm long and wide; ovary pubescent. Fruit obovoid with terminal beak, 4.5–5.5 mm long, spreading-pilose.

Known only from the type locality south of Wickepin, W.A. Grows in sandy loam in tall shrubland. Flowers Sept.–Oct. Map 338.

Closely related to *S. petiolaris*. The broad, mixed, simple and 2- or 3-lobed leaves and almost glabrous inflorescence are distinctive. A collection from 20 km south of Wickepin, *E.Wittwer 2050* (CANB, PERTH), resembles this species but has all simple, narrower leaves and smaller flowers (adaxial tepal 4 mm long) and probably represents an undescribed taxon.

### **37. Synaphea nexosa** A.S.George, *Fl. Australia* 16: 492 (1995)

T: near Scott R., W.A., 21 Oct. 1993, *A.S.George 17114*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Densely tangled shrub, to 1 m tall. Stems to c. 30 cm long, glabrous or almost so. Leaves deeply 3-lobed, ±flat, with a few appressed hairs when young, soon glabrescent; petiole 13–30 cm long; lamina 8–20 cm long and wide; lobes linear, 3–7 mm wide, obtuse or rarely acute; reticulation open, shallow. Spikes exceeding leaves, 10–30 cm long; flowers widely spaced; peduncle to 60 cm long; rachis sparsely puberulous near base, glabrous above; bracts 2 mm long, broad, obtuse, glabrous except a few hairs near base. Perianth ascending, opening widely, glabrous; adaxial tepal 5.5–6 mm long, 2.2 mm wide, curved; abaxial tepal 4 mm long. Stigma lunate with prominent horns, 1.4 mm long, 1.5 mm wide; ovary shortly silky in lower half, glabrous above. Fruit ellipsoidal, beaked, on prominent neck, 8–9 mm long, glabrous except a few hairs near base.

Known only from the type locality on the Scott River plain east of Augusta, far south-western W.A. Grows on winter-wet flats, in clay-loam among mixed scrub. Flowers Oct.–Nov. Map 339.

The large, tangled habit, long spikes with widely spaced flowers and long fruit are distinctive. Glands on apex of fruit fall early. Flowers a duller yellow than most species. Similar to *S. petiolaris* subsp. *triloba*.

### **38. Synaphea petiolaris** R.Br., *Trans. Linn. Soc. London* 10: 156 (1810)

T: King George Sound [W.A.], Dec. 1801, *R.Brown Iter Australiense (Britten 3265)*; lecto: BM; isolecto: BM, K, *fide* A.S.George, *Fl. Australia* 16: 493 (1995).

Illustration: R.Erickson *et al.*, *Fl. & Pl. W. Australia* 65, t. 174 (1973).

Shrub to 60 cm tall. Stems tufted, to 10 cm long, appressed-pubescent or glabrous. Leaves simple and obovate or more usually deeply 3-lobed to pinnatipartite, ±flat to multiplanar; primary lobes simple or deeply lobed; petiole 5–27 cm long, glabrous except base; lamina 6–20 cm long, appressed-puberulous, glabrescent; lobes linear to lanceolate, 5–8 mm wide, rounded, openly reticulate. Spikes 3–15 cm long; flowers rather widely spaced; peduncle simple or branched, 7–35 cm long, glabrous to puberulous; rachis puberulous; bracts 1–1.5 mm long, almost glabrous. Perianth ascending, opening ±widely, glabrous or sparsely hairy; adaxial tepal 4–5.5 mm long, 1.9–2.5 mm wide, strongly curved, prominently pubescent behind anthers; abaxial tepal 3.5–4 mm long. Stigma broadly ovate to transversely oblong,

deeply emarginate to horned, somewhat concave, 0.8–1.3 mm long, 0.9–1.1 mm wide; ovary pubescent to almost glabrous. Fruit ellipsoidal or obovoid on prominent neck, obtusely beaked, 5–6 mm long, spreading-puberulous or glabrous.

Resembles *S. preissii* but has smaller bracts and flowers and a broader but shorter, prominently emarginate to horned stigma. A variable species with 3 subspecies.

**1** Leaves simple **38c.** subsp. **simplex**

**1:** Leaves divided

**2** Lower leaf lobes usually 2- or 3-lobed; adaxial tepal 5–5.5 mm long; abaxial tepal 4 mm long; stigma prominently emarginate to horned **38a.** subsp. **petiolaris**

**2:** Lower leaf lobes simple; adaxial tepal 4–5.5 mm long; abaxial tepal 3.5 mm long; stigma with prominent, obtuse horns **38b.** subsp. **triloba**

### 38a. Synaphea petiolaris R.Br. subsp. petiolaris

Primary leaf lobes 2- or 3-lobed; petiole 5–27 cm long. Adaxial tepal 5–5.5 mm long; abaxial tepal 4 mm long. Stigma deeply emarginate to horned, 0.8–1.1 mm long, 0.9–1.2 mm wide. Ovary hairy throughout . Figs 120M, 121B–C.

Widespread from Walpole east to Boyatup and inland to the Stirling Range and north to Wooroloo, W.A. Grows in sand or sandy loam, sometimes over laterite or granite, often in low-lying areas. Flowers Aug.–Oct. Map 340.

W.A.: 15 km NNW of Denmark, *A.R.Annels 1743* (PERTH); The Pass Rd, WSW of Narrikup, *A.S.George 17151* (PERTH); Brookton Hwy, 26 km SE of Karagullen junction, *A.S.George 14865* (MEL, NSW, PERTH); c. 13 km N of Gibson, *R.D.Royce 3605* (PERTH).

Eastern populations have shorter leaves with smaller reticulations and usually shorter spikes. Darling Range populations have larger flowers and a more prominently horned stigma, except *M.Koch 1516* from Wooroloo (PERTH) which has an emarginate stigma. Collections from the kwongan in the Eneabba district (e.g. *A.S.George 17402*, PERTH) resemble this but have smaller flowers, a shortly emarginate stigma and a densely silky ovary; they may represent another, unnamed species.

### 38b. Synaphea petiolaris subsp. triloba A.S.George, *Fl. Australia* 16: 493 (1995)

T: near Acton Park, E of Busselton, W.A., 20 Oct. 1993, *A.S.George 17083*; holo: PERTH; iso: AD, CANB, K, MEL, NSW.

Leaves 3-lobed, rarely 4- or 5-lobed; lower leaf lobes simple; petiole 10–20 cm long. Adaxial tepal 4–5.5 mm long; abaxial tepal 3.5 mm long; lateral tepals less curved than those of subsp. *petiolaris*. Stigma transversely elliptic with prominent, obtuse horns, 0.8–1.3 mm long.

Occurs in far south-western W.A., from Walpole to Busselton. Grows on winter-damp sandy and clay flat, in low shrubland. Flowers Aug.–Oct. Map 341.

W.A.: c. 25 km NW of Busselton, *B.G.Briggs 762* (NSW); Ruabon, *A.S.George 15230* (PERTH); W of Tutunup Rd on Wonnerup Rd, *M.Pieroni 15* (PERTH).

### 38c. Synaphea petiolaris subsp. simplex A.S.George, *Fl. Australia* 16: 493 (1995)

T: Ruabon, near Busselton, W.A., 33°39'S, 115°30'E, 20 Oct. 1993, *A.S.George 17103*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Leaves simple; petiole to 13 cm long; lamina narrowly obovate, 8–20 cm long, 8–15 mm wide, obtuse. Adaxial tepal 4.2 mm long. Stigma horned, 1.1 mm long and wide.

Occurs north-east of Busselton, W.A.; grows on sandy flats in open eucalypt woodland. Flowers Sept.–Oct. Map 342.


**Figure 121**. *Synaphea*. **A**, *S. decorticans*, leaf (A.George 17178, PERTH). **B–C**, *S. petiolaris* subsp. *petiolaris*. **B**, flowering branchlet (A.George 16986, PERTH); **C**, leaf, Darling Range variant (A.George 17185, PERTH). Scale bar = 2 cm. Drawn by M.Pieroni.

W.A.: S of Elgin, *A.S.George 17076* (CANB, K, MEL, NSW, PERTH); near Busselton, *F.W.Went 38* (MO).

*A.S.George 17101* from the type locality (PERTH) has a few 3-lobed leaves among the predominantly simple ones.

### **39. Synaphea otiostigma** A.S.George, *Fl. Australia* 16: 492 (1995)

T: 9 km S of Nannup on Pemberton Rd, W.A., 34°03'S, 115°46'E, 21 Oct. 1993, *A.S.George 17130*; holo: PERTH; iso: CANB, K, MEL, NSW.

Stems to 5 cm long, pubescent and long-hirsute. Leaves ±cuneate but 3-lobed or ±pinnatipartite, ±flat to undulate; primary lobes 2- or 3-lobed and these sometimes with further small lobes or teeth; petiole 5–16 cm long, hirsute and puberulous; lamina 4–9 cm long, 3–8 cm wide, puberulous; primary lobes 8–18 mm wide; ultimate lobes triangular, obtuse but mucronate; reticulation open, shallow, sharply defined. Spikes to 20 cm long; flowers rather openly spaced; peduncle to 25 cm long, branched, puberulous; rachis puberulous, red; bracts broadly cordate, acute, 1.5–2 mm long, puberulous. Perianth ascending, opening widely, striate when dried, puberulous; adaxial tepal 5–6 mm long, 1.9–2 mm wide, strongly curved; abaxial tepal 4 mm long. Stigma broadly lunate, 0.8–1 mm long, 1–1.1 mm wide; margins somewhat recurved; ovary pubescent. Fruit obovoid, with short beak, 5 mm long, pilose. Fig. 120E.

Occurs near Nannup, W.A. Grows in clayey laterite and gravelly loam, in Jarrah-Marri forest. Flowers Oct.–Nov. Map 343.

W.A.: c. 17 km S of Nannup, *V.Mann 65 & A.S.George* (PERTH); 10 km SW of Nannup, *A.S.George 17129* (PERTH).

The long hairs of the stem are distinctive, as is the leaf lamina in passing quite abruptly into the petiole. A collection from the Stewart Hwy turn-off, Milyeannup Coast Rd, *A.S.George 17121* (PERTH) is similar but has smaller flowers with a flatter stigma.

### **40. Synaphea flabelliformis** A.S.George, *Fl. Australia* 16: 490 (1995)

T: Boyagin Nature Reserve, W.A., 32°29'S, 116°51'E, 4 Sept. 1971, *A.S.George 10895*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Stems ascending or decumbent, to 25 cm long, simple or sparsely branched, pubescent and pilose. Leaves flabelliform, undulate; petiole 5–14 cm long, shortly pubescent; lamina 5–9 cm long, 2–6 cm wide, coarsely dentate to shortly lobed, shortly pubescent to puberulous, with several prominent veins; teeth and lobes mucronate; reticulation fine. Spikes 6–12 cm long; upper flowers crowded; peduncle to 15 cm long, sparsely branched, spreading-puberulous to pilose; rachis pubescent; bracts almost acute, 2 mm long, pubescent. Perianth opening moderately widely, sparsely puberulous, sometimes glabrous towards base and apex; adaxial tepal spathulate, strongly curved, 3–3.5 mm long, 1.5–1.8 mm wide; abaxial tepal 2.8–3 mm long. Stigma transversely curved-elliptic, broadly emarginate, 0.6 mm long, 1.1 mm wide, ±convex; ovary pubescent. Fruit not seen. Fig. 120J–L.

Occurs between Toodyay, Narrogin and the Wickepin area, W.A. Grows in gravel soil in Wandoo or Marri woodland and in sandy clay in tall shrubland. Flowers July–Oct. Map 344.

W.A.: c. 15 km E of Wickepin, *A.S.George 16547* (PERTH); 8 km E of Toodyay, *G.J.Keighery 7071* (PERTH); c. 14 km N of Dryandra [settlement], *G.J.Keighery 9321* (PERTH); 5 km E of Tincurrin, *K.H.Rechinger 59092* (PERTH).

Distinguished among this group of wedge-leaved species by the small flowers. A suckering plant to 1 m across.

### **41. Synaphea damopsis** A.S.George, *Fl. Australia* 16: 489 (1995)

T: c. 8 km S of Collie, W.A., 25 Oct. 1973, *A.S.George 17174*; holo: PERTH; iso: AD, BRI, CANB, K, MEL, NSW.

Stems tufted, decumbent, to 10 cm long, pilose and/or spreading-pubescent. Leaves flabelliform, undulate, dentate to shortly lobed across apex; petiole 4–13 cm long, puberulous, glabrescent; sheath villous; lamina 5–10 cm long, 2–7 cm wide, often pilose; lobes triangular, ±acute, pungent; reticulation fine, shallow. Spikes 2–9 cm long; flowers ±crowded, at length open; peduncle to 12 cm long, branched at base or clustered, pubescent; rachis densely pubescent; bracts obtuse, 1.7–2 mm long, pubescent to puberulous. Perianth opening moderately widely, spreading-puberulous to glabrous; adaxial tepal 5.2–5.5 mm long, 2.5 mm wide, gently curved; abaxial tepal 4–4.5 mm long. Stigma trapeziform, shallowly emarginate with lobes bent back, thick, concave, 0.8–1.1 mm long, 1–1.5 mm wide; ovary pubescent. Fruit ellipsoidal, shortly beaked, 5 mm long, pilose. Fig. 119C.

Occurs on the Darling Plateau between Armadale, Dryandra and Collie, W.A. Grows in lateritic gravel in Jarrah forest. Flowers Sept.–Nov. Map 345.

W.A.: Tomingley Rd, Dryandra State Forest, *M.G.Corrick 10984* (MEL, PERTH); c. 46 km SE of Perth on Albany Hwy, Sept. 1969, *A.S.George s.n.* (PERTH); 18 km E of Collie, *A.S.George 17176* (AD, PERTH); Saddleback State Forest, *D.Halford 80120* (PERTH).

Similar to *S. flabelliformis* which has smaller flowers and a transversely curved-elliptic stigma. Also resembles *S. cuneata* which has larger flowers and a transversely elliptic stigma with obtuse, divergent horns.

### **42. Synaphea cuneata** A.S.George, *Fl. Australia* 16: 489 (1995)

T: 7 km S of Bannister, Albany Hwy, W.A., 32°37'S, 116°29'E, 14 Oct. 1993, *K.F.Kenneally 11394*; holo: PERTH; iso: CANB, K, MEL.

Stems decumbent or ascending, to 20 cm long, little-branched, velvety and pilose. Leaves cuneate, ±flat to undulate; petiole 3–12 cm long, pubescent and pilose; lamina 4–15 cm long, 1.5–7.5 cm wide, upper margin dentate with teeth obtuse, mucronate, pubescent and sparsely pilose, several-veined, finely reticulate. Spikes 5–15 cm long; flowers moderately crowded, but rachis elongating; peduncle simple or sparsely branched, to 18 cm long, pubescent and pilose; rachis pubescent; bracts ovate, almost acute, spreading, pubescent. Perianth opening widely, sparsely puberulous; adaxial tepal 6 mm long, 3–3.4 mm wide, gently convex; abaxial tepal 4.2–4.5 mm long. Stigma transversely elliptic-lunate with obtuse, divergent horns, convex but not bent back, 0.9–1 mm long, 1.8 mm wide; ovary pubescent. Fruit ellipsoidal to obovoid, 4–5 mm long, sparsely hirsute. Fig. 120N.

Occurs on the Darling Plateau between York and Bannister, W.A. Grows in lateritic soil in Jarrah forest and in sandy loam in Wandoo woodland. Flowers Sept.–Oct. Map 346.

W.A.: c. 100 km SE of Perth, *A.S.George 9651* (CANB, K, MEL, NSW, PERTH); c. 8 km W of York, *A.S.George 17068* (AD, CANB, K, PERTH).

Distinguished from the previous 2 species by the cuneate leaves with straight to convexly curved margins and by the larger flowers.

### **43. Synaphea macrophylla** A.S.George, *Fl. Australia* 16: 491 (1995)

T: W of Blackwood R., Nannup–Augusta Hwy, W.A., 21 Oct. 1993, *A.S.George 17112*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Stems decumbent, to 20 cm long, appressed-puberulous. Leaves flabelliform, ±flat or concave, simple or shortly 2–5-lobed across apex; petiole 6–17 cm long, glabrous; sheath small, appressed-puberulous; lamina 3–18 cm long, 3–8 cm wide, narrowed gradually to petiole; lobes obtuse; reticulation open. Spikes 7–10 cm long; flowers moderately crowded; peduncle to 30 cm long, sparsely puberulous; rachis pubescent; bracts obtuse, 1.3–1.8 mm long, puberulous. Perianth moderately ascending to spreading, opening widely, glabrous; adaxial tepal 5.5 mm long, 2 mm wide, gently curved; abaxial tepal 4 mm long. Stigma

transversely oblong, prominently 2-lobed, 0.7 mm long, 1 mm wide; ovary hirsute. Fruit obovoid, 5.5–6 mm long, pilose.

Collected only once, but also seen to the east of the lower Blackwood River, W.A. Grows in gravelly loam in Jarrah-Marri forest. Flowers Oct. Map 347.

Distinguished mainly by the large, flabelliform leaves and small, transversely oblong stigma.

### 44. Synaphea decumbens A.S.George, *Fl. Australia* 16: 489 (1995)

T: near Moorinup Lake, W.A., 34°15'S, 116°42'E, 3 Oct. 1971, *A.S.George 11129*; holo: PERTH.

Stems decumbent, to 7 cm long, simple, pubescent and pilose. Leaves cuneate to flabelliform, gently undulate, irregularly dentate-lobed; lamina 4–10 cm long, 2.5–5 cm wide, passing gradually into 1–4 cm long petiole; ultimate lobes ±triangular, obtuse, mucronate, with several main veins, reticulate between, villous, becoming puberulous. Spikes 4–5 cm long; flowers moderately crowded; peduncle simple, 5–10 cm long, pilose; rachis pubescent; bracts acute, 2.5–3 mm long, ±appressed-pilose. Perianth opening widely, sparsely puberulous; adaxial tepal 6–6.5 mm long, 2.8 mm wide, very convex; abaxial tepal 5–5.5 mm long, with a narrowed, thick, recurved apex. Stigma oblong but expanded at base, shallowly emarginate, 1.5 mm long, 1 mm wide, concave and with a thick dorsal ridge in lower half; ovary pubescent. Fruit not seen. Fig. 122C.

Recorded only near Moorinup Lake, north of Lake Muir, W.A. Grows in sand over laterite, in Jarrah forest. Flowers Sept.–Oct. Map 348.

The oblong stigma and large flowers are diagnostic. This species resembles *S. hians* but the stigma is very different.

## Sect. 2. Bicornis

**Synaphea** sect. **Bicornis** A.S.George, *Fl. Australia* 16: 487 (1995).

Type: *S. reticulata* (Sm.) Druce

Leaves entire, dentate or shortly lobed. Stigma oblong to elliptic, divided to halfway or more into 2 narrow, erect to incurved apical horns; ovary with large apical glands.

A section of 4 species distinguished especially by the deeply lobed (2-horned) stigma.

### 45. Synaphea reticulata (Sm.) Druce, *Rep. Bot. Exch. Club Brit. Isles* 1916: 650 (1917)

*Conospermum reticulatum* Sm., *Rees Cycl.* 9 (1808); *Synaphea dilatata* R.Br., *Trans. Linn. Soc. London* 10: 156 (1810), *nom. illeg.* T: King George Sound [W.A.], 1791, *A.Menzies*; holo: Smith Herb. 164.6, LINN; iso: BM.

Illustration: F.Bauer *in* M.Flinders, *Voy. Terra Australis* t. 7 (1814), as *S. dilatata*.

Stems decumbent, to 13 cm long, sparsely branched, pubescent and hirsute. Leaves cuneate, ±flat to gently undulate, 3-lobed or sometimes entire, concolorous; petiole 2–7 cm long, hirsute, glabrescent; lamina 5–10 cm long, 1–4 cm wide; lobes sometimes 1- or 2-lobed, obtuse but mucronate, somewhat undulate, with several prominent veins, finely reticulate, hirsute, sometimes glabrescent. Spikes to 5 cm long; flowers rather openly spaced; peduncle simple or branched, 1–4 cm long, villous; rachis villous; bracts ovate, acute, spreading, 2.5–3 mm long, villous. Perianth ascending, opening moderately, hirsute; adaxial tepal 5–7.2 mm long, 3–3.2 mm wide, slightly hooded, with flared margins; abaxial tepal 4.5–5.8 mm long. Stigma transversely oblong with 2 erect or incurved horns, 1.5–2 mm long, 1.2 mm wide, concave; ovary villous. Fruit ellipsoidal, 3.5–4 mm long, hirsute.

Occurs mainly from Albany to the Fitzgerald River National Park but also in the Stirling Range and north-east of Jerramungup, W.A. Flowers Sept.–Oct. Map 349.

W.A.: between Middle Mt Barren and Whoogarup Ra., *A.S.George 10961* (PERTH); near Salmon Holes, Torndirrup Natl Park, *A.S.George 17146* (PERTH); 16 km NE of Jerramungup, *K.Newbey 4819* (PERTH); Capecup, Stirling Ra., Sept. 1921, *E.Pelloe* (PERTH).

The broad, adaxial tepal and usually 3-lobed cuneate hirsute leaves with open reticulation are diagnostic. *A.S.George 10961* has smaller flowers than the other collections.

### 46. Synaphea favosa R.Br., *Trans. Linn. Soc. London* 10: 156 (1810)

T: King George Sound [W.A.], Dec. 1801, *R.Brown Iter Australiense (Britten 3264)*; lecto: BM; isolecto: BM, K, MEL, *fide* A.S.George, *Fl. Australia* 16: 490 (1995).

*Synaphea favosa* var. *lanceolata* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 314 (1856). T: south-western W.A., 1844, *J.Drummond 3: 258*; syn: BM, K (3 sheets).

Stems erect or decumbent, to 8 cm long, simple or branched, pubescent. Leaves entire or few-dentate to lobed, flat; petiole 2–10 cm long, glabrescent or sparsely pilose towards base; lamina oblanceolate to obovate, 5–12 cm long, 1.5–3 cm wide, silky, glabrescent, with 3 main veins, pitted-reticulate between. Spikes 5–8 cm long; flowers rather openly spaced; peduncle to 7 cm long, simple or branched, puberulous; rachis pubescent; bracts obtuse to almost acute, 1.5 mm long, spreading, puberulous in lower half. Perianth opening widely, sparsely appressed-puberulous; adaxial tepal 6–6.5 mm long, 2–2.6 mm wide; abaxial tepal 3.5–4.5 mm long. Stigma transversely elliptic with 2 erect horns, 1.2–1.5 mm long, 1.2–1.3 mm wide, slightly convex, thickened dorsally; ovary pubescent. Fruit obovoid, 3.5–4 mm long, pilose. Fig. 120Q–S.

Occurs from Rocky Gully to Denmark and east to Bremer Bay including the Stirling Range, W.A. Grows in sand over gravel in kwongan. Flowers Sept.–Nov. Map 350.

W.A.: near Johns Cove, Bremer Bay, *M.G.Corrick 7661* (MEL, PERTH); W of Jimmy Newles Harbour, Torndirrup Natl Park, *A.S.George 14381* (PERTH); Mt Willyung, N of Albany, *A.S.George 16889* (CANB, K, PERTH); Nornalup Rd, SW of Rocky Gully, *A.S.George 17137* (AD, MEL, NSW, PERTH); 1 km N of The Arrows, Stirling Range Natl Park, *G.J.Keighery 8566* (PERTH).

Diagnostic characters are the entire or lobed finely pitted leaves (even when fresh), and the almost glabrous perianth. A collection from the west end of the Stirling Range Natl Park (*A.S.George 17159*, PERTH) has lobed leaves and smaller flowers and is tentatively placed here. Another atypical collection is *A.S.George 17160* from W of the Albany Hwy on the Cranbrook–Frankland Rd (PERTH), with peduncles to 10 cm long and spikes to 15 cm long.

### 47. Synaphea hians A.S.George, *Fl. Australia* 16: 490 (1995)

T: c. 6 km E of Busselton on road to Nannup, W.A., 20 Oct. 1993, *A.S.George 17082*; holo: PERTH; iso: AD, CANB, K, MEL, NSW.

Stems prostrate or decumbent, to 50 cm long, pubescent and long-pilose (hairs to 5 mm long), glabrescent. Leaves cuneate, 3-lobed, ±undulate, discolorous; petiole 4–15 cm long, puberulous and pilose; sheath prominent, red-brown; lamina 4–10 cm long, 2.5–4.5 cm wide, flat, pilose, glabrescent; lobes triangular, entire or shortly 1- or 2-dentate, obtuse to acute, mucronate; reticulation open, shallow. Spikes 4–10 cm long; flowers ±crowded; peduncle to 25 cm long, branched or simple, pilose and puberulous; rachis densely pilose and pubescent; bracts spreading, almost acute, 3–6 mm long, pilose. Perianth opening widely, puberulous; adaxial tepal 6.5–7.5 mm long, 2.8–3.5 mm wide, gently to strongly curved; abaxial tepal 4.5–6 mm long. Gynoecium 4.5–5.5 mm long; stigma transversely oblong with erect to incurved horns, 1.7–2.5 mm long, 1.8 mm wide, thick; ovary pubescent. Fruit broadly obovoid, 3–3.5 mm long, pilose.

Occurs east of Busselton and south of Collie, W.A. Grows on sandy rises in low eucalypt woodland. Flowers Sept.–Oct. Map 351.

W.A.: Fish Road Nature Reserve, 13 km SSE of Busselton, *G.J.Keighery & J.J.Alford 978* (CANB, PERTH); 4 km S of Collie on road to Mummballup, *A.N.Rodd 4851 & G.Fensom* (NSW, PERTH); 6 km E of Busselton, Vasse Hwy, *J.H.Ross 2968* (CBG, MEL, PERTH); Busselton, *R.D.Royce 5634* (PERTH).

This and *S. floribunda* have discolorous leaves of much thinner texture than the previous 2 species. Moreover, the reticulation is shallower and more open, and the bracts are larger. Differs from the following species in the cuneate, lobed leaves and slightly larger flowers.


**Figure 122**. *Synaphea*. **A**, *S. pinnata*, flowering branchlet (A.George 11160, PERTH). **B**, *S. floribunda*, flowering branchlet (A.George 15033, PERTH). **C**, *S. decumbens*, flowering branchlet (A.George 16289, PERTH). Scale bar = 3 cm. Drawn by D.Boyer.

**48. Synaphea floribunda** A.S.George, *Fl. Australia* 16: 490 (1995)

T: edge of Darling Scarp, SE of Capel, W.A., 19 Oct. 1993, *A.S.George 17078*; holo: PERTH; iso: CANB, K, MEL.

Illustration: A.S.George, *Intr. Proteaceae W. Australia* 107, pl. 159 (1984), as *Synaphea* sp.

Stems decumbent, branched, pilose and pubescent, glabrescent. Leaves oblanceolate, flat, entire or rarely 2- or 3-dentate near apex, discolorous; petiole 3–9 cm long, pubescent and pilose, glabrescent; lamina 4–12 cm long, 8–18 mm wide, with midrib and intramarginal veins, shallowly reticulate between, pilose and puberulous, glabrescent. Spikes 2–11 cm long; flowers crowded; peduncle simple or branched, 2–15 cm long, pilose and pubescent; rachis villous; bracts 3–3.5 mm long, acute, spreading, villous. Perianth opening widely, puberulous; adaxial tepal 6–6.5 mm long, 2.5–3 mm wide, gently hooded; abaxial tepal 4–4.9 mm long. Stigma lunate, 2-horned, 1.5–2 mm long, 1.8–2 mm wide, slightly convex; ovary pubescent. Fruit broadly obovoid, 3.5 mm long, puberulous, without beak . Figs 71, 120A–B, 122B.

Relatively common between Yallingup and Ludlow, and occurs in scattered localities to Lake Muir and Kojonup, W.A. Grows in sandy loam and gravelly sand in woodland and forest. Flowers Sept.–Nov. Map 352.

W.A.: 3 km S of Ambergate, *D.B.Foreman 1534* (AD, CANB, HO, K, MEL, NSW, PERTH); between Unicup L. and Kulunilup L., *A.S.George 15033* (PERTH); 2 km S of Yallingup, *A.S.George 14180* (PERTH); Ludlow, 3 Sept. 1953, *A.T.Hotchkiss* (MO, PERTH).

Differs from *S. favosa* in the hairier inflorescence, leaves with wider, shallower reticulation, larger bracts, broader tepals and larger stigma. The leaves are discolorous, the veins are less prominent on the adaxial face and are ±abruptly narrowed to the petiole. A similar plant from Darkin Swamp, east of Mundaring Weir (e.g. *M.Pieroni 91/12*, PERTH), is smaller in all respects and may represent an unnamed taxon.

## Sect. 3. Oulopha

**Synaphea** sect. **Oulopha** A.S.George, *Fl. Australia* 16: 487 (1995).

Type: *S. oulopha* A.S.George

Leaves pinnatipartite. Stigma oblong, bent back, with incurved margins; ovary without apical glands.

A monospecific section. The lack of apical glands on the ovary is unique in the genus.

**Figure 123.** *Carnarvonia araliifolia* var. *araliifolia*.
Photograph — J.Plaza (NSW).

**Figure 124.** *Orites lancifolia* (reproduced with permission).
Photograph — M.Fagg.

**Figure 125.** *Darlingia darlingiana*.
Photograph — G.Sankowsky.

**Figure 126.** *Carnarvonia araliifolia* var. *araliifolia*.
Photograph — J.Plaza (NSW).

**Figure 127.** *Cardwellia sublimis.*
Photograph — B.Gray.

**Figure 128.** *Strangea linearis.*
Photograph — R.Purdie.

**Figure 129.** *Stenocarpus sinuatus.*
Photograph — M.Fagg.

**Figure 130.** *Stenocarpus salignus.*
Photograph — M.Fagg.

**Figure 131.** *Opisthiolepis heterophylla.*
Photograph — G.Sankowsky.

**Figure 132.** *Buckinghamia celsissima.*
Photograph — M.Fagg.

**Figure 133.** *Lomatia fraxinifolia.*
Photograph — J.Plaza (NSW).

**Figure 134.** *Lomatia myricoides.*
Photograph — M.Fagg.

**Figure 135.** *Lomatia arborescens* (reproduced with permission).
Photograph — M.Fagg.

**Figure 136.** *Alloxylon flammeum*.
Photograph — M.Crisp.

**Figure 137.** *Telopea truncata*.
Photograph — M.Fagg.

**Figure 138.** *Telopea mongaensis*.
Photograph — M.Fagg.

**Figure 139.** *Hollandaea riparia.*
Photograph — G.Sankowsy.

**Figure 140.** *Helicia lewisensis.*
Photograph — G.Sankowsky.

**Figure 141.** *Xylomelum pyriforme.*
Photograph — M.Fagg.

**Figure 142.** *Xylomelum occidentale.*
Photograph — A.George.

**Figure 143.** *Triunia montana.*
Photograph — G.Sankowsky.

**Figure 144.** *Gevuina bleasdalei.*
Photograph — P.Weston (NSW).

**Figure 145.** *Hicksbeachia pilosa.*
Photograph — G.Sankowsky.

**Figure 146.** *Hicksbeachia pinnatifolia.*
Photograph — T.Low.

**Figure 147.** *Athertonia diversifolia* (reproduced with permission).
Photograph — M.Fagg.

**Figure 148.** *Catalepidia heyana*.
Photograph — B.Gray.

**Figure 149.** *Floydia praealta* (reproduced with permission).
Photograph — M.Fagg.

**Figure 150.** *Macadamia whelanii*.
Photograph — G.Sankowsky.

**Figure 151.** *Macadamia tetraphylla.*
Photograph — M.Fagg.

**Figure 152.** *Lambertia inermis* var. *inermis.*
Photograph — M.Fagg.

**Figure 153.** *Lambertia ilicifolia* (reproduced with permission).
Photograph — M.Fagg.

**Figure 154.** *Lambertia formosa.*
Photograph — M.Fagg (ANBG).

### **49. Synaphea oulopha** A.S.George, *Fl. Australia* 16: 493 (1995)

T: Bunney Rd, NNE of Eneabba, W.A., 12 Aug. 1993, *A.S.George 17036*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Stems several, 2–5 cm long, villous. Leaves pinnatipartite, multiplanar, glabrescent except a few long hairs persisting on lower petiole; lowest pair of lobes multipartite; uppermost simple; petiole 3–13 cm long; lamina 4–6 cm long, 4–8 cm wide; ultimate lobes linear, 1.5–2.5 mm wide, tapering, acuminate, shallowly and widely reticulate, sparsely puberulous and pilose. Spikes to 15 cm long; flowers openly spaced; peduncle sparsely branched, to 15 cm long, sparsely puberulous; rachis puberulous, red; bracts ovate, obtuse, 0.7–0.9 mm long, spreading puberulous. Perianth ascending, opening widely, glabrous; adaxial tepal 3–4 mm long, 1.5 mm wide, strongly curved; abaxial tepal 2.1–2.3 mm long, not recurved. Stigma oblong, scarcely emarginate, 0.7–0.8 mm long, 0.2 mm wide, with incurved margins; ovary pubescent at base, otherwise glabrous. Fruit cylindrical with oblique apex, 6–7 mm long.

Occurs west of Arrino, W.A. Grows in clay, gravelly loam and lateritic gravel on breakaways, in low open kwongan. Flowers June–Aug. Map 353.

W.A.: South Eneabba Rd, *R.J.Cranfield 1479* (PERTH); N of Arrowsmith R., *E.A.Griffin 3188* (PERTH); 18–20 km WNW of Arrino, 22 July 1980, *R.J.Hnatiuk 800017* (PERTH).

*Synaphea oulopha* is unique in lacking the terminal tuft of gland-like hairs on the ovary. The small, widely opening perianth, small oblong stigma and multipartite leaf lamina with shallow reticulation are also distinctive.

## Sect. 4. Pinnata

**Synaphea** sect. **Pinnata** A.S.George, *Fl. Australia* 16: 487 (1995).

Type: *S. pinnata* Lindl.

Leaves pinnatisect, usually with 1–3 lanceolate lobes from each node. Bracts large. Stigma rounded, very concave, not lobed; ovary with an apical ring of translucent glands.

A monospecific section.

### **50. Synaphea pinnata** Lindl., *Sketch Veg. Swan R.* xxxii (1839)

T: *s. loc.*; holo: CGE, without collection data.

Illustration: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 519 (1989).

Stems to 2 cm long, erect, pubescent, glabrescent. Leaves pinnatisect, ±flat, usually with 1–3 lobes from each node; petiole 10–23 cm long, pilose and puberulous; lamina 5–11 cm long, 4–11 mm wide, very sparsely puberulous when young; lobes lanceolate, acute, discolorous; midrib and lateral veins prominent below with open reticulation; reticulation obscure on upper surface; margins slightly incurved. Spikes 5–10 cm long; flowers openly spaced; peduncle 10–42 cm long, branched, appressed-puberulous; rachis puberulous; bracts 4–5 mm long, appressed-puberulous. Perianth ±straight, opening ±widely, glabrous; adaxial tepal 7.5 mm long, 1.4 mm wide; abaxial tepal 7.5 mm long. Gynoecium thickened below attachment to membrane; stigma orbicular, deeply concave, c. 0.5 mm long and wide; ovary pubescent. Fruit enclosed within enlarged bract, ellipsoidal with lateral incurved beak, 5–6 mm long, puberulous. Figs 120 O–P, 122A.

Occurs along the Darling Scarp east of Perth, between John Forrest National Park and Gosnells, W.A. Grows in doloritic soil in *Eucalyptus wandoo* woodland. Flowers Oct.–Nov. Map 354.

W.A.: Ellis Brook, Darling Scarp, *A.S.George 11160* (PERTH); Helena Valley, 29 Nov. 1987, *J.Marshall* (PERTH); between Smith Mill and Gooseberry Hill, 22 Sept. 1904, *A.Morrison* (PERTH).

A distinctive species especially in its pinnatisect discolorous leaves, large narrow perianth, small concave stigma and beaked fruit enclosed within an enlarged bract.

## Trib. 2. FRANKLANDIEAE

*Proteaceae* trib. *Franklandieae* Endl., *Gen. Pl.* 339 (1837).

Type: *Franklandia* R.Br.

Leaves entire, pinnate or ±dichotomous, with glandular cavities. Inflorescence racemose, sometimes reduced to a single flower. Flowers actinomorphic or zygomorphic. Anther filaments fused to tepals. Hypogynous glands present. Fruit a nut or achene.

Includes 2 endemic Australian subtribes, Franklandiinae and Adenanthinae.

## Subtrib. 1. FRANKLANDIINAE

*Proteaceae* subtrib. *Franklandiinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 171 (1975).

Type: *Franklandia* R.Br.

Leaves ±dichotomous, bearing glandular cavities with internal hairs. Inflorescence an elongate, many-flowered raceme. Perianth with filaments and hypogynous glands forming an elongated tube; margins of tepal limbs incurved. Pollen grains large, globose. Fruit a nut. $n$ = 14 or 28.

A monogeneric subtribe from south-western W.A.

## 14. FRANKLANDIA

*A.S.George*

*Franklandia* R.Br., *Trans. Linn. Soc. London* 10: 157 (1810); named after Thomas Frankland (1750–1831), an English botanist who specialised in marine plants.

Type: *F. fucifolia* R.Br.

Small shrubs with fire-tolerant rootstock, glabrous except the fruit. Leaves alternate, ±dichotomously divided into erect, terete lobes with prominent glands. Flowers in terminal, few-flowered racemes. Perianth tubular with 4 horizontal, lanceolate lobes. Stamens inserted at apex of tube. Gynoecium straight, shortly exserted; stigma capitate; ovary sessile; ovule l. Fruit a narrow nut surmounted by a horizontal plate or a long, trifid awn. $n$ = 14, 28, L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 168 (1975).

A genus of 2 species endemic in south-western Australia. Both sprout from the rootstock after fire.

A.S.George, *Intr. Proteaceae W. Australia* 46–47 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 188–190 (1989).

Perianth lobes 10–14 mm long, dull gold inside and outside, spotted red inside; apex of fruit a horizontal plate **1. F. fucifolia**

Perianth lobes 18–28 mm long, creamy white inside, reddish outside; apex of fruit produced into a twisted column surmounted by 3 long awns **2. F. triaristata**

### 1. Franklandia fucifolia R.Br., *Trans. Linn. Soc. London* 10: 157 (1810)

T: King George Sound [W.A.], Dec. 1801, *R.Brown Iter Australiense (Britten 3276)*; iso: B?, BM, K, MEL.

Illustrations: F.L.Bauer *in* M.Flinders, *Voy. Terr. Australis* t. 6 (1814); A.S.George, *op. cit.* 47, pl. 64.

Stems including scape to 1.6 m tall. Leaves to 15 cm long, to 5-furcate. Floral bracts ovate-triangular, obtuse, 2–4 mm long. Flowers lanoline-scented. Perianth tube and pedicel together 25–31 mm long; segments free towards apex; lobes 10–14 mm long, acute, greenish

gold outside, dull gold and spotted red inside. Nut fusiform, 13–14 mm long, pubescent at base, surmounted by a rounded-triangular concave plate, 5–6 mm wide, hirsute outside. *n* = 14, L.A.S.Johnson & B.G.Briggs, *loc. cit. Lanoline Bush*. Fig. 74.

Widespread in south-western W.A., from William Bay to Israelite Bay, extending inland to Kojonup, and with outliers westwards to the Whicher Range and Dinninup. Grows in sand in kwongan, mallee kwongan and open woodland. Flowers at all seasons, but mainly winter, spring and summer. Map 355.

W.A.: 9 km SW of Israelite Bay, *M.D.Crisp 4892* (CBG, PERTH); William Bay Natl Park, Jan. 1984, *C.V.Malcolm* (PERTH); old telegraph (line) track, 3 km W of Hamersley R., Fitzgerald River Natl Park, *N.G.Walsh 1046* (MEL).

A relatively consistent species. However, one collection [35 km S of Arthur R., *R.J.Cranfield 4681* (PERTH)] has the perianth tube and pedicels to 42 mm long, and another from the same area [*A.S.George 176* (PERTH)] to 38 mm long.

### 2. **Franklandia triaristata** Benth., *Fl. Austral.* 5: 377 (1870)

T: south-western W.A., *J.Drummond s.n.*; lecto: K (in fruit); isolecto: MEL, *fide* A.S.George, *Fl. Australia* 16: 496 (1995); Tone R., W.A., *A.Oldfield*; syn: K (in flower); Capel R., W.A., *A.Oldfield*; syn: B, K, MEL (in flower).

Illustration: A.S.George, *Intr. Proteaceae W. Australia* 46, pl. 63 (1984).

Stems including scape to 1 m tall. Leaves to 35 cm long, but mostly less than 15 cm, to 5-furcate. Floral bracts ovate-rhombic, 4–5 mm long. Flowers vanilla-scented. Perianth tube and pedicel together 45–70 mm long; segments slightly separated towards apex; lobes lanceolate, 18–28 mm long, acuminate, reddish brown outside, creamy white inside. Nut narrowly fusiform, 17–19 mm long, hirsute at base, glabrous and ribbed above, surmounted by a hirsute, twisted column 4–6 cm long and 3 awns 6–7 cm long. *n* = 28, L.A.S.Johnson & B.G.Briggs, *loc. cit.* *Fig.* 159A–C.

Restricted to a few populations near Busselton, W.A. Grows on sandy flats in *Eucalyptus marginata* woodland. Flowers Aug.–Oct.; fruits Nov.–Jan. Map 356.

W.A.: Ruabon, *G.J.Keighery 6617* (PERTH); Busselton, 1870, *A. & E.Pries* (MEL, NSW, PERTH); Claymore Siding, near Nannup, Jan. 1937, *J.Thompson* (PERTH); S of Tutunup, *E.Wittwer 689* (PERTH).

A rare species, notable for the large, strongly scented flowers and remarkable fruit.

## Subtrib. 2. ADENANTHINAE

*Proteaceae* subtrib. *Adenanthinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 171 (1975).

Type: *Adenanthos* Labill.

Leaves entire to pinnate, not dichotomous, bearing glandular cavities that lack internal hairs. Inflorescence a short, 1-flowered raceme. Perianth somewhat tubiform; margins of tepal limbs not incurved. Hypogynous glands fused with perianth only at their bases. Fruit an achene. Pollen grains moderate in size, triangular. *n* = 13.

A monogeneric subtribe endemic in extra-tropical Australia.

# 15. ADENANTHOS

*E.C.Nelson*

*Adenanthos* Labill., *Nov. Holl. Pl.* 1: 28 (1805); from the Greek *aden* (a gland) and *anthos* (a flower), in reference to the prominent glands at the base of the ovary.

Type: *A. cuneatus* Labill.

Shrubs or small trees, some with lignotubers; branches erect or prostrate; bark smooth, rarely warty. Leaves simple, entire or lobed, or deeply segmented, glandular, sclerified. Inflorescence solitary, axillary or terminal, single-flowered. Flowers zygomorphic, bisexual, sessile, within an involucre of numerous, scale-like bracts. Perianth tubular, with 4 tepals, hirsute outside, bearded inside behind anthers. Stamen filaments fused to tepal claws; all stamens perfect and fertile, or adaxial stamen sterile. Hypogynous glands 4, alternating with tepals. Ovary sessile; style terminal; pollen presenter conical or flattened and elliptic; ovule 1. Fruit an achene. $n$ = 13, H.P.Ramsay, *Austral. J. Bot.* 11: 4 (1963); G.J.Keighery, *Taxon* 24: 510 (1975).

A genus of 33 species endemic in southern temperate Australia; 2 species in south-eastern S.A. and Vic. and 31 species in south-western W.A.

Although *anthos* has the neuter gender in Greek, Labillardière gave *Adenanthos* feminine gender. However, the genus is treated here as masculine as required by the *International Code of Botanical Nomenclature* 1994 [Art. 62.2.c].

In leaves that have deep indentations, the initial division of the leaf is termed a segment. If the leaf is divided further and the division is very pronounced (e.g. into terete, filiform divisions), the ultimate divisions of the segments are termed laciniae. The number of laciniae varies within and between species and is an important character in species delimitation. The term lobe is used when the leaf is not deeply divided but the margin is merely indented. Such leaves have a broad basal portion which is flattened and this constitutes the leaf lamina. For an overview of the range of leaf shapes in *Adenanthos*, see E.C.Nelson, *Brunonia* 1: 307, fig. 2 (1978).

A.S.George, Five new species of *Adenanthos* (Proteaceae) from Western Australia, *Nuytsia* 1: 381–385 (1974); E.C.Nelson, Studies in *Adenanthos* Labill. (Proteaceae) II: the taxonomic status of *A. velutina* Meisn. reassessed, *Glasra* 2: 5–70 (1978); E.C.Nelson, A taxonomic revision of the genus *Adenanthos* (Proteaceae), *Brunonia* 1: 303–406 (1978); A.S.George, *Intr. Proteaceae W. Australia* 2–5 (1984); E.C.Nelson, *Adenanthos* × *pamela* (Proteaceae), a hybrid from south-western W. Australia, *Glasra* 9: 1–5 (1986); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 58–73 (1989).

## KEY TO SECTIONS

| | |
|---|---|
| One anther sterile, with stamen reduced to a linear filament; pollen presenter flattened and elliptic, much broader that distal part of style | sect. 1. **EURYLAEMA** |
| All anthers fertile; pollen presenter conical, only slightly broader than distal part of style | sect. 2. **ADENANTHOS** |

## KEY TO SPECIES

*Flowering material is essential for the accurate identification of Adenanthos spp., and this key combines vegetative and floral characters. Flower length is the total length of the perianth tube immediately prior to anthesis.*

**1** One stamen sterile; pollen presenter flattened and elliptic; leaves entire

**2** Leaves linear-lanceolate or oblong-linear to elliptic, more than 30 mm long; flower bud with acute, upturned apex; involucral bracts conspicuously hirsute

**3** Leaves with conspicuous, scattered, tuberculate glands; flowers yellow; shrub without lignotuber **1. A. detmoldii**

**3:** Leaves without scattered glands but with a single apical gland; flowers red; shrub with lignotuber **2. A. barbiger**

**2:** Leaves elliptic or obovate to spathulate, usually less than 30 mm long; flower bud with obtuse apex, not upturned; involucral bracts glabrous or sparsely pubescent

**4** Flowers scarlet (very rarely orange); leaves without scattered glands but with a single apical gland **3. A. obovatus**

**4:** Flowers bright orange or pale red; leaves with numerous scattered glands **4. A. × pamela**

**1:** All stamens fertile; pollen presenter conical; leaves entire or lobed or deeply segmented

**5** Leaves with terete laciniae; flowers not more than 15 mm long

**6** Leaves usually with 5 laciniae; flowers yellow with red apex; perianth tube with dense tuft of hairs inside at throat after anthesis; style sharply recurved at base, almost straight above after anthesis **5. A. drummondii**

**6:** Leaves with 3 or 5 laciniae; flowers cream or pale pink; perianth tube without hairs inside; style distinctly arcuate after anthesis

**7** Leaves hirsute with silvery sheen; flowers cream or pink; erect shrub **6. A. dobagii**

**7:** Leaves glabrous or nearly so, without silvery sheen; flowers cream; prostrate shrub **7. A. apiculatus**

**5:** Leaves entire or lobed or with terete segments or laciniae; flowers more than 15 mm long and generally more than 20 mm long

**8** Leaves entire (very rarely with some lobed leaves)

**9** Leaves linear

**10** Leaves not rigid, flattened in cross-section, obtuse; flowers cream **8. A. linearis**

**10:** Leaves rigid (densely sclerified), terete, with sharply pointed apices; flowers pink **9. A. pungens**

**9:** Leaves not linear

**11** Flowers with glandular hairs on outside, claret with cream band in centre; leaves ovate to obovate, acuminate or mucronate-acute, with tuft of hairs near base, but otherwise glabrous **11. A. venosus**

**11:** Flowers without glandular hairs, colour not as above; leaves not as above

**12** Leaves sessile; flowers 22–25 mm long; erect shrub to 70 cm tall

**13** Leaves conspicuously tomentose with silvery sheen; involucral bracts without conspicuous apical glands; style glabrous or sparsely hirsute; ovary hirsute **12. A. dobsonii**

**13:** Leaves glabrescent; involucral bracts with conspicuous apical glands; style glabrous; ovary glabrous **13. A. glabrescens**

**12:** Leaves petiolate; flowers 24–30 mm long; shrub prostrate or erect to 3 m tall

**14** Leaves almost glabrous, without silvery sheen, to 30 mm long **14. A. ellipticus**

**14:** Leaves tomentose, silvery, 20 mm long or less

**15** Leaves cuneate, with numerous, scattered glands; flowers crimson **15. A. cuneatus**

**15:** Leaves spathulate or obovate, with single apical gland only (or single apical gland on each segment); flowers pale red and cream, or cream **18. A. forrestii**

**8:** Leaves lobed or deeply divided (very rarely with some entire leaves)

**16** Leaves deeply divided into segments or laciniae; segments or laciniae terete, linear, spathulate or obovate, without marginal spines

**17** Segments rigid (densely sclerified) and terete

**18** Segments 2 or 3, sharply pointed; flowers pink; style often hirsute near apex; shrubs without lignotuber **9. A. pungens**

**18:** Laciniae 3–6, not sharply pointed; flowers cream and reddish pink; style glabrous; shrubs with lignotuber **10. A. gracilipes**

**17:** Segments or laciniae not as above (if terete, then not rigid)

**19** Flowers with glandular hairs outside, occasionally with glandular hairs on leaves

**20** Leaves without velvety indumentum, but petiole sometimes densely hairy; flowers purple; involucral bracts less than 5 mm long **29. A. meisneri**

**20:** Leaves with persistent, conspicuous, velvety indumentum; flowers cream and grey-black; involucral bracts to 8 (–9) mm long **30. A. velutinus**

**19:** Flowers and leaves without glandular hairs

**21** Segments or laciniae flattened in T.S.

**22** Leaf with 2 or 3 segments, not further divided; segments spathulate, obovate or obovate-lanceolate

**23** Segments with emarginate apex, to 5 mm long; flowers cream and pale red or cream; ovary hirsute; bark not warty **18. A. forrestii**

**23:** Segments without emarginate apex, to 10 mm long; flowers dark crimson; ovary glabrous; bark warty **19. A. eyrei**

**22:** Leaf with 3 or more laciniae or apical lobes; lobes or laciniae linear to linear-ovate and not conspicuously broader near apex

**24** Laciniae at least 6, linear; leaves c. 25–30 mm long; flowers dull crimson; shrub without lignotuber, to 2 m tall **26. A. × cunninghamii**

**24:** Apical lobes mostly 3 to 5, linear-ovate to linear; leaves 10–15 mm long; flowers bright pink; shrub with lignotuber, rarely more than 1 m tall **20. A. cacomorphus**

**21:** Laciniae terete (*A. oreophilus* ±terete, channelled in upper surface)

**25** Most leaves with 5 or fewer laciniae

**26** Mature leaves glabrous or often glabrescent with hairs persisting at the base; flowers pale pink, creamy green, cream or cream and green, or claret and cream, shortly hairy or villose

**27** Mature leaves glabrous or with hairs near base of floral leaves; flowers to 16 mm long, cream or cream and green; ovary densely hirsute [S.A. & Vic.] **24. A. terminalis**

**27:** Leaves often glabrescent but with hairs persisting near base; flowers 22–28 mm long, pink and green, or creamy green, or claret and cream; ovary glabrous [W.A.]

**28** Leaves to 20 mm long, with both curled and straight hairs; flowers pink and green, or creamy green; style c. 37 mm long **28. A. cygnorum**

**28:** Leaves c. 15 mm long, with long hairs often persistent towards base and on petiole; flowers cream with claret base and dark claret apex; style to 33 mm long **32. A. labillardierei**

**26:** Leaves usually with persistent appressed straight hairs, often silvery; flowers scarlet or bright pink, rarely pale pink or cream, if pale pink or cream then with hairs conspicuous and white or yellow

**29** Leaves c. 20 mm long; flowers scarlet **27. A. oreophilus**

**29:** Leaves to 15 mm long; flowers bright pink (rarely cream or pale pink) with yellow or white hairs

**30** Leaves sessile or almost so, to 15 mm long; shrub with lignotuber; perianth c. 27 mm long; ovary hirsute **21. A. flavidiflorus**

**30:** Leaves distinctly petiolate, to 10 mm long; shrub without lignotuber; perianth c. 20 mm long; ovary glabrous **22. A. argyreus**

**25:** Most leaves with more than 5 laciniae

**31** Flowers scarlet, usually concealed by leaves; leaves 25–45 mm long **25. A. sericeus**

**31:** Flowers not scarlet; leaves 20 mm long or less, not concealing flowers

**32** Leaves silvery, with 9 laciniae; flowers bright pink or rarely yellow [Kangaroo Is., S.A.] **23. A. macropodianus**

**32:** Leaves not silvery, almost glabrous or glabrescent, with 5–7 (–9) or more than 12 laciniae; flowers cream and blue-black, cream and claret, pink and green or creamy green [W.A.]

**33** Leaves with more than 12 laciniae; involucral bracts to 6 mm long; flowers to 21 mm long, cream and blue-black **31. A. filifolius**

**33:** Leaves with 5 (–9) or 5–7 laciniae; involucral bracts less than 5 mm long; flowers 22–28 mm long, cream and claret, pink and green or creamy green

**34** Leaves to 20 mm long, with 5–7 laciniae, with short curled and long straight hairs persistent near base; flowers pink and green or creamy green; style c. 37 mm long **28. A. cygnorum**

**34:** Leaves c. 15 mm long, with 5 (–9) laciniae, with long hairs often persistent towards base; flowers cream with claret base and dark claret apex; style to 33 mm long **32. A. labillardierei**

**16:** Leaves with broad lamina, with rounded or triangular apical lobes only, or with marginal spines

**35** Leaves with marginal spines **33. A. acanthophyllus**

**35:** Leaves without marginal spines

**36** Leaves to 30 mm long, glabrescent, elliptic to obovate; flowers cream and orange-red **14. A. ellipticus**

**36:** Leaves on mature plants 25 mm long or less, cuneate, fan-shaped or ±triangular; leaves glabrous, glabrescent or tomentose; flowers crimson, bright pink or cream and pale pink

**37** Leaves with minute, scattered glands; flowers crimson

**38** Shrub with a lignotuber; mature leaves silvery tomentose, to 20 mm long; style to 40 mm long, with long hairs above and shorter hairs near base; ovary glabrous **15. A. cuneatus**

**38:** Shrub without a lignotuber; leaves on mature plants ±glabrescent, to 25 mm long; style c. 35 mm long, with long and short hairs above, short hairs only at base; ovary pubescent **16. A. stictus**

**37:** Leaves without scattered glands on lamina but lobes each with single apical gland; flowers pink or pink and cream

**39** Shrub to 2 m tall; leaves to 10 mm long, with 3 apical lobes, lobed to about ¼ of length of leaf; flowers cream and pale pink **17. A. ileticos**

**39:** Shrub rarely over 1 m tall; leaves 10–15 mm long, with 3–5 (–7) lobes incised to at least ½ of length of leaf; flowers bright pink **20. A. cacomorphus**

## Sect. 1. Eurylaema

**Adenanthos** sect. **Eurylaema** Benth., *Fl. Austral.* 5: 350, 351 (1870).

Type: *A. obovatus* Labill.

Three stamens perfect and fertile; adaxial stamen sterile and reduced to a linear staminode. Pollen presenter flattened, elliptic, much broader than distal part of style.

A section of 4 species endemic in W.A.

### 1. Adenanthos detmoldii F.Muell., *Fragm.* 8: 149 (1874)

T: Blackwood River, W.A., c. 1870, *J.Forrest*; holo: MEL; iso: NSW, PERTH.

Illustrations: E.C.Nelson, *Brunonia* 1: 307, fig. 2j, 309, fig. 3a, b (1978); J.Leigh *et al., Extinct & Endangered Pl. Australia* opposite p. 288 (1984); E.C.Nelson, *Glasra* 9: facing 1, fig. 2 (1986).

Erect shrub to 4 m tall, without lignotuber; branches densely hirsute, glabrescent; leaf-scars prominent. Leaves linear-lanceolate, to 80 mm long, c. 5 mm wide, with numerous, scattered, tuberculate glands. Involucral bracts villose outside. Perianth c. 25 mm long, yellow, with dense felt of yellow hairs outside; throat orange, becoming brown after pollination; in bud the apex acute and upturned. Style 40 mm long, with long, divaricate, yellow hairs; pollen presenter brown; ovary slightly hirsute. Figs 77, 155H–I.

Endemic in the Scott River area, east of Augusta, W.A. Grows in wet, sandy flats. Flowers Aug.–Nov. Map 357.

W.A.: Scott River Rd, *S.Paust 261* (PERTH); Blackwood R., *Mrs McHard* (K); Scott River area, E of Augusta, *E.C.Nelson ANU 16876* (CANB, DBN); Scott River Rd, E of Augusta, 20 Dec. 1984, *P.E.Sanderson & E.C.Nelson* (DBN).

Now largely confined to roadsides. It is distinguished by its yellow flowers and gland-spotted leaves. The hybrid with *A. obovatus* is frequent (see *A.* × *pamela* below).

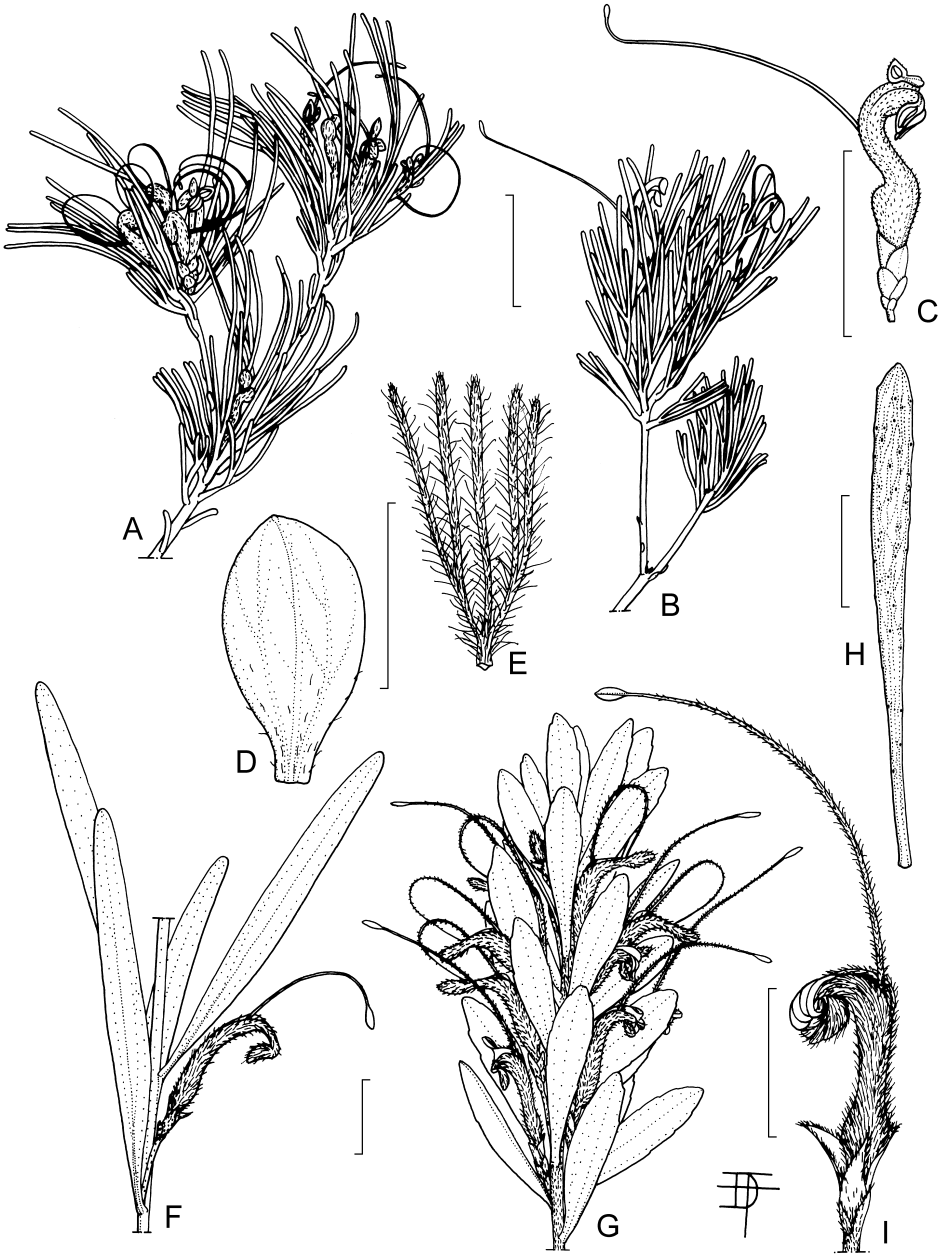



**Figure 155**. *Adenanthos*. **A**, *A. apiculatus*, flowering branchlet (E.Nelson ANU 16794, CANB). **B–C**, *A. drummondii*. **B**, flowering branchlet; **C**, flower (**B–C**, G.Keighery 6874, CANB). **D**, *A. obovatus*, leaf (E.Nelson ANU 17118, CANB). **E**, *A. dobagii*, leaf (E.Nelson ANU 16958, CANB). **F**, *A. barbiger*, flowering branchlet (N.Burbidge 7978, CANB). **G**, *A.* × *pamela*, flowering branchlet (G.Keighery 6147, CANB). **H–I**, *A. detmoldii*. **H**, leaf; **I**, flower (**H–I**, E.Nelson ANU 16876, CANB). Scale bars = 1 cm. Drawn by D.Fortescue.

## 2. **Adenanthos barbiger** Lindl., *Sketch Veg. Swan R.* xxxvi (1839)

T: Vasse River, W.A., c. 1838, *J.Molloy*; lecto: CGE; isolecto: B, *fide* E.C.Nelson, *Brunonia* 1: 324, 328 (1978). Swan River district, W.A., c. 1839, *J.Drummond s.n.*; syn: CGE; Swan River, W.A., *Mr Toward*; syn: CGE.

*Adenanthos intermedius* Ostenf., *Biol. Meddel. Kongel. Danske Vidensk. Selsk.* 3: 49 (1921). T: near Yallingup Cave, W.A., 30 Sept. 1914, *C.E.H.Ostenfeld 674*; holo: C; iso: DBN, K, PERTH.

Illustrations: R.Erickson *et al.*, *Fl. & Pl. W. Australia* t. 108 (1973); E.C.Nelson, *op. cit.* 307, fig. 2k, 309, fig. 3c, d & 325, fig. 7b.

Erect shrub to 1 m tall, with lignotuber; branches hirsute, glabrescent. Leaves sessile, oblong-linear to elliptic, to 80 mm long, c. 7 mm wide, glabrous or with a few hairs near base, with a single apical gland. Involucral bracts with short hairs outside. Perianth c. 25 mm long, scarlet, sparsely hairy outside; in bud the apex acute and upturned. Style c. 40 mm long, usually with long hairs except at base and tip; pollen presenter scarlet; ovary slightly hirsute. *Hairy Gland-flower.* *Fig.* 155F.

Endemic in W.A., ranging from Manjimup northwards to Perth, on the Darling Range and coast; inhabits Jarrah woodland. Flowers Aug.–Dec., but flowers can be found most of the year. Map 358.

W.A.: S of Nannup, on road to Pemberton, *E.C.Nelson ANU 17128* (CANB, DBN); Dunsborough, *E.C.Nelson ANU 17055* (CANB, DBN); c. 5 km NW of Gleneagle, on road to Armadale, 29 Aug. 1959, *Hj.Eichler* (AD); Greenmount, 24 Aug. 1897, *A.Morrison* (CANB, E, MEL, P, PERTH); c. 32 km from Perth on Toodyay road, 12 Sept. 1968, *M.E.Phillips* (CBG, NSW, PERTH).

Plants which are intermediate between *A. barbiger* and *A. obovatus* in terms of their leaf shape may be of hybrid origin. These species can be distinguished reliably using bud characters.

## 3. **Adenanthos obovatus** Labill., *Nov. Holl. Pl.* 1: 29, t. 37 (1805)

T: King George Sound, [W.A.], 1803, *M.Leschenault de la Tour*; holo: G; iso: P.

Illustrations: R.Erickson *et al.*, *Fl. & Pl. W. Australia* t. 45 (1973); E.C.Nelson, *Brunonia* 1: 307, fig. 2d, 310, fig. 4B & 325, fig. 7a (1978); A.S.George, *Intr. Proteaceae W. Australia* 3, pls 2, 3 (1984).

Erect shrub to 1 m tall, rarely to 2 m, with lignotuber; branches hirsute, glabrescent; leaf-scars often prominent. Leaves sessile, obovate to elliptic, to 20 mm long, to 15 mm wide, glabrous or with a few hairs at base, and a single apical gland. Involucral bracts glabrous. Perianth c. 25 mm long, scarlet, very rarely orange, with short, scattered hairs outside; in bud the apex obtuse and not upturned. Style sparsely hirsute, with long hairs; pollen presenter green; ovary with a few short hairs. *Jug-flower.* *Figs* 76, 155D.

Widespread and common on seasonally moist, sandy flats and gravelly hillsides, from north of Perth south through coastal regions to King George Sound, Stirling Range and Mt Manypeaks. Flowers Aug.–Dec., but flowers can be found most of the year. Map 359.

W.A.: Waychinicup, Mt Manypeaks, *E.C.Nelson ANU 17123* (CANB, DBN); Chester Pass, Stirling Ra., 4 Sept. 1947, *J.H.Willis* (MEL); c. 48 km S Manjimup, 5 Sept. 1950, *Davis* (AD); Muchea, 21 Nov. 1961, *T.E.H.Aplin* (PERTH); Guildford, *L.Preiss 790* (B, FI, MEL, NY, P, TCD).

Distinguished from *A. barbiger* by its leaf shape and obtuse bud apex. The typification of this species was discussed by E.C.Nelson, *Taxon* 23: 319–336 (1975). A hybrid with *A. detmoldii* is noted below.

## 4. **Adenanthos × pamela** E.C.Nelson, *Glasra* 9: 2 (1986)

T: Governor Broome Road, west of Canebreak Road crossing, Scott River region, W.A., 20 Dec. 1984, *P.E.Sanderson & E.C.Nelson*; holo: DBN; iso: K, PERTH.

Illustrations: G.J.Keighery, *W. Austral. Gardener* 10(4): 27 (1979); E.C.Nelson, *op. cit.* facing p. 1, fig. 1.

Erect shrub to c. 1.5 m tall, with lignotuber; branches hirsute, glabrescent; leaf scars prominent. Leaves sessile, obovate-attenuate, usually 25–30 mm long, 6–10 mm wide, glabrous except for a tuft of hairs at apex and around base, with numerous scattered resinous

glands that are sometimes prominent and tuberculate. Involucral bracts sparsely hirsute. Perianth c. 25 mm long, orange or dull pale red; in bud the apex obtuse and not upturned. Style c. 40 mm long, with white, divaricate hairs except at base and apex; pollen presenter orange or pale red. Fig. 155G.

Occurs only in the Scott River area, W.A., where the parent species *A. detmoldii* and *A. obovatus* grow together. Grows in damp, sandy flats; frequent on roadsides in disturbed areas. Map 360.

W.A.: 7.3 km along Governor Broome Rd from Scott River Rd, *G.J.Keighery 1927* (PERTH); 3 km N of Brennans Ford, Scott River Plains, *G.J.Keighery 6147* (PERTH); Governor Broome Rd, c. 6 km W of Canebreak Rd intersection, 20 Dec. 1984, *P.E.Sanderson & E.C.Nelson* (DBN).

Frequent on roadsides in disturbed areas. Differs from *A. detmoldii* in having orange flowers, relatively short leaves, and in possessing a lignotuber. *Adenanthos* × *pamela* is a taller shrub than *A. obovatus* and has longer, gland-dotted leaves.

## Sect. 2. Adenanthos

**Adenanthos** Labill. sect. **Adenanthos**.

Type: *A. cuneatus* Labill.

*Adenanthos* sect. *Stenolaema* Benth., *Fl. Austral.* 5: 352 (1870). T: not designated.

Anthers 4, all perfect and fertile. Pollen presenter conical, not much thicker than distal part of style.

A section of 29 species: 27 in W.A., 2 in S.A. and Vic.

### 5. Adenanthos drummondii Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 514 (1845)

T: Swan River Colony, W.A., *J.Drummond 1: 593*; iso: B, BM, K, MEL, OXF, P.

[*Adenanthos terminalis auct. non* R.Br.: C.D.F.Meisner *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 514 (1845); C.D.F.Meisner *in* A.L.P.P. de Candolle, *Prodr.* 14: 313 (1856), *p.p.*]

[*Adenanthos apiculatus auct. non* R.Br.: G.Bentham, *Fl. Austral.* 5: 356 (1870), *p.p.*]

Illustrations: E.C.Nelson, *Brunonia* 1: 310, fig. 4A(a), 311, fig. 5a, b (1978).

Diffuse shrub to 1 m tall, with lignotuber. Leaves in tufts at branch apices, deeply segmented; laciniae terete, usually 5, to 10 mm long, less than 0.5 mm diam., with short, appressed hairs. Perianth c. 12 mm long, yellow at base, scarlet at apex, pubescent outside and with a tuft of hairs filling throat after anthesis. Style arched sharply in bud, after anthesis sharply recurved at base and almost straight above, hirsute only at base, 30 mm long; ovary shortly hirsute. Fig. 155B–C.

Endemic between New Norcia, Wongan Hills and Three Springs, W.A. Grows in kwongan. Flowers Aug.–Nov. Map 361.

W.A.: Three Springs, *W.E.Blackall 4392* (PERTH); Dandaragan, *E.C.Nelson ANU 17001* (CANB, DBN); between Moore R. and Murchison R., *E.Pritzel 290* (AD, BM, DBN, E, NSW, P, S); 11.7 km NE of Bolgart, 23 Aug. 1959, *A.S.George* (PERTH); Quangen [N of Toodyay], *L.Preiss 795* (G, MEL, P).

Distinguished by its red and yellow flowers, and by its sharply reflexed, almost straight style after anthesis. The tuft of hairs blocking the throat of the flower occurs otherwise only in *A. argyreus*.

### 6. Adenanthos dobagii E.C.Nelson, *Brunonia* 1: 334 (1978)

T: Quoin Head track turn-off, Fitzgerald River National Park, W.A., 28 Sept. 1972, *E.C.Nelson ANU 16957*; holo: CANB 237045; iso: DBN.

Illustration: S.Hopper *et al.*, *W. Australia's Endangered Fl.* 34 (1990).

Diffuse shrub to 50 cm tall, without lignotuber. Leaves in tufts at branch apices, deeply segmented; laciniae usually 5, terete, 8–20 mm long, c. 0.5 mm diam., densely hirsute and

appearing silvery. Perianth c. 11 mm long, cream or pale pink, hirsute outside. Style c. 25 mm long, becoming reflexed near base and dorsally arched after anthesis, with long hairs except at base and apex; ovary sparsely hirsute. Fig. 155E.

Endemic in W.A. and apparently restricted to a small area within Fitzgerald River Natl Park; grows in sandy soil among low shrubs. Flowers Aug.–Nov. Map 362.

W.A.: Quoin Head Track, *E.C.Nelson ANU 16958* (CANB, DBN); near Quoin Head, track to Hamersley R., *E.C.Nelson ANU 17081* (CANB, DBN).

Similar in appearance to *A. flavidiflorus*, but *A. dobagii* has smaller flowers and lacks a lignotuber. Closely allied to *A. apiculatus*. Gazetted as a rare and endangered species (S.Hopper *et al*., 1990).

### 7. **Adenanthos apiculatus** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 9 (1830)

T: King George Sound, [W.A.], 1823, *W.Baxter*; holo: BM; iso: K, NSW.

*Adenanthos procumbens* Meisn. *in* J.G.C.Lehmann., *Pl. Preiss*. 1: 512 (1845). T: Mt Wuljenup [Mt Willyung], W.A., 14 Oct. 1840, *L.Preiss 589*; holo: NY; iso: B, C, HBG, K, KIEL, LE, MEL, MO, P.

Illustrations: E.C.Nelson, *Brunonia* 1: 307, fig. 2s, 311, fig. 5c, d (1978).

Prostrate, spreading shrub often 2 m across, rarely 50 cm tall, without lignotuber. Leaves on shoots very small; those surrounding flowers much longer, deeply segmented, petiolate; laciniae usually 3, terete, 5–20 mm long, c. 0.5 mm diam., usually glabrous; floral leaves with long hairs near base. Perianth c. 13 mm long, pale cream, or with green apex and cream base, hirsute outside. Style c. 25 mm long, after anthesis reflexed at base and dorsally arched, glabrous, rarely with long hairs; ovary hirsute. Fig. 155A.

Endemic in W.A., between King George Sound and Pallinup River on the south coast and inland to Stirling Range. Grows as an undershrub in sandy or gravelly soil, often in dense scrub. Flowers Aug.–Nov. Map 363.

W.A.: Mt Hassell, Stirling Ra., *E.C.Nelson ANU 16743b* (CANB); Chester Pass, Stirling Ra., *R.D.Royce 3703* (PERTH); King George Sound, *F.Mueller* (NY, P); near Waychinicup, Mt Manypeaks, *E.C.Nelson ANU 16794* (CANB); Bremer Bay townsite, 14 Apr. 1974, *E.Croxford* (CANB).

This is related to *A. dobagii*, but has less hairy leaves and is a more vigorous, spreading shrub. A hybrid between *A. apiculatus* and *A. cuneatus* has been collected near Wellstead townsite, east of Albany. Meisner misapplied the name *A. apiculatus* to plants later described as *A. cygnorum*, and Bentham considered *A. drummondii* a synonym of *A. apiculatus* because of inadequate material.

### 8. **Adenanthos linearis** Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 311 (1856)

T: Swan River Colony [W.A.], *J.Drummond 4: 265*; holo: NY; iso: B, BM, E, K, MEL, NSW, OXF, P, PERTH, TCD.

Illustration: E.C.Nelson, *Brunonia* 1: 310, fig. 4A(d) (1978).

Prostrate shrub rarely more than 25 cm tall and 50 cm diam., without lignotuber. Leaves sessile, entire, linear, to 30 mm long, c. 2 mm wide, obtuse at apex, glabrous, with prominent, red, apical gland. Perianth c. 20 mm long, cream, hirsute outside. Style c. 25 mm long, flexuose near base and dorsally arched after anthesis, with long hairs in upper portion only; ovary pubescent. Fig. 156A–B.

Endemic in W.A., restricted to northern foothills of the Stirling Range. Grows in sandy soil and open scrub, often with *Banksia aculeata*. Flowers Jan.–Mar. Map 364.

W.A.: Salt River Rd, Stirling Ra., *E.Wittwer 600* (PERTH); Salt Lake Rd, near Stevenson Rd turn-off, *E.C.Nelson ANU 17111* (CANB).

Rare and probably drastically reduced due to agricultural expansion north of the Stirling Range. This species is unusual in reaching peak flowering between January and March. It resembles *A. apiculatus* but has larger flowers and undivided adult leaves. The first pair of true leaves produced by seedlings are 3-segmented, with terete lobes.

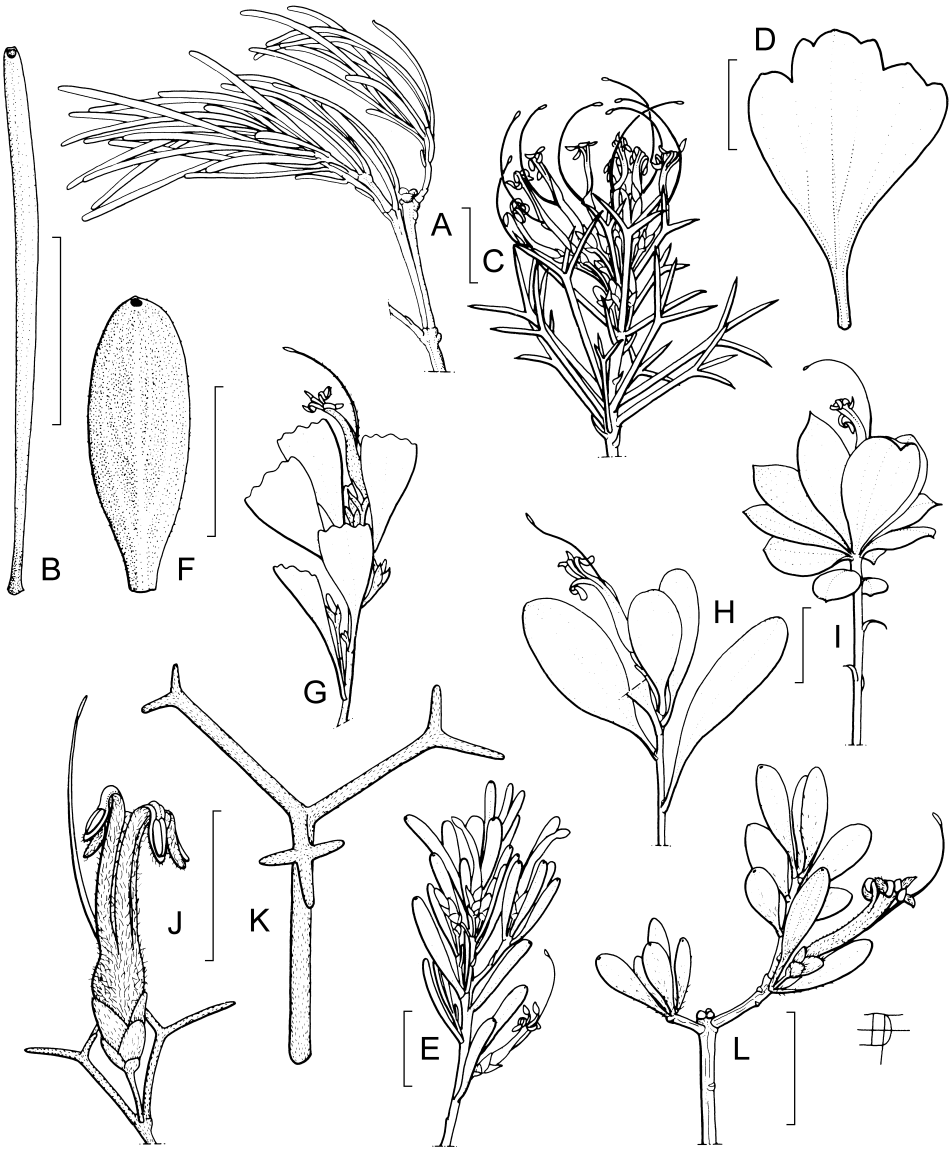



**Figure 156**. *Adenanthos*. **A–B**, *A. linearis*. **A**, branchlet; **B**, leaf (**A–B**, E.Nelson ANU 17105, CANB). **C**, *A. pungens* subsp. *pungens*, flowering branchlet (E.Nelson ANU 17137, CANB). **D**, *A. stictus*, leaf from immature plant (E.Nelson ANU 17066, CANB). **E**, *A. glabrescens* subsp. *glabrescens*, flowering branchlet (E.Nelson ANU 17441, CANB). **F**, *A. glabrescens* subsp. *exasperatus*, leaf (E.Croxford ANU 17425, CANB). **G**, *A. cuneatus*, flowering branchlet (E.Nelson ANU 17073, CANB). **H**, *A. ellipticus*, flowering branchlet (E.Nelson ANU 16691, CANB). **I**, *A. venosus*, flowering branchlet (E Mt Barren, W.A., J.Willis s.n., CANB). **J–K**, *A. gracilipes*. **J**, flower; **K**, leaf; (**J–K**, E.Nelson ANU 17100, CANB). **L**, *A. dobsonii*, flowering branchlet (E.Nelson ANU 17035, CANB). Scale bars: **A–E**, **H–L** = 1 cm; **F** = 5 mm; **G** = 2 cm. Drawn by D.Fortescue.

### 9. **Adenanthos pungens** Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 515 (1845)

T: interior, south-western W.A., Oct. 1840, *L.Preiss 671*; holo: NY.

Illustrations: E.C.Nelson, *Brunonia* 1: 307, fig. 2p, 312, fig. 6a–c (1978).

Erect (to 3m tall) or prostrate shrub, without lignotuber. Leaves densely sclerified, rigid, terete, to 30 mm long, 1–2 mm diam., simple or divided (if divided then with (2–) 3 segments), pungent. Flowers clustered at tips of branchlets. Perianth to 30 mm long, pale pink tinted with cream, or bright pink. Style c. 40 mm long, glabrous or with hairs near apex; ovary glabrous.

Endemic in W.A., north-west of Stirling Range and in wheatbelt south of Lake Grace; grows on rocky hillslopes in deep sand and on gypsum dunes. *Adenanthos pungens* (both subspecies) is a gazetted rare plant (S.Hopper *et al.*, 1990). The first true leaves produced by seedlings are linear, resembling those of *A. linearis*. There are 2 subspecies.

| | |
|---|---|
| Shrub erect; leaves usually 3-segmented; flowers deep pink | **9a.** subsp. **pungens** |
| Shrub prostrate; leaves simple or 3-segmented; flowers pale pink | **9b.** subsp. **effusus** |

### 9a. **Adenanthos pungens** Meisn. subsp. **pungens**

*Adenanthos armatus* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 313 (1856). T: Swan River Colony [W.A.], *J.Drummond 5: 400*; iso: B, BM, FI, K, MEL, OXF, P, TCD.

Illustration: S.Hopper *et al.*, *W. Australia's Endangered Fl.* 35 (1990).

Erect shrub to 3 m tall. Leaves usually trisected in upper half, very rarely simple. Flowers deep pink. Fig. 156C.

Occurs in widely scattered localities, including Hamilla Hill Reserve, east of Cranbrook, and on adjacent hills of western Stirling Range; also collected on gypsum west of Pingrup on gypsum dunes. Flowers Aug.–Nov. Map 365.

W.A.: Hedge Hill, near Donnelly Peak, Stirling Ra., 27 Oct. 1934, *C.A.Gardner* (PERTH); c. 13 km E of Cranbrook, 10 Oct. 1960, *B.G.Briggs* (NSW); Hamilla Hill, Cranbrook, *E.C.Nelson ANU 17110* (CANB), DBN); Reserve 28.395, W of Pingrup, 20 Aug. 1984, *K.Wallace* (DBN).

### 9b. **Adenanthos pungens** subsp. **effusus** E.C.Nelson, *Brunonia* 1: 350 (1978)

T: south of Tambellup, W.A., 3 Oct. 1973, *E.C.Nelson ANU 17113*; holo: CANB 237056; iso: DBN.

*Adenanthos pungens* var. *simplicifolia* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 248 (1848). T: Swan River Colony, W.A., *J.Drummond 3: 256*; holo: NY; iso: FI, G-DC, K, MEL, NSW, OXF, TCD.

Prostrate shrub forming a dense mat up to 3 m wide, rarely more than 50 cm tall. Leaves simple or 3-segmented. Perianth pale pink flushed with cream.

Confined to a single population south of Tambellup. Grows in deep siliceous sand. Flowers Aug.–Nov. Map 366.

W.A.: S of Tambellup, *R.D.Royce 7682* (PERTH); *loc. id.*, *N.Demarz 5091* (KPBG).

The prostrate subspecies is a most distinctive plant. Blooming profusely, it is of considerable horticultural potential, but is seriously threatened in the wild.

### 10. **Adenanthos gracilipes** A.S.George, *Nuytsia* 1: 383 (1974)

T: c. 65 km east of Lake King, on Norseman Road, W.A., 15 Sept. 1964, *R.H.Kuchel 1817*; holo: PERTH; iso: AD, CANB, PERTH.

Illustration: E.C.Nelson, *Brunonia* 1: 307, fig. 2q (1978).

Erect shrub to 1.5 m tall, with lignotuber. Leaves densely sclerified, rigid, usually 3-segmented; segments simple or bifid, very rarely trifid, terete, c. 1 mm diam., obtuse, glabrous. Perianth c. 25 mm long, cream and reddish pink, hairy on outside. Style c. 30 mm long, glabrous; ovary hirsute. Fig. 156J–K.

Endemic in W.A. and confined to the region of the Johnston Lakes and Frank Hann Natl Park. Flowers Aug.–Dec. Map 367.

W.A.: E of Hyden, on road to Norseman, near 300 mile peg, *E.C.Nelson ANU 17147* (CANB, DBN); *loc. id.*, *J.S.Beard 3853* (PERTH); 65 km E of L. King, on Daniell Rd, *E.C.Nelson ANU 17000* (CANB, DBN).

This species is not closely related to others, except perhaps *A. argyreus*. The flowers are similar, but *A. gracilipes* has remarkable sclerified leaves. The only other species with terete, rigid leaves is *A. pungens*; its leaves, however, are sharply pointed.

### 11. **Adenanthos venosus** Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 311 (1856)

T: Swan River Colony [W.A.], *J.Drummond 4: 264*; holo: NY; iso: B, BM, FI, K, MEL, OXF, P, TCD.

Illustration: E.C.Nelson, *Brunonia* 1: 307, fig. 2e (1978).

Diffuse shrub with ascending branches, to c. 1.5 m tall, with lignotuber. Leaves mostly clustered at tips of shoots, entire, sessile, ovate to obovate, to 15 mm long, c. 10 mm wide, acuminate or mucronate-acute, glabrous except at base. Perianth c. 25 mm long, dull crimson with cream band in centre, with numerous glandular hairs outside, especially on limb. Style c. 40 mm long, glabrous; ovary shortly hairy. Fig. 156I.

Endemic in W.A., in the Fitzgerald River Natl Park (West and East Mts Barren). Grows on rocky hillslopes in siliceous sand. Flowers Aug.–Nov. Map 368.

W.A.: base of West Mt Barren, *E.C.Nelson ANU 16712* (CANB, DBN); Mt Bland, 6 Apr. 1963, *K.Newbey* (PERTH); E side of Hamersley Inlet, *E.C.Nelson ANU 17079* (CANB, DBN); East Mt Barren, 28 Oct. 1965, *J.Wrigley* (CBG, NSW); No Tree Hill, near Hopetoun, 3 Dec. 1960, *A.S.George* (PERTH).

A distinctive species with glandular hairs on the flowers; the only other species with this character have laciniate leaves (*A. meisneri* and *A. velutinus*). The locality 'interior from Cape Le Grand', cited by G.Bentham (*Fl. Austral.* 5: 353, 1870), is clearly incorrect; the species has not been found in that region.

### 12. **Adenanthos dobsonii** F.Muell., *Fragm.* 6: 204 (1868)

T: Point Malcolm, W.A., *G.Maxwell*; holo: MEL; iso: K, NSW.

Illustration: E.C.Nelson, *Brunonia* 1: 307, fig. 2i (1978).

Erect shrub to 70 cm tall, with lignotuber. Leaves entire, rarely lobed, sessile, obovate to spathulate, usually less than 10 (–15) mm long and 4 (–10) mm wide, obtuse or rarely emarginate at apex, with short and long appressed hairs giving a silvery sheen, with single, prominent, dorsal apical gland; lobes, if present, 3, c. 4 mm long, with single gland on each apex. Involucral bracts eglandular. Perianth c. 25 mm long, red with cream base, or creamy yellow, shortly hairy outside. Style c. 30 mm long, glabrous except for a few hairs near base; ovary hirsute. Fig. 156L.

Endemic in W.A., east of Esperance; frequent between Israelite Bay, Cape Arid and sandplain south of Mt Ragged. Grows in deep, siliceous sand in kwongan. Flowers Aug.–Dec. Map 369.

W.A.: E of Esperance, on Israelite Bay track, *E.C.Nelson ANU 16975* (CANB, DBN); S of Mt Baring, *E.C.Nelson ANU 16969* (CANB, DBN); Israelite Bay, *J.S.Beard 5329* (KPBG); c. 35 km SW of Mt Ragged, 17 Jan. 1966, *A.S.George* (PERTH).

Allied to *A. glabrescens* (see below), but restricted to the kwongan east of Esperance, *A. dobsonii* grows with *A. cuneatus*, and a hybrid between these species is known.

### 13. **Adenanthos glabrescens** E.C.Nelson, *Brunonia* 1: 345 (1978)

T: western edge of Lake King, W.A., 19 Oct. 1973, *E.C.Nelson ANU 17090*; holo: CANB 237039; iso: DBN.

Erect shrub to 70 cm. Leaves mostly clustered at tips of shoots, entire, rarely lobed, sessile, ovate or linear-lanceolate to obovate, to 25 mm long, to 6 mm wide, obtuse at apex, glabrescent, with single, prominent, dorsal apical gland; lobes, if present, 3, c. 4 mm long, with single gland on each apex. Involucral bracts divaricate or remaining imbricate when

mature, innermost bracts with prominent gland at apex. Perianth c. 22 mm long, pinkish scarlet and cream, hirsute outside. Style c. 35 mm long, glabrous; ovary glabrous.

Endemic in W.A., south of Lake King and in the Fitzgerald River Natl Park region.

There are 2 subspecies. These subspecies are geographically isolated and differ in the occurrence or absence of a lignotuber. Both are about 250 km from the nearest populations of *A. dobsonii*, to which species they are closely related. The latter has silvery, hirsute leaves that are shorter than those of *A. glabrescens*.

Shrub with lignotuber; leaves linear-lanceolate to obovate, 10–25 mm long, 2–3 mm wide, smooth **13a.** subsp. **glabrescens**

Shrub without lignotuber; leaves ovate, 10–25 mm long, 3–6 mm wide, sometimes rough **13b.** subsp. **exasperatus**

### 13a. Adenanthos glabrescens E.C.Nelson subsp. glabrescens

Erect shrub, with lignotuber. Leaves linear-lanceolate to obovate, 10–25 mm long, 2–3 mm wide, smooth. Involucral bracts divaricate when mature. Figs 75, 156E.

The northern populations around Lake King, and those extending south towards Magdhaba Soak and Halls Track form this subspecies. Grows in deep, siliceous sand in open scrub, often on dunes. Flowers Aug.–Nov. Map 370.

W.A.: c. 50 km E of Newdegate, towards L. King, 20 Mar. 1970, *M.D.Tindale & B.R.Maslin* (NSW, PERTH); c. 16 km SE of L. King, *E.Wittwer 354* (KPBG, PERTH); N of Magdhaba Soak, S of L. King, *R.A.Saffrey 426* (PERTH); Ravensthorpe district, 26 June 1924, *Ralph & Stanford* (PERTH).

### 13b. Adenanthos glabrescens subsp. exasperatus E.C.Nelson, *Brunonia* 1: 346 (1978)

T: 8 miles [c. 13 km] north of Point Charles, Fitzgerald River National Park, W.A., Jan. 1974, *K.Newbey*; holo: CANB 237053.

Erect shrub, without lignotuber. Leaves ovate, 5–15 mm long, 2–6 mm wide; young leaves with few scattered hairs, becoming ±glabrous and sometimes scabrous. Involucral bracts remaining imbricate. Fig. 156F.

Found only in Fitzgerald River area and east of Ravensthorpe. Grows on gravelly hillsides, not in deep, siliceous sand. Flowers Nov.–Apr. Map 371.

W.A.: Fitzgerald River Reserve, 12 July 1970, *R.D.Royce* (PERTH); near Fitzgerald R., on hill overlooking Pabelup L., 14 Apr. 1974, *E.Croxford* (CANB); c. 33 km E of Ravensthorpe, and 3 km S of highway, *A.Weston 9935* (CANB, PERTH).

### 14. Adenanthos ellipticus A.S.George, *Nuytsia* 1: 383 (1974)

T: East Mount Barren, Fitzgerald River National Park, W.A., 9 Sept. 1971, *A.S.George 10968*; holo: PERTH; iso: CANB, K, PERTH.

Illustrations: E.C.Nelson, *Brunonia* 1: 307, fig. 2c (1978); S.Hopper *et al.*, *W. Australia's Endangered Fl.* 35 (1990).

Erect shrub to 3 m tall, without lignotuber. Leaves entire, rarely with 3 rounded, apical lobes; petiole distinct; lamina elliptic to obovate, to 30 mm long, c. 15 mm wide, obtuse at apex, with short, appressed hairs, glabrescent. Perianth c. 27 mm long, orange-red and cream, with short, sparse indumentum outside. Style c. 40 mm long, with short divaricate hairs; ovary pubescent. Fig. 156H.

Endemic in W.A.; restricted to East Mt Barren and Thumb Peak in Fitzgerald River Natl Park. Grows on rocky hillslopes in siliceous sand. Flowers Aug.–Nov. Map 372.

W.A.: East Mt Barren, 26 Oct. 1931, *W.E.Blackall* (PERTH); summit of East Mt Barren, *E.C.Nelson ANU 16968* (CANB, DBN).

Related to *A. cuneatus* and growing with that species on East Mt Barren, but the leaves are glabrous and elliptic in *A. ellipticus*, hirsute and fan-shaped in *A. cuneatus*. Some plants on

East Mt Barren may be hybrids between the two. Gazetted as rare and endangered (S.Hopper *et al*., 1990).

### 15. **Adenanthos cuneatus** Labill., *Nov. Holl. Pl.* 1: 28, t. 36 (1805)

*Adenanthos flabellifolius* Knight, *Cult. Prot.* 96 (1809), *nom. illeg.* T: Esperance Bay [W.A.], Dec. 1792, *J.J.H. de Labillardière*; holo: FI; iso: B, BM, FI, G-DC, P, TCD.

*Adenanthos crenatus* Willd. *in* C.P.J.Sprengel, *Syst.* 1: 472 (1825). T: Esperance Bay [W.A.], Dec. 1792, *J.J.H. de Labillardière*; holo: B; iso: BM, FI, G-DC, P, TCD.

Illustrations: E.C.Nelson, *Brunonia* 1: 307, fig. 2a (1978); A.S.George, *Intr. Proteaceae W. Australia* 4, pl. 4 (1984).

Prostrate to erect shrub to 2 m tall and wide, with lignotuber. Leaves cuneate, on a short petiole, to 20 mm long, 10–15 mm wide, with (3–) 5 (–7), apical, rounded to triangular lobes, sometimes entire, with dense, silvery indumentum of short, appressed hairs, with numerous scattered glands (sometimes obscured by tomentum). Perianth to 30 mm long, crimson, paler or greenish towards base, sparsely and shortly hairy outside. Style to 40 mm long, with long hairs above and shorter hairs near base; ovary glabrous. *Sweat-bush*, *Flame-bush*, *Bridle-bush*. Figs 78, 156G.

Widespread and abundant along the south coast of W.A. from Twilight Cove west to Walpole; extending inland to the Stirling Range. A characteristic species of the southern kwongan; grows in deep siliceous sand. Flowers Aug.–Nov., but flowers can be found most of the year. Map 373.

W.A.: Walpole, Jan. 1938, *A.M.Baird* (CANB); 5 km E of Denmark, *E.C.Nelson ANU 17415* (CANB); Mt Mistake, Stirling Ra., *E.C.Nelson ANU 17108* (CANB, DBN); c. 13 km N of Israelite Bay, *E.C.Nelson ANU 16526* (CANB, DBN); 24 km S of Cocklebiddy, 16 Oct. 1966, *A.S.George* (PERTH).

A variable plant, especially in habit. Some individuals are almost prostrate but there are no distinctive and separate populations. Related to *A. stictus* which grows north of Perth, and to *A. ellipticus* in Fitzgerald River Natl Park. *Adenanthos cuneatus* apparently hybridises readily with others, and putative hybrids between it and *A. dobsonii*, *A. apiculatus* and *A. sericeus* (*A.* × *cunninghamii*, see below) have been reported (E.C.Nelson, *op. cit*. 391–392).

### 16. **Adenanthos stictus** A.S.George, *Nuytsia* 1: 384 (1974)

T: 8 miles [c. 13 km] north of Marchagee, on Geraldton Highway, W.A., 10 Sept. 1970, *A.S.George 10379*; holo: PERTH; iso: CANB, PERTH.

Illustration: E.C.Nelson, *Brunonia* 1: 307, fig. 2b (1978).

Erect shrub to at least 5 m tall, without lignotuber. Leaves cuneate, on short petioles, on mature plants to 25 mm long and 15 mm wide, with 7–9 rounded or triangular, apical lobes, at first with a short, silvery indumentum, later ±glabrescent, with numerous scattered glands. Perianth to 28 mm long, dark crimson, with paler base, with sparse indumentum of short hairs outside. Style c. 35 mm long, with long and short hairs above, short hairs only near base; ovary pubescent. Fig. 156D.

Restricted to the area between Watheroo and Three Springs, W.A.; growing in deep siliceous sand. Flowers Aug.–Nov. Map 374.

W.A.: c. 26 km W of Winchester, on Eneabba road, *J.S.Beard 7329* (PERTH); c. 16 km W of Coorow, *E.C.Nelson ANU 17094* (CANB, DBN); Watheroo Natl Park, 7 Oct. 1971, *R.D.Royce* (PERTH); *loc. id*., *E.C.Nelson ANU 17002* (CANB, DBN).

A very robust shrub, among the tallest in the genus, closely related to *A. cuneatus*, but differs mainly in habit (*A. stictus* lacks a lignotuber). Its most remarkable character is the considerable difference in size between the seedling leaves (to 5 cm long and wide) and the smaller leaves of mature plants.

### 17. Adenanthos ileticos E.C.Nelson, *Brunonia* 1: 384 (1978)

T: 70 km north of Esperance, on road to Norseman, near Red Lake, W.A., 8 Aug. 1973, *E.C.Nelson ANU 17007*; holo: CANB 237042; iso: CANB, DBN.

Illustration: S.Hopper *et al.*, *W. Australia's Endangered Fl.* 35 (1990).

Diffuse shrub to 2 m tall, with lignotuber. Leaves distinctly petiolate; lamina fan-shaped, to 10 mm long, to 5 mm wide, with 3 rounded, apical lobes, usually glabrous; lobes c. 2 mm long, emarginate, with a single apical gland at base of notch. Perianth to 25 mm long, pale reddish pink and cream, with short hairs. Style to 32 mm long, glabrous; ovary pubescent. Fig. 157D.

Endemic between Esperance and Norseman, W.A.; grows in sandy soil in open woodland. Flowers Aug.–Oct. Map 375.

W.A.: 70 km N of Esperance, on road to Norseman, *E.C.Nelson ANU 17086* (CANB, DBN).

Leaves much smaller than those of *A. cuneatus*, and not segmented into lobes as in the related species *A. forrestii*. Gazetted as a rare and endangered species (S.Hopper *et al*., 1990).

### 18. Adenanthos forrestii F.Muell., *S. Sci. Rec.* 2: 230 (1882)

T: near Point Dover, W.A., 14 June 1870, *J.Forrest*; lecto: MEL; isolecto: K, NSW, *fide* E.C.Nelson, *Brunonia* 1: 356–357 (1978); near Point Culver, W.A., 1 June 1870, *J.Forrest*; syn: MEL.

Illustration: E.C.Nelson, *Brunonia* 1: 307, fig. 2h (1978).

Diffuse, erect shrub to 1 m tall, with lignotuber. Leaves usually deeply segmented, with a distinct petiole, sometimes entire, to 15 mm long; segments usually 3, spathulate or obovate, to 5 mm long, to 3 mm wide, emarginate with prominent apical gland, with short, appressed hairs, appearing silvery. Perianth to 24 mm long, pale red and cream or cream, with short hairs outside. Style to 30 mm long, glabrous; ovary hirsute. Fig. 157H.

Occurs only east of Norseman, on siliceous dunes of the Great Australian Bight, and also collected inland in the Fraser Range, W.A. Flowers Aug.–Nov. Map 376.

W.A.: 25 km SSE of Mt Malcolm, Fraser Ra., c. 115 km E of Norseman, *K.Newbey 7641* (PERTH); Twilight Cove, *E.C.Nelson ANU 16980* (CANB); Toolinna sandpatch, *E.C.Nelson ANU 17045* (CANB, DBN).

Related to *A. ileticos* and *A. eyrei*. The latter has longer leaves and lacks a lignotuber. A hybrid with *A. cuneatus* has been found on two occasions.

### 19. Adenanthos eyrei E.C.Nelson, *Brunonia* 1: 355 (1978)

T: Toolinna sandpatch, south of Caiguna and north-east of Point Culver, Great Australian Bight, W.A., 24 Oct. 1973, *E.C.Nelson ANU 17044*; holo: CANB 237043; iso: CBG, DBN, PERTH.

Illustrations: E.C.Nelson, *Brunonia* 1: 310, fig. 4A(b), 312, fig. 6d (1978).

Erect shrub to 1 m tall, without lignotuber. Older stems with warty bark. Leaves segmented, very rarely entire; petiole distinct; lamina to 15 mm long; segments 3, obovate-lanceolate, to 10 mm long, c. 3 mm wide, obtuse or occasionally uncinate, with short, appressed hairs, silvery. Perianth to 25 mm long, dark crimson, shortly hairy outside. Style 35 mm long, glabrous; ovary glabrous. Fig. 157B.

Known only from the type locality; grows in deep siliceous sands, in heath with *A. forrestii*, *A. cuneatus* and *Banksia epica*. Flowers Oct. Map 377.

A remarkable species that is gazetted as rare and endangered (S.Hopper *et al.*, *W. Australia's Endangered Fl.* 35, 1990). It has warty bark and dark crimson flowers. The leaves resemble those of *A. forrestii*, but are larger. Like *A. cuneatus*, the young foliage is crimson.

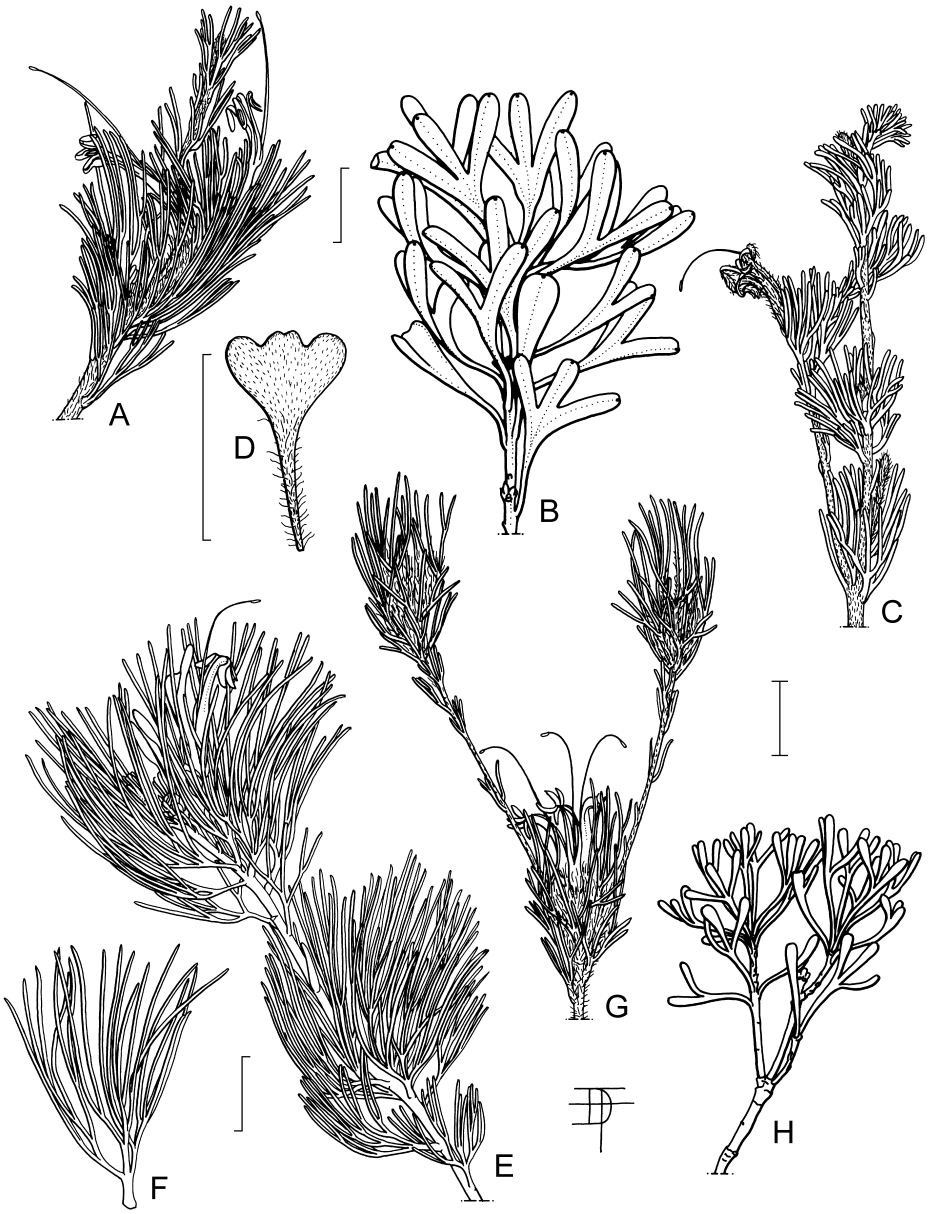



**Figure 157**. *Adenanthos*. **A**, *A. macropodianus*, flowering branchlet (E.Nelson ANU 17024, CANB). **B**, *A. eyrei*, branchlet (E.Nelson ANU 17044, CANB). **C**, *A. flavidiflorus*, flowering branchlet (E.Nelson ANU 16935, CANB). **D**, *A. ileticos*, leaf (E.Nelson ANU 17086, CANB). **E–F**, *A. sericeus* subsp. *sericeus*. **E**, flowering branchlet; **F**, leaf (E–F, E.Nelson ANU 17037, CANB). **G**, *A. terminalis*, flowering branchlet (K.Czornij 679, CANB). **H**, *A. forrestii*, branchlet (A.Weston 8272, CANB). Scale bars = 1 cm. Drawn by D.Fortescue.

### **20. Adenanthos cacomorphus** E.C.Nelson, *Brunonia* 1: 385 (1978)

T: 7.5 km west-south-west of Bivouac Rocks, Fitzgerald River National Park, W.A., 9 May 1974, *K.Newbey 4134*; holo: CANB 237041; iso: DBN.

Erect shrub rarely over 1 m tall, with lignotuber. Leaves ±triangular, 10–15 mm long, with 3–5 (–7) apical lobes, some incised to at least half length of leaf; petiolate; lobes linear-ovate to linear, acute at apex with prominent, red-brown apical gland, with dense indumentum of short appressed hairs, silvery. Perianth to 25 mm long, bright pink, with short, white hairs especially near apex. Style to 35 mm long, with long hairs except near base; ovary pubescent.

Confined to the western part of the Fitzgerald River Natl Park and adjacent region, W.A. Grows in kwongan, in deep siliceous sand or sandy gravel. Flowers Nov.–Mar., but flowers can be found most of the year. Map 378.

W.A.: c. 22 km SE of Jerramungup, 8 Feb. 1969, *K.Newbey* (PERTH); Quiss Rd, Fitzgerald River Natl Park, 31 Dec. 1984, *E.C.Nelson* (DBN); W bank of Gairdner R., Devils Creek Rd, near Bremer Bay, *E.C.Nelson ANU 17452* (CANB, DBN, MEL, PERTH).

*Adenanthos cacomorphus* links *A. cuneatus* and *A. flavidiflorus*. Its leaves are more deeply incised than those of *A. cuneatus* and the flower colour is distinct. In the latter character it resembles *A. flavidiflorus* which is distinguished by its teretely lobed leaves. As these species are sympatric, *A. cacomorphus* may be of hybrid origin.

### **21. Adenanthos flavidiflorus** F.Muell., *Fragm.* 1: 157 (1859)

T: near West Mount Barren, W.A., *G.Maxwell*; holo: MEL; iso: B, BM, K.

Illustration: E.C.Nelson, *Brunonia* 1: 307, fig. 2n (1978).

Low diffuse shrub to c. 1 m tall, with lignotuber. Leaves sessile or almost so, deeply divided, to 15 mm long; laciniae terete, 5 (–7), c. 1 mm diam., silvery, with short and long appressed hairs. Perianth c. 27 mm long, bright reddish pink, rarely pale cream or creamy pink, densely covered with bright white or yellow hairs. Style c. 30 mm long, with long spreading hairs, rarely glabrous; ovary hirsute. Fig. 157C.

Occurs in southern-central W.A. from Bremer Bay east to Culham Inlet and north to Wagin and Hyden; grows in deep siliceous sand. Flowers Nov.–Jan. Map 379.

W.A.: N of Wickepin, *E.C.Nelson ANU 16935* (CANB); Lake Varley Reserve, S of Hyden, *E.C.Nelson ANU 16941* (CANB); Bremer Bay town, 14 Apr. 1974, *E.Croxford* (CANB); W of Hamersley Inlet, Fitzgerald River Natl Park, *E.C.Nelson ANU 16961 (*CANB).

Similar in appearance to *A. argyreus* which may be distinguished by the glabrous style, absence of a lignotuber, and the smaller, less divided leaves. The two species frequently grow together. *Adenanthos dobagii*, which also resembles *A. flavidiflorus*, has a smaller flower.

### **22. Adenanthos argyreus** Diels, *Bot. Jahrb. Syst.* 35: 138 (1904)

T: 100 miles [c. 160 km] north of Stirling Range, W.A., 1879, *Muir*; lecto: MEL; isolecto: NSW, PERTH, *fide* E.C.Nelson, *Brunonia* 1: 366 (1978); between York and Hampton Plains, W.A., Aug. 1888, *Sayer & Carlson*; syn: MEL; near Tammin, W.A., Aug. 1901, *E.Pritzel 3559*; syn: B.

*Adenanthos intricatus* C.A.Gardner, *J. & Proc. Roy. Soc. W. Australia* 9: 39 (1923). T: Bendering, W.A., 28 Oct. 1922, *C.A.Gardner*; holo: PERTH; iso: B, PERTH.

Illustrations: E.C.Nelson, *op. cit.* 312, fig. 6f; A.S.George, *Intr. Proteaceae W. Australia* 5, pl. 5 (1984); W.R.Elliot & D.L.Jones, *Encycl. Austral. Pl.* 2: 154 (1982), as *A. flavidiflora*.

Erect shrub to 1 m tall, without lignotuber. Leaves clustered at tips of branches; petiole distinct; lamina deeply divided, to 10 mm long; laciniae 3, very rarely 5, terete, c. 0.5 mm diam., silvery, with a conspicuous gland at apex and appressed short and long hairs. Perianth c. 20 mm long, bright pink, with white hairs outside, some long hairs growing inwards and forming tuft in tube. Style to 27 mm long, flexuous at base, glabrous; ovary glabrous.

Widespread in the wheatbelt between Lake King, Lake Grace, Wyalkatchem and Southern Cross, W.A.; grows in deep, siliceous sand. Flowers Aug.–Oct. Map 380.

W.A.: S of Wyalkatchem, 16 Feb. 1964, *S.B.Rosier* (PERTH); Hollands Track, c. 53 km SE of Queen Victoria Rock, S of Coolgardie, *R.Filson 8898* (MEL); 93 km W of fence on Hyden–Norseman road, *E.C.Nelson ANU 17091* (CANB, CBG, DBN); c. 37 km E of L. King, *J.S.Beard 3697* (KPBG, PERTH).

This species is similar to *A. flavidiflorus*, from which it may be distinguished by the glabrous style.

### 23. Adenanthos macropodianus E.C.Nelson, *Brunonia* 1: 378 (1978)

T: near Breakneck Creek, Flinders Chase, Kangaroo Is., S.A., 6 Nov. 1973, *E.C.Nelson ANU 17025*; holo: CANB 237038; iso: DBN.

*Adenanthos sericeus* var. *brevifolius* Benth., *Fl. Austral.* 5: 354 (1870). T: near Wallans hut, Kangaroo Is., S.A., *Waterhouse*; lecto: MEL, *fide* E.C.Nelson, *loc. cit.*; Kangaroo Is., S.A., *F.Mueller*; syn: MEL.

Illustration: E.C.Nelson, *op. cit.* 307, fig. 2l.

Erect shrub to 1 m tall, occasionally to 3 m, without lignotuber. Leaves petiolate, deeply lobed, to 15 mm long; laciniae 9 or more, terete, c. 0.5 mm diam., silvery, covered with long, appressed and divaricate hairs. Perianth to 27 mm long, red-pink, rarely yellow, with creamy white hairs outside. Style to 38 mm long, glabrous; ovary glabrous. Figs 80, 157A.

Endemic on Kangaroo Is., S.A.; especially abundant in Flinders Chase; grows in siliceous sand. Flowers most of the year. Map 381.

S.A.: Cape Borda, 29 Aug. 1964, *M.E.Phillips* (CBG, MEL); Yacca Flat, Flinders Chase, *Hj.Eichler 15114* (AD, B, NY); near American R., *E.C.Nelson ANU 17019* (CANB, DBN).

Grows with *A. terminalis*, the only other member of the genus found in south-eastern Australia. The latter has a hirsute style, yellow perianth, and almost glabrous, less divided leaves.

### 24. Adenanthos terminalis R.Br., *Trans. Linn. Soc. London* 10: 152 (1810)

T: Bay X [Port Lincoln, S.A.], 3 Mar. 1802, *R.Brown s.n.*; holo: BM; iso: B, E, FI, G-DC, K, MEL, NSW, P, S.

*Adenanthos terminalis* var. *plumosa* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 12: 313 (1856). T: Marble Ranges, Adelaide [Eyre Peninsula, S.A.], *F.Mueller*; holo: NY; iso: G-DC, MEL, P.

Illustrations: E.C.Nelson, *Brunonia* 1: 307, fig. 2m, 310, fig. 4A(c) (1978).

Erect shrub to 1 m tall, rarely 2 m, without lignotuber. Leaves mostly clustered at tips of branches, sessile or shortly petiolate, deeply 3-segmented, 5–15 mm long; laciniae usually 5, terete, c. 0.5 mm diam., usually glabrous but with floral leaves often with long hairs near base. Flowers concealed by floral leaves; perianth to 16 mm long, cream or nearly white, or cream and green, shortly hairy outside. Style to 30 mm long, with long hairs about mid-point and short hairs towards base, rarely glabrous; ovary densely hirsute. Fig. 157G.

Extends from Eyre Peninsula and Kangaroo Is., S.A. east into the Big and Little Deserts, Vic. Flowers Aug.–Jan., but flowers can be found most of the year. Map 382.

S.A.: Port Lincoln, *E.C.Nelson ANU 16985* (CANB); 20 km S of Kimba, 31 Jan. 1959, *Rohrlach* (AD); near American R., Kangaroo Is., *E.C.Nelson ANU 17018* (CANB, DBN). Vic.: SW corner, Wyperfeld Natl Park, 30 Oct. 1968, *A.C.Beauglehole* (PERTH); 20 km S of Kaniva, Little Desert, *E.C.Nelson ANU 16461* (CANB).

The more widespread of the 2 species in south-eastern Australia, growing with *A. macropodianus* on Kangaroo Is. (see that species). *Adenanthos terminalis* is probably most closely related to the W.A. species *A. apiculatus* and *A. dobagii* which have smaller flowers than other members of the genus.

### 25. Adenanthos sericeus Labill., *Nov. Holl. Pl.* 1: 29, t. 38 (1805)

T: King George Sound [W.A.], 1803, *M.Leschenault de la Tour*; holo: FI; iso: G, P.

Erect shrub or small tree to 3 m tall, sometimes to 5 m, without lignotuber. Leaves deeply segmented into fine terete laciniae, often less than 0.5 mm diam. Flowers concealed by floral

leaves; perianth c. 28 mm long, scarlet, slightly hirsute outside. Style to 40 mm long, glabrous; ovary glabrous. *Woolly Bush.*

Occurs about Albany and at Cape Le Grand on the south coast, W.A. Two subspecies are recognised.

Leaves more than 30 mm long, with 6–50 laciniae **25a.** subsp. **sericeus**

Leaves rarely more than 30 mm long, with 6 (–15) laciniae **25b.** subsp. **sphalma**

### 25a. Adenanthos sericeus Labill. subsp. sericeus

Illustrations: E.C.Nelson, *Brunonia* 1: 307, fig. 2y, z (1978); A.S.George, *Intr. Proteaceae W. Australia* 5, pl. 6 (1984).

Leaves generally not appressed to branches, forming soft, bushy shoots, 30–45 mm long; laciniae 6–50 (average 11–35), very fine, c. 0.4 mm diam. Fig. 157E–F.

Confined to the south coast of W.A. between Torbay Inlet and Warriup, with main populations around King George Sound; grows in deep siliceous sand, often close to the sea. Flowers most of the year. Map 383.

W.A.: Torbay Inlet, 12 Oct. 1968, *J.W.Wrigley* (CBG, NSW); Torndirrup Natl Park, King George Sound, *E.C.Nelson ANU 17440* (CANB, DBN); Warriup, 50 km NE of Albany, *E.C.Nelson ANU 16785* (CANB, DBN).

The type of this species is clearly from the western population and must have been collected by Leschenault (see E.C.Nelson, *Glasra* 3: 9–19, 1979).

### 25b. Adenanthos sericeus subsp. sphalma E.C.Nelson, *Brunonia* 1: 375 (1978)

T: Thistle Cove, Cape Le Grand National Park, W.A., 21 Sept. 1972, *E.C.Nelson ANU 16591*; holo: DBN; iso: CANB.

Illustration: E.C.Nelson, *op. cit.* 307, fig. 2w.

Leaves appressed to branches (shoots therefore not softly bushy); c. 25 mm long, rarely over 30 mm; laciniae usually 6, rarely as many as 12, very rarely to 15, c. 0.6 mm diam.

Confined to the Cape Le Grand and Cape Arid Natl Parks, east of Esperance, W.A. Flowers Aug.–Dec., but flowers can be found most of the year. Map 384.

W.A.: c. 0.8 km W of Lucky Bay, *E.C.Nelson ANU 17038* (CANB, DBN); Cape Arid, 1974, *A.Weston* (PERTH).

The eastern subspecies has less divided leaves and broader laciniae than the western taxon. The populations remain distinct under cultivation. The leaves of *A. sericeus* subsp. *sphalma* are more divided than those of the closely related species *A. oreophilus*.

The subspecific epithet sphalma (noun, neuter) means a mistake; it cannot have the masculine (-us) termination.

### 26. Adenanthos × cunninghamii Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 513 (1845), as *A. cunninghamii*

T: King George Sound [W.A.], 1836, *A.Cunningham*; lecto: G-DC (microfiche seen); isolecto: NY, *fide* E.C.Nelson, *Brunonia* 1: 353 (1978).

Illustrations: E.C.Nelson, *op. cit.* 307, fig. 2r; S.Hopper *et al.*, *W. Australia's Endangered Fl.* 34 (1990).

Erect shrub to 2 m tall, sometimes spreading with almost prostrate branches, without lignotuber. Leaves petiolate, 3-segmented, c. 25–30 mm long; laciniae usually 6, sometimes more, linear, flattened, slightly concave, c. 3 mm wide, silver-grey tomentose. Perianth to 30 mm long, dull crimson, with short hairs on outside. Style to 40 mm long, glabrous; ovary glabrous. Fig. 158J–K.

Confined to the Albany district of south-western W.A. where the parent species are sympatric. Map 385.

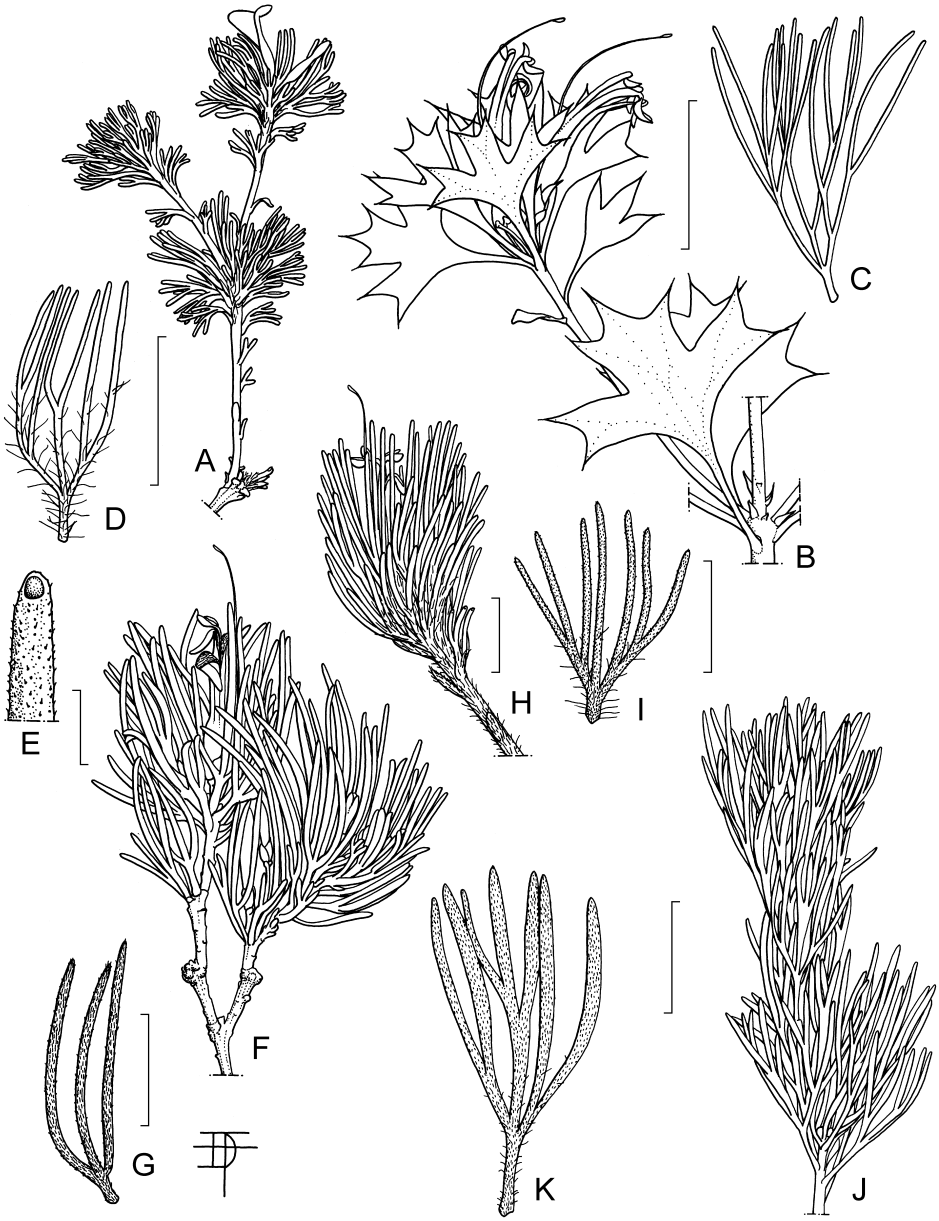



**Figure 158**. *Adenanthos*. **A**, *A. meisneri*, flowering branchlet (E.Nelson ANU 16869, CANB). **B**, *A. acanthophyllus*, flowering branchlet (J.Beard 7389, CANB). **C**, *A. filifolius*, leaf (E.Nelson ANU 17013, CANB). **D–E**, *A. labillardierei*. **D**, leaf; **E**, leaf tip (**D–E**, E.Nelson ANU 16963, CANB). **F–G**, *A. oreophilus*. **F**, flowering branchlet; **G**, leaf (**F–G**, A.Weston 9641, CANB). **H–I**, *A. cygnorum* subsp. *cygnorum*. **H**, flowering branchlet; **I**, leaf (**H–I**, Bayswater, Lower Swan R., W.A., A.Morrison, CANB). **J–K**, *A.* × *cunninghamii*. **J**, branchlet; **K**, leaf (**J–K**, E.Nelson ANU 17135, CANB). Scale bars: **A**, **B**, **J** = 2 cm; **C**, **D**, **F–I**, **K** = 1 cm; **E** = 1 mm. Drawn by D.Fortescue.

W.A.: King George Sound, *E.C.Nelson ANU 17135, 17143* (CANB, DBN); Salmon Holes, Torndirrup Natl Park, 16 Dec. 1984, *P.E.Sanderson, D.Davidson & E.C.Nelson* (DBN); Two Peoples Bay, 15 Dec. 1984, *P.E.Sanderson, E.C.Nelson & G.Foley* (DBN).

A confusing and enigmatic plant which is now considered a hybrid between *A. sericeus* subsp. *sericeus* and *A. cuneatus*. Shrubs are relatively frequent in Torndirrup Natl Park, and occasional at Two Peoples Bay and are especially conspicuous in summer when the young shoots glow coppery red. Plants which are most probably back-crosses with *A. cuneatus* have recently been discovered around King George Sound. The broad laciniae (to 3 mm) clearly distinguish the hybrid from *A. sericeus*, as do its crimson flowers.

### 27. Adenanthos oreophilus E.C.Nelson, *Brunonia* 1: 367 (1978)

T: East Mount Barren, Fitzgerald River National Park, W.A., 12 Oct. 1972, *E.C.Nelson ANU 16948*; holo: CANB 237037; iso: DBN.

Illustration: E.C.Nelson, *Brunonia* 1: 307, fig. 2v (1978).

Similar to *A. sericeus*, but leaves c. 20 mm long, with laciniae 3 or 5 (very rarely more than 5), c. 1 mm diam, appearing terete, but with a channel on upper surface, with appressed hairs, occasionally becoming ±glabrous. Flowers 27–35 mm long, scarlet. Style glabrous; ovary hirsute. Fig. 158F–G.

Occurs in two disjunct mountain regions; the western populations inhabit the slopes of the Barrens, Fitzgerald River Natl Park and adjacent hills, and the eastern populations Mt Ragged and Hill 62, east of Esperance, W.A. Flowers Aug.–Dec. Map 386.

W.A.: Mt Desmond, S of Ravensthorpe, *A.S.George 1649* (PERTH); East Mt Barren, *E.C.Nelson ANU 17003* (CANB, CBG, DBN); Point Anne, Fitzgerald River Natl Park, *E.C.Nelson ANU 17041* (CANB, CBG, DBN); summit ridge of Mt Ragged, *J.S.Beard 5237* (PERTH); Hill 62, E of Esperance, *A.S.George 2157* (PERTH).

Distinguished from *A. sericeus* by the fewer laciniae, which are also thicker. The two species remain distinct in cultivation. Whereas *A. sericeus* inhabits sandplain, *A. oreophilus* is restricted to rocky quartzitic, granitic and lateritic hills.

### 28. Adenanthos cygnorum Diels, *Bot. Jahrb. Syst.* 35: 138 (1904)

T: near Perth, W.A., 22 Sept. 1839, *L.Preiss* 787; lecto: B; isolecto: C, FI, G, G-DC, HBG, KIEL, MEL, MO, NSW, NY, P, S, TCD, *fide* E.C.Nelson, *Brunonia* 1: 360, 365 (1978); Perth, W.A., Dec. 1900, *L.Diels 1974*; syn: B; near Moore River, between Moora and Dandaragan, W.A., *L.Diels 5765*; syn: B (destroyed); Hutt River, W.A., *L.Diels 5714*; syn: B (destroyed); Swan River, W.A., *J.Drummond coll. 1, s.n.*; syn: G-DC; isosyn: BM, FI, K, P.

[*Adenanthos sericeus auct. non* Labill.: G.Bentham, *Fl. Austral.* 5: 354 (1870), *p.p.*]

Shrub without lignotuber. Leaves shortly petiolate, 3-segmented, to 20 mm long (those at tips of branches noticeably longest); laciniae 5–7, terete, with short curled and long straight hairs, often glabrescent except near base. Involucral bracts to 3.5 mm long. Perianth 22–28 mm long, pallid pink and green, or creamy green, with short hairs outside. Style c. 37 mm long, glabrous; ovary glabrous.

Endemic in W.A., ranging from Kojonup northwards as far as Murchison River and inland to Wickepin; usually growing in deep siliceous sand in kwongan, but also in lateritic gravels and clay. There are 2 subspecies.

| | |
|---|---|
| Shrub erect | **28a.** subsp. **cygnorum** |
| Shrub prostrate, or with a few ascending branches | **28b.** subsp. **chamaephyton** |

### 28a. Adenanthos cygnorum Diels subsp. cygnorum

Illustration: E.C.Nelson, *Brunonia* 1: 307, fig. 2u (1978).

Erect shrub, to 4 m tall. Involucral bracts c. 8. Flowers c. 28 mm long; apex of bud obtuse. Figs 79, 158H–I.

Occurs from Kojonup north to the Murchison River and from Perth east to Wickepin, W.A. Flowers Aug.–Dec., but flowers can be found most of the year. Map 387.

W.A.: Kalbarri Natl Park, *J.S.Beard 7122*; W of Pingelly, *E.C.Nelson ANU 16991* (CANB); Bayswater, near Perth, 5 Mar. 1898, *A.Morrison* (AD, CANB, E, P, PERTH).

### 28b. **Adenanthos cygnorum** subsp. **chamaephyton** E.C.Nelson, *Brunonia* 1: 364 (1978)

T: near Mundaring Weir, W.A., 4 Sept. 1973, *E.C.Nelson ANU 17092*; holo: CANB 237055; iso: CBG, DBN.

*Adenanthos teges* A.S.George, *Nuytsia* 1: 385 (1974). T: north-east of Mundaring, c. 32 km east of Perth, W.A., 7 Dec. 1973, *A.S.George 11758*; holo: PERTH; iso: CANB, PERTH.

Prostrate shrub, spreading to form a mat, to 4 m across, sometimes with ascending branches. Leaf laciniae usually 5. Involucral bracts c. 5. Flowers c. 22 mm long; apex of bud acute.

Confined to a few areas near Mundaring and Chidlow, in the Darling Range east of Perth, W.A.; grows in laterite soil as an undershrub in Jarrah woodland. Flowers Nov.–Jan. Map 388.

W.A.: near Chidlow, *E.C.Nelson ANU 17093* (CANB, DBN); c. 2 km N of Chidlow, *A.S.George 11759* (PERTH); Halfwayhouse, *L.Preiss 796* (LE, NY).

The differences between the two subspecies are relatively minor; the most significant being habit. As prostrate plants are found in other species (e.g. *A. pungens*), the distinction does not warrant recognition at a higher status. *Adenanthos cygnorum* was formerly included in *A. sericeus*, but the two species are easily distinguished by flower colour.

### 29. **Adenanthos meisneri** Lehm. ex Meisn. *in* J.G.C.Lehmann, *Pl. Preiss*. 1: 512 (1845)

T: towards foot of Darling Range, Nelson Distr., W.A., 9 Dec. 1839, *L.Preiss 791*; holo: NY; iso: B, C, FI, G, G-DC, HBG, KIEL, MEL, P.

Illustrations: E.C.Nelson, *Brunonia* 1: 307, fig. 2o, 312, fig. 6e (1978).

Diffuse, erect or semiprostrate shrub to 1 m tall, with lignotuber. Leaves petiolate, 3-segmented, to 15 mm long; laciniae usually 9, terete or slightly flattened, with long and short, eglandular hairs and, occasionally, also short, glandular hairs, glabrescent, occasionally retaining hairs on petiole. Involucral bracts less than 5 mm long. Perianth to 30 mm long, red-purple to pale violet, with both glandular and eglandular hairs outside. Style to 40 mm long, glabrous; ovary glabrous. Fig. 158A.

Ranges from the Swan River south to Point D'Entrecasteaux on the coastal plain, W.A.; grows in sandy soil in woodland and sand heath. Flowers Sept.–Dec. Map 389.

W.A.: Mundaring, 15 Feb. 1922, *C.A.Gardner* (PERTH); near Yallingup, *E.C.Nelson ANU 17036* (CANB, DBN); c. 40 km S of Nannup, *E.C.Nelson ANU 16867* (CANB); Point D'Entrecasteaux, 1870, *F.Mueller* (K, PERTH).

A distinctive plant with purple or pale violet flowers and with glandular hairs on the perianth. The only other species with the latter character are *A. velutinus* (see below) and *A venosus* which has entire leaves.

### 30. **Adenanthos velutinus** Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 312 (1856)

*Adenanthos meisneri* var. *velutinus* (Meisn.) Benth., *Fl. Austral.* 5: 355 (1870). T: Swan River Colony, W.A., *J.Drummond 4: 266*; holo: NY; iso: BM, FI, K, MEL.

Illustrations: J.Leigh *et al.*, *Extinct & Endangered Pl. Australia* opposite p. 288 (1984); S.Hopper *et al.*, *W. Australia's Endangered Fl.* 35 (1990).

As *A. meisneri*, but to 3 m tall, without lignotuber. Young shoots and leaves bright red, with dense, felty indumentum of white hairs; branchlets glabrescent after 2 or 3 years. Involucral bracts to 8 (–9) mm long. Flowers cream with grey-black apex.

Known only from Geekabee Hill Flora Reserve near Cranbrook, west of the Stirling Range, W.A. Map 390.

W.A.: Warriup–Cranbrook road, E of Cranbrook, 18 Sept. 1965, *F.W.Humphreys* (PERTH); 17.3 km from Cranbrook, along Ballochmyle Rd, 11 Oct. 1968, *E.M.Canning* (CBG); Geekabee Hill Nature Reserve, W of Cranbrook, *E.C.Nelson ANU 17451* (CANB, DBN, K, MEL, NY, PERTH).

Differs from *A. meisneri* in the absence of a lignotuber and in the flower colour. Gazetted a rare and endangered species (S.Hopper *et al.*, 1990).

### 31. **Adenanthos filifolius** Benth., *Fl. Austral.* 5: 355 (1870)

T: Stirling Range, W.A., *F.Mueller*; lecto: K; isolecto: MEL, *fide* E.C.Nelson, *Brunonia* 1: 379 (1978); Mondurup, Stirling Range, Kojoneerup Hills, East Stirling Range, W.A., *G.Maxwell*; syn: BM, MEL.

*Adenanthos filifolius* var. *sericifolius* Benth., *Fl. Austral.* 5: 355 (1870). T: Swan River Colony, W.A., *J.Drummond 63*; holo: MEL.

Illustration: E.C.Nelson, *op. cit.* 307, fig. 2t.

Erect shrub to c. 1.5 m tall, without lignotuber. Leaves petiolate, 3-segmented, 10–20 mm long; laciniae more than 12, terete, less than 0.5 mm diam., with appressed hairs when young, glabrescent (the floral leaves retaining some hairs about base). Involucral bracts to 6 mm long. Perianth to 21 mm long, cream with black or dark navy, with short hairs on outside. Style c. 37 mm long, glabrous; ovary glabrous. Fig. 158C.

Restricted to the higher slopes of the Stirling Range, reaching the summit of Bluff Knoll (c. 1000 m), W.A.; grows on rocky hillslopes in dense scrub. Flowers Aug.–Dec. Map 391.

W.A.: summit of Bluff Knoll, *E.C.Nelson ANU 17138* (CANB, DBN); Mt Mistake *E.C.Nelson ANU 17109* (CANB, DBN).

Resembling *A. velutinus* in flower colour and habit, *A. filifolius* is distinguished by the absence of both glandular hairs and the dense, persistent tomentum. It is closely allied to *A. labillardierei*.

### 32. **Adenanthos labillardierei** E.C.Nelson, *Brunonia* 1: 381 (1978)

T: track on eastern side of Whoogarup Range, Fitzgerald River National Park, W.A., 15 Oct. 1973, *E.C.Nelson ANU 17082*; holo: CANB 237040; iso: CBG, DBN.

Similar to *A. filifolius* in habit. Leaves c. 15 mm long and with fewer laciniae (usually 5, but sometimes up to 9). Involucral bracts less than 5 mm long. Perianth to 25 mm long, cream with claret base and dark claret apex, with short hairs outside. Style to 33 mm long, glabrous; ovary glabrous. Fig. 158D–E.

Restricted to the Barrens, Fitzgerald River Natl Park, W.A.; grows in rocky soil, usually in siliceous sand; occasionally growing with *A. oreophilus*. Flowers Sept.–Dec. Map 392.

W.A.: Middle Mount Barren, *C.A.Gardner 9152* (PERTH); Eyre Range, *A.S.George 7245* (KPBG, PERTH); between Fitzgerald R. and Hamersley R., *E.C.Nelson ANU 17085* (CANB).

The flower colour and fewer laciniae may be used to distinguish this species from *A. filifolius*, which is confined to the Stirling Ra.

### 33. **Adenanthos acanthophyllus** A.S.George, *Nuytsia* 1: 382 (1974)

T: Nanga Station, on road to Tamala, 5 miles [c. 8 km] SW of turn-off from Denham road, 15 July 1973, *A.S.George 11671*; holo: PERTH; iso: CANB, PERTH.

Illustration: E.C.Nelson, *Brunonia* 1: 307, fig. 2f (1978).

Tall robust shrub at least 5 m tall, with many stems arising from a lignotuber. Leaves petiolate, ±fan-shaped, 3-segmented, to 30 mm long and often 30 mm wide, pubescent when young but soon glabrescent; segments with irregularly lobed margins with spines. Perianth to 27 mm long, dark red or pale red-pink and green, with short and long hairs outside. Style c. 35 mm long, glabrous; ovary slightly pubescent. Fig. 158B.

Occurs in the Shark Bay area, extending south to Coburn Stn, W.A.; grows in deep, red sand, often the dominant plant. Flowers Apr.–June. Map 393.


**Figure 159**. **A–C**, *Franklandia triaristata*. **A**, leaf; **B**, flowering branchlet (**A–B**, G.Keighery 6617, PERTH); **C**, nut (P.Weston 47, PERTH). **D–E**, *Sphalmium racemosum*. **D**, flowering and fruiting branchlet; **E**, flower; (**D–E**, B.Hyland 7019, QRS). Scale bars: **A–D** = 2 cm; **E** = 2 mm. Drawn by D.Boyer.

W.A.: Nanga Stn, 26 July 1969; *A.S.George* (PERTH); Nanga Stn, on road from Hamelin Pool to Tamala, *E.C.Nelson ANU 17009* (CANB, DBN); W of Coburn Stn, *J.S.Beard 7389* (CANB, PERTH).

A most remarkable species, with broad lobes armed with spines. The leaves resemble those of members of other proteaceous genera, e.g. *Isopogon baxteri* R.Br. It is the most northerly species, and over 80 km disjunct from the nearest known populations of any other species of *Adenanthos*.

## Subfam. 5. SPHALMIOIDEAE

*Proteaceae* subfam. *Sphalmioideae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 172 (1975).

Type: *Sphalmium* B.G.Briggs, B.Hyland & L.A.S.Johnson

Rainforest trees. Adult leaves entire; juvenile leaves pinnatifid. Inflorescence racemose. Flowers actinomorphic, andromonoecious, not in regular pairs. Staminal filaments adnate to tepal base. Hypogynous glands absent. Style tip not modified as a pollen presenter. Ovules 2. Fruit follicular. Seeds 2, longitudinally oriented; pendulous from a false dissepiment. Chromosomes medium sized at mitotic metaphase, c. 2.4–3.7 µm; $n = 12$.

A monogeneric subfamily of rainforest trees confined to north-eastern Qld.

## 16. SPHALMIUM

*Helen J.Hewson*

*Sphalmium* B.G.Briggs, B.Hyland & L.A.S.Johnson, *Austral J. Bot.* 23: 165 (1975); from the Greek *sphalma* (a mistake); in reference to mistaken interpretation of the taxon for classification purposes and the consequent failure by botanists to recognise the new genus.

Type: *S. racemosum* (C.T.White) B.G.Briggs, B.Hyland & L.A.S.Johnson.

Tree, unbuttressed. Adventitious roots present or absent; proteoid roots present. Leaves alternate, simple, or pinnate on sapling and coppice growth, glabrescent. Inflorescence a short, bracteate, axillary raceme. Flowers ±actinomorphic, andromonoecious. Tepals 4, free. Stamens 4; filament adnate to tepal base. Hypogynous glands absent. Ovary shortly stipitate; style not modified as a pollen presenter; ovules 2. Fruit a woody follicle. Seeds 2, winged, separated by a false dissepiment.

An endemic, monospecific genus from north-eastern Qld.

J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 513–514 (1989).

**Sphalmium racemosum** (C.T.White) B.G.Briggs, B.Hyland & L.A.S.Johnson, *Austral. J. Bot.* 23: 166 (1975)

*Orites racemosa* C.T.White, *Proc. Roy. Soc. Queensland* 50: 85 (1939). T: Mt Spurgeon, Qld, Sept. 1936, *C.T.White 10621*; holo: BRI; iso: K.

Illustration: B.G.Briggs *et al.*, *op. cit.* 167, fig. 1 (1975).

Tree to 30 m tall or more. Leaves narrowly elliptic, 7–20 cm long (including tapering base), acute, basally attenuate, sometimes oblique, entire, rusty-pubescent when young. Inflorescence 6–10-flowered, 2–3 cm long; bracts linear, 2–3 mm long; pedicels 1–2 mm long. Tepals oblong, c. 4.5 mm long, cream-coloured, glabrescent abaxially. Stamens shorter than tepals. Style c. height of stamens; stigma a narrow, bilabiate crest at style apex. Follicle compressed, shortly beaked, oblique, narrowly obovoid, c. 4.5 cm long. *Mystery Oak*. $2n = 24$, B.G.Briggs *et al.*, *op. cit.* 168 (1975). Figs 81, 159D–E.

This species grows in granite soils in rainforest between 500 m and 1200 m in north-eastern Qld from 16°00' to 16°40'S and 145°00' to 145°25'E. Map 394.

Qld: North Mary Logging Area, *B.P.M.Hyland 7019* (BRI, K, MEL, QRS); Mt Lewis, *A.Irvine 316* (K); Forest Reserve, 144°16'15"S, 145°00'E, *B.P.M.Hyland 5666* (BRI, K, QRS).

## Subfam. 6. CARNARVONIOIDEAE

*Proteaceae* subfam. *Carnarvonioideae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 172 (1975).

Type: *Carnarvonia* F.Muell.

Rainforest trees. Leaves digitately divided; divisions pinnately divided. Inflorescences irregularly branched. Flowers actinomorphic, bisexual, not in regular pairs. Hypogynous glands absent. Style tip not modified as a pollen presenter. Ovules 2. Fruit follicular. Seeds 2, longitudinally oriented, not separated by a dissepiment. Chromosomes small at mitotic metaphase, c. 0.7–1.1 μm; $n = 14$.

A monogeneric subfamily of rainforest trees confined to north-eastern Qld.

## 17. CARNARVONIA

*B.P.M.Hyland*

*Carnarvonia* F.Muell., *Fragm.* 6: 80 (1867); named after the Fourth Earl of Carnarvon, Henry Herbert, Undersecretary for the Colonies (1858–1866).

Type: *C. araliifolia* F.Muell.

Trees. Leaves alternate, compound, 3-foliate, palmate, pedately pinnate or bipinnate. Inflorescence raceme-like, axillary or paniculately branched. Flowers actinomorphic, bisexual, solitary, pedunculate; floral bracts present at anthesis. Tepals valvate, reflexed at anthesis. Stamens 4; anthers 2-locular, basifixed, dehiscing by longitudinal slits. Hypogynous glands absent. Ovary sessile; ovules 2; pollen presenter not developed; stigmatic surface terminal. Fruit a 1–2-seeded, woody follicle. Seeds ±elliptic, winged at one end.

A monospecific genus, confined to north-eastern Qld. Readily distinguished by the usually palmate or pedately pinnate leaves, unpaired flowers, few ovules and seeds that are winged at one end.

F.M.Bailey, *Queensland Fl.* 4: 1351 (1901); W.D.Francis, *Austral. Rain-forest Trees* 4th edn, 400 (1982); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 128–129 (1989).

**Carnarvonia araliifolia** F.Muell., *Fragm.* 6: 81 (1867)

T: Rockingham Bay, Qld, *J. Dallachy s.n.*; syn: many sheets in MEL.

Illustration: J.W.Wrigley & M.Fagg, *op. cit.* 128.

Tree 30 m or more tall. Leaves 3-foliate, palmate or pedately compound, to 35 cm long; petiole 5–14 cm long; leaflets entire, serrate, crenate, long-petiolulate, penninerved, ovate, elliptic or lanceolate, c. 7–20 cm long. Inflorescence 6–15 cm long, not exceeding leaves. Tepals 3–6 mm long, cream-coloured; abaxial surface villous, with upward-pointing hairs; adaxial surface glabrous in upper half, vesicular in lower half. Anthers 1.4–2.5 mm long; mucro 0.1–0.2 mm long; filament 0.1–0.4 mm long. Ovary 0.7–1.4 mm long; style 1.8–2.7 mm long. Fruit 3.6–5 cm long, 15–21 mm wide; pedicels lateral. Seeds 1–2, 3–4.3 cm long, 8–15 mm wide; embryo 10–14 mm long, 8–13 mm wide. $n$ = c. 14, L.A.S.Johnson & B.G.Briggs, *Austral. J. Bot.* 11: 24 (1963).

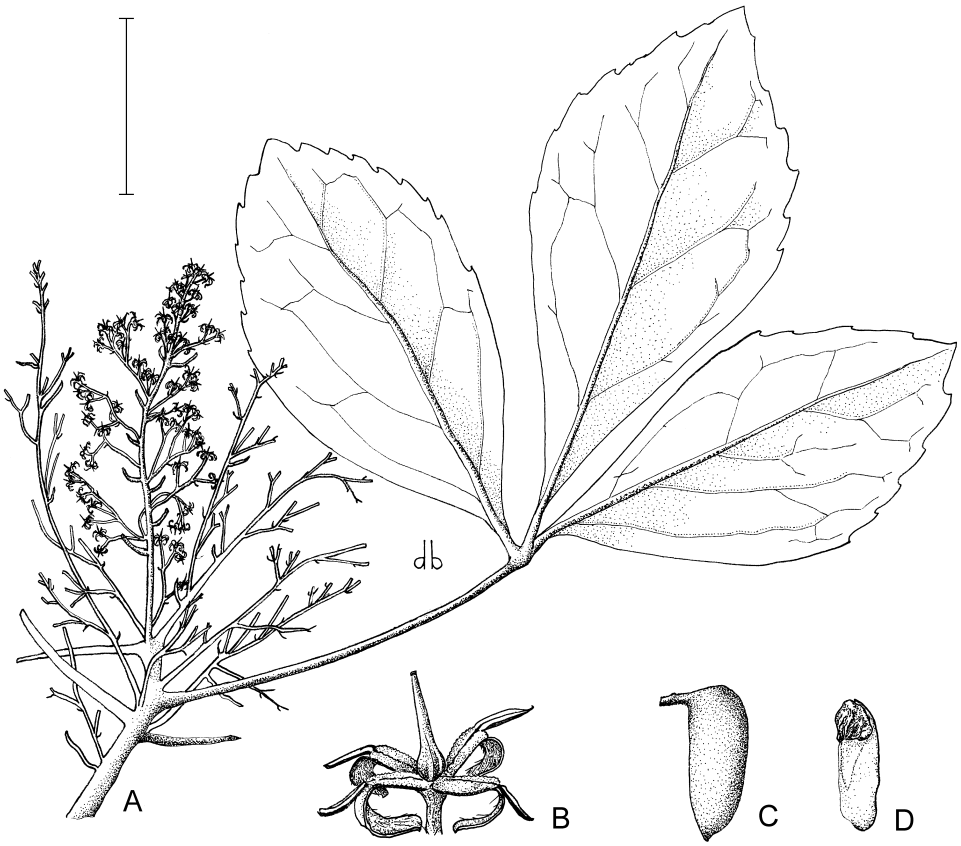



**Figure 160**. *Carnarvonia araliifolia* var. *araliifolia*. **A**, flowering branchlet; **B**, flower (**A–B**, B.Gray 1252, CANB); **C**, fruit; **D**, seed (**C–D**, B.Hyland 7134, QRS). Scale bar: **A**, **C**, **D** = 5 cm; **B** = 5 mm. Drawn by D.Boyer.

Two varieties are recognised.

| | |
|---|---|
| Hairs on the pedicel cream to pale brown, ±straight or slightly sinuate, predominantly prostrate, only a few erect | **a.** var. **araliifolia** |
| Hairs on the pedicel ferruginous, tortuous, many ±erect | **b.** var. **montana** |

### a. Carnarvonia araliifolia F.Muell. var. araliifolia

Leaves usually palmate on mature trees; leaflets broad, 5–12 cm wide; margin usually toothed. Hairs on pedicel cream to pale brown, ±straight or slightly sinuate, predominantly prostrate, only a few erect. *Oak, Red Oak.* *Figs* 123, 126, 160.

Occurs in rainforest between Cooktown and Ingham, north-eastern Qld, from near sea level to 1000 m. Flowers Nov., Jan.–Mar. Map 395.

Qld: Timber Reserve 176, Monkhouse, *B.P.M.Hyland 12206* (QRS); Wyvuri Holding, *G.C.Stocker 1014* (QRS); Burgoo Logging Area, Parish of Garrawalt, *K.Sanderson 578* (QRS).

Used primarily as a structural timber.

### b. Carnarvonia araliifolia var. montana B.Hyland, *Fl. Australia* 16: 496 (1995)

T: State Forest Reserve 194 Western, Qld, 6 Jan. 1972, *B.P.M.Hyland 5744*; holo: QRS.

Leaves palmate or pedately pinnate on mature trees; leaflets narrow, 4–8 cm wide, entire, toothed from c. middle of leaf blade to apex. Hairs on pedicel ferruginous, tortuous, many ±erect. *Caledonian Oak.*

Occurs in the rainforests of the Cape York Region of Qld between Cooktown and Tully, usually above 1000 m. Flowers Nov.–Mar. and May. Map 396.

Qld: Timber Reserve 146, Fritz Logging Area, *B.P.M.Hyland 6774* (QRS); State Forest Reserve 194 Western, *B.P.M.Hyland RFK2157* (QRS); Tully Falls, Cairns, *A.Fielding 13354* (QRS).

Occasionally used for structural timber.

## Subfam. 7. GREVILLEOIDEAE

*Proteaceae* subfam. *Grevilleoideae* Engl. *in* H.G.A.Engler & K.A.E.Prantl, *Nat. Pflanzenfam.* 3(1): 128 (1888), as Grevilloideae.

Type: *Grevillea* R.Br. ex Knight

Subshrubs, shrubs or trees of heath, sclerophyllous forest or woodland, or of rainforest. Flowers zygomorphic or actinomorphic, usually in pairs in the axil of a common bract; floral bracts present or absent. (If flowers not paired then flowers in dense heads, clusters or single-flowered inflorescences and fruit a follicle). Stamen filaments free or fused to tepals for most of their length. Hypogynous glands present, free or fused, rarely absent. Style tip modified as a pollen presenter, or pollen presenter absent. Ovules 2–many, hemitropous, orthotropous or anatropous. Fruit follicular with flattened seeds, or, rarely, indehiscent and large-seeded. Chromosomes small to medium at mitotic metaphase, 1–4.5 μm; $n$ = 14, sometimes 13, 11, 10 or 15.

A subfamily of 7 tribes, 44 genera and c. 950 species. In Australia, 7 tribes, 29 genera and c. 700 species, varying widely in habit and ecology, from subshrubs to trees, and growing in rainforest habitats, sclerophyllous forest and woodland and in semi-arid shrubberies.

## Trib. 1. ORITEAE

*Proteaceae* trib. *Oriteae* Venkata Rao ex L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 172 (1975).

*Proteaceae* trib. *Oriteae* Venkata Rao, *Proc. Linn. Soc. New South Wales* 82: 269 (1957), *nom. inval.* T: *Orites* R.Br.

Peduncles and floral bracts absent. Flowers actinomorphic. Pollen presenter not or scarcely developed. Ovules 2–many, hemitropous. Fruit follicular. Seeds winged. *n* = 14 (possibly rarely 15).

A tribe of 2 genera, both Australian, with 1 extending to South America.

## 18. ORITES

*A.S.George & B.P.M.Hyland*

*Orites* R.Br., *Trans. Linn. Soc. London* 10: 189 (1810); named from the Greek *oreites* (a mountaineer), the first two species described by Brown occurring on the mountains of Tasmania.

Type: *O. diversifolia* R.Br.; lecto, *fide* A.S.George, *Fl. Australia* 16: 496 (1995).

Shrubs or trees. Leaves alternate, simple or juveniles variously lobed, entire, dentate or serrate. Conflorescence spike-like, in upper axil or terminal; flowers subtended by caducous, common bracts but without floral bracts. Perianth actinomorphic, straight or almost so; tepals separating almost to base and recurving, caducous; limb slightly enlarged. Anthers apiculate; filaments basally adnate to tepals. Hypogynous glands 4, thick, free or shortly united. Gynoecium ±straight; ovary sessile; ovules 2; style end small, not or slightly enlarged, presenting some pollen in a small terminal cup but not externally. Fruit a follicle, dehiscing at maturity and then often persisting for several years. Seeds 2, winged. *n* = 14 (possibly rarely 15), L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 99 (1975).

A genus of 9 species, 7 endemic in Australia (4 in Tas.), 1 in the Chilean Andes and 1 in Bolivia. Characterised by the absence of floral bracts, by the actinomorphic perianth, 4 hypogynous glands, style end not or only slightly enlarged and only partially presenting pollen, and by the 2-seeded follicle. In this treatment, sect. *Excelsae* has been prepared by both contributors, sect. *Orites* by A.S.George.

W.M.Curtis, *Students Fl. Tasmania* 3: 603–605 (1967); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 470–473 (1989); R.J.Carpenter, Cuticular morphology and aspects of the ecology and fossil history of North Queensland rainforest Proteaceae, *Bot. J. Linn. Soc.* 116: 249–303 (1994).

### KEY TO SECTIONS

Conflorescence 5–11 cm long; follicles 20–44 mm long; leaves 15–45 mm wide, thin or leathery; trees of tropical and subtropical rainforest — sect. 1. **EXCELSAE**

Conflorescence less than 5 cm long; follicles 10–24 mm long; leaves less than 12 mm wide, cartilaginous; shrubs of alpine and subalpine heaths, sometimes temperate rainforest — sect. 2. **ORITES**

## KEY TO SPECIES

**1** Leaves thin or leathery, 15–45 mm wide; conflorescence 5–11 cm long

**2** Perianth glabrous; follicle 20–30 mm long, boat-shaped **1. O. excelsa**

**2:** Perianth villous; follicle 28–44 mm long, opening flat **2. O. megacarpa**

**1:** Leaves cartilaginous, less than 12 mm wide, or, if wider, serrate; conflorescence less than 5 cm long

**3** Leaves terete, 1-grooved above **7. O. acicularis**

**3:** Leaves flat; margins sometimes recurved to revolute

**4** Leaves ovate to obovate, serrate, 9–19 mm wide **5. O. milliganii**

**4:** Leaves linear or narrowly oblong to lanceolate or elliptic

**5** Leaves linear with revolute margins **6. O. revoluta**

**5:** Leaves lanceolate, elliptic, oblong or ovate, flat or margins slightly recurved

**6** Leaves clearly discolorous, 2–12 cm long, bluntly mucronate; follicle boat-shaped, tapering [Tas.] **3. O. diversifolia**

**6:** Leaves concolorous, usually obtuse, 1–3 cm long; follicle obliquely oblong-obovate, obtuse [high mountains of N.S.W., A.C.T. & Vic.] **4. O. lancifolia**

## Sect. 1. Excelsae

**Orites** R.Br. sect. **Excelsae** A.S.George & B.Hyland, *Fl. Australia* 16: 496 (1995).

Type: *O. excelsa* R.Br.

Trees or tall shrubs of tropical and subtropical rainforest and vine thicket. Leaves thin or leathery, broadly elliptic or lanceolate, 15–45 mm wide. Conflorescence 5–11 cm long. Follicles 20–44 mm long.

A section of 4 species, 2 in Qld and north-eastern N.S.W., 1 in Chile and 1 in Bolivia. Oligocene fossils 'almost indistinguishable' from *O. excelsa* have been found in Tas. (R.J.Carpenter, *Bot. J. Linn. Soc.* 116: 249–303, 1994).

### 1. Orites excelsa R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 32 (1830)

T: Hastings River, N.S.W., 1818, *C.Fraser*; *n.v.*

*Orites excelsa* var. *fissifolia* F.Muell., *Fragm.* 5: 153 (1866). T: Hastings R., N.S.W., *coll. unknown*; neo: MEL; isoneo: MEL, *fide* A.S.George, *Fl. Australia* 16: 496 (1995).

*Orites fragrans* F.M.Bailey, *Rep. Meston's Exped. Bellenden-Ker* 2 (1889). T: Mt Bellenden Ker, Qld, *coll. unknown*; syn: *n.v.*; Mt Bartle Frere, Qld, *coll. not cited*; syn: *n.v.*

Illustrations: N.C.W.Beadle, *Students Fl. NE New South Wales* 2: 241, fig. 112 (1972); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 481 (1989).

Tree to 30 m tall, sometimes a shrub. New shoots rusty-appressed-tomentose, glabrescent. Bark minutely scaly, later finely fissured, brown or grey; blaze pinkish brown turning dark brown. Leaves with petiole 1–2.5 cm long; lamina elliptic, lanceolate, ovate or oblong, 4–18.5 cm long, 1.5–4.5 cm wide, acute or obtuse or emarginate, entire or serrate or lobed, thin, shining above, pale beneath; juvenile leaves pinnatisect. Conflorescence axillary; rachis 5–11 cm long, puberulous; bracts ovate, obtuse to acute, 4.5–7 mm long, red, striate, glabrous except fimbriate margins; pedicels to 0.5 mm long. Perianth 4.5–5.5 mm long, creamy white, glabrous. Hypogynous glands triangular-oblong to ovate, thick, 0.3–0.6 mm long. Gynoecium 4–5.5 mm long; ovary pubescent. Follicle boat-shaped, acuminate, 20–30 mm long, 8–10 mm wide, appressed-puberulous. Seeds oblong to lanceolate, 23–24 mm

long; wing terminal, truncate. *Prickly Ash, Silky Oak, Mountain Silky Oak, White Beefwood*. Fig. 161G–J.

Common above 750 m from the Craven Plateau to the McPherson Range, N.S.W., and on several ranges in south-eastern Qld; also from 1000 to 1500 m on Mt Bellenden Ker, Thornton Peak, Mt Bartle Frere etc., in northern Qld. Grows in volcanic, granitic or sedimentary soil, in rainforest. Flowers May–Oct.; fruits Aug.–Dec. Map 397.

Qld: Mt Bartle Frere, *M.Godwin C2869* (BRI, QRS); Springbrook, *L.S.Smith 14077* (BRI); Mt Spurgeon, *C.T.White 10627* (BRI). N.S.W.: 10.5 km SW of Stratford on Berrico trig. road, *R.G.Coveny 8469* (NSW); Chaelundi Mtn, 37 km N of Ebor, *H.Streimann 8153* (BRI, CBG, MEL, NSW).

Sometimes flowers among juvenile foliage which is simple or 2- or 3-lobed. Flowers fragrant. Cotyledons obovate-oblong, c. 15 mm long. Timber used for shingles, casks, furniture, cabinet work and internal joinery. Northern specimens (for many years known as *O. fragrans*) tend to have slightly smaller flowers and seeds. No syntype of *O. fragrans* has been found at BRI or MEL. Carpenter (1994, p. 259) commented on the similarity of the cuticle in specimens referred to *O. excelsa* and *O. fragrans* and, in later discussion (pp 297, 298), grouped them as a nomenclatural unit.

### 2. Orites megacarpa A.S.George & B.Hyland, *Fl. Australia* 16: 497 (1995)

T: Mt Bartle Frere, Qld, 27 Dec. 1986, *M.Godwin C2960 & J.P.Stanton*; holo: QRS 095401; iso: BRI, QRS.

Canopy tree to 25 m tall. New shoots appressed-hirsute, glabrescent. Bark with close lenticels, pale grey-brown; outer blaze with anastomosing red, pink and orange striations; inner blaze paler. Leaves with glabrous petiole, 5–12 mm long; lamina elliptic, obtuse to acute, 5–10 cm long, 2–3 cm wide, entire, leathery, shining above. Flowers in a terminal or axillary panicle of spike-like branches; rachis rusty-villous; bracts linear, 2–3 mm long, villous; pedicels 2–4 mm long, creamy villous. Perianth 5–6 mm long, cream, villous. Hypogynous glands cordate, shortly united, 0.5 mm long. Gynoecium 4.2–4.5 mm long; ovary and base of style silky, with a few scattered hairs above. Follicle obliquely obovoid, beaked, 28–44 mm long, very thick, opening ±flat. Seeds elliptic to almost orbicular, 15–20 mm long, 10–15 mm wide, with marginal wing 2–4 mm wide.

Occurs between 100 and 1200 m on Mt Bartle Frere, Mt Spurgeon and Mt Lewis, northern Qld. Grows in granitic soil in microphyll vine forest. Flowers Dec.–Mar.; fruits Oct., Dec., possibly June. Map 398.

Qld: Mt Bartle Frere, *M.Godwin C2955* (BRI, QRS); State Forest Logging Area 143, Parish of Kanawarra, Carbine Logging Area, *B.Gray 5410* (QRS).

The linear bracts, villous flowers and large, thick-walled fruit are distinctive. Indumentum of the flowers of the Mt Bartle Frere and Mt Lewis plants is especially villous. Flowers strongly scented. Cotyledons obovate or triangular, sagittate at base, 15–18 mm long. Seedling leaves entire. Referred to in B.P.M.Hyland & T.Whiffin, *Austral. Trop. Rain Forest Trees* 2: 409 (1993) as '*849 Orites sp.*' *(=MG/2960).* Leaf cuticular morphology is 'quite distinct from that of the other *Orites* species, although there is some resemblance to *O. excelsa* and *O. fragrans*' (Carpenter, 1994).

## Sect. 2. Orites

**Orites** R.Br. sect. **Orites**.

*Oritina* R.Br., *Trans. Linn. Soc. London* 10: 224 (1810); *Orites* sect. *Amphiderris* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 32 (1830); *Orites* sect. *Oritina* (R.Br.) Kuntze, *Lex. Gen. Phan.* 404 (1903). T: *Oritina acicularis* R.Br. = *Orites acicularis* (R.Br.) Roem. & Schult.

Shrubs of alpine and subalpine heaths and woodlands, sometimes temperate rainforest. Leaves cartilaginous, less than 12 mm wide. Conflorescence to 5 cm long. Follicles 10–24 mm long.

A section of 5 species, 4 endemic in Tas., the other in alpine areas of N.S.W., A.C.T. and Vic. In this section the floral bracts fall much earlier than in sect. *Excelsae*.

### 3. Orites diversifolia R.Br., *Trans. Linn. Soc. London* 10: 190 (1810)

T: on mountain tops, locality not given [Tas.], 1804, *R.Brown s.n.*; *n.v.*

Illustration: M.Stones *in* W.M.Curtis & M.Stones, *Endemic Fl. Tasmania* IV: t. LXXXIX no. 150 (1973).

Erect, rather open shrub to 3 m tall, with lignotuber. New shoots pale rusty-pubescent, glabresent. Leaves with petiole 2–3 mm long; lamina narrowly oblong to lanceolate or ovate, 2–12 cm long, 3–11 mm wide, bluntly mucronate, shining above, pale beneath, puberulous; margins recurved to almost flat, entire or serrate. Conflorescence in upper axils; rachis to 4 cm long, rusty-tomentose; bracts broadly ovate, obtuse to almost acute, papery, 3–4 mm long, glabrous except pubescent tip and margins. Perianth 4–5 mm long, creamy white, glabrous. Hypogynous glands ±ovoid, 0.3 mm long. Gynoecium 3.5–4.5 mm long; ovary and base of style villous. Follicle boat-shaped, almost acute, 18–24 mm long, 6–8 mm wide, glabrous or nearly so. Seed wing terminal.

Endemic in Tas.; occurs in heath up to 1300 m, and in rainforest at lower altitudes. Flowers Oct.–Nov. Map 399.

Tas.: Mt Mangana, South Bruny Is., *B.G.Briggs 8261* (HO, NSW); L. Fenton, Mt Field Natl Park, *B.G.Briggs 7008* (NSW); 2 km S of Mt Darwin, *P.Collier 4401* (HO); S of Dog Hill, *A.M.Buchanan 12199* (AD, CANB, HO); Captain Cook Ck, South Bruny Is., *A.M.Buchanan 11050* (HO).

Occasionally produces flowers among the larger, serrate, juvenile leaves. A collection from Mt Dromedary (*A.M.Buchanan 13368*, HO) has a persistent indumentum and follicles 10–12 mm long and may represent a new taxon.

### 4. Orites lancifolia F.Muell., *Defin. Austral. Pl.* 31 (June–July 1855); *Trans. Philos. Soc. Victoria* 1: 108 (10 Sept. 1855)

T: Australian Alps [Vic.], Dec. 1854, *F.Mueller*; lecto: MEL; isolecto: MEL, *fide* A.S.George, *Fl. Australia* 16: 497 (1995); Mt Hotham [Vic.], date unknown, *F.Mueller*; syn: MEL; Mt Wellington, Gippsland [Vic.], Nov. 1854, *F.Mueller*; syn: MEL; Munyang Mountains [Vic.], Jan. 1855, *F.Mueller*; syn: MEL.

Illustrations: A.B.Costin *et al.*, *Kosciusko Alpine Fl.* [270], fig. 148 (1979); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 481 (1989).

Spreading shrub to 2 m, sometimes prostrate, with lignotuber. New shoots appressed-pubescent, glabrescent. Leaves with petiole 2–6 mm long; lamina oblong-elliptic to oblong-lanceolate, 1–3 cm long, 5–12 mm wide, obtuse or sometimes acute, entire or sometimes with a few apical teeth, smooth above, openly reticulate below; margins thickened, slightly recurved. Conflorescence terminal or in upper axil; rachis 1.5–5 cm long, rusty-villous; bracts ovate, 3–6 mm long, scarious, with ciliate margins. Perianth 4–6 mm long, white to pale yellow, glabrous. Hypogynous glands linear-oblong, obtuse, 0.2 mm long. Gynoecium 4–6.5 mm long; ovary villous. Follicle obliquely oblong-obovate, 15–20 mm long, appressed-pubescent. Seed not seen. *Alpine Orites*. Figs 124, 161A–B.

An alpine and subalpine plant of the Australian Alps in N.S.W., A.C.T. and Vic. Grows in granitic rocky situations, in heath and tussock grassland. Flowers Dec.–Jan. Map 400.

N.S.W.: Charlotte Pass, *J.I.Raine ANU10347* (NSW). A.C.T.: Bimberi Peak, Bimberi Ra., *T.G.Hartley 14261* (NSW). Vic.: near Bridge of Sighs, Mt Buffalo, *R.Melville 2593* (BRI, K, NSW, PERTH); Echo Flat, Lake Mtn, *J.H.Ross 2461* (MEL, PERTH).

The name *O. planifolia* F.Muell., *Hooker's J. Bot. Kew Gard. Misc.* 7: 236 (Aug.–Sept. 1855) was suggested by Mueller in a letter but was never validly published.

### 5. Orites milliganii Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 424 (1856)

T: Mt Sorrel, near Macquarie Harbour, Tas., *J.Milligan 739*; iso: K (photo seen), MEL.

Illustration: M.Stones *in* W.M.Curtis & M.Stones, *Endemic Fl. Tasmania* III: t. LXX, no. 118 (1971).

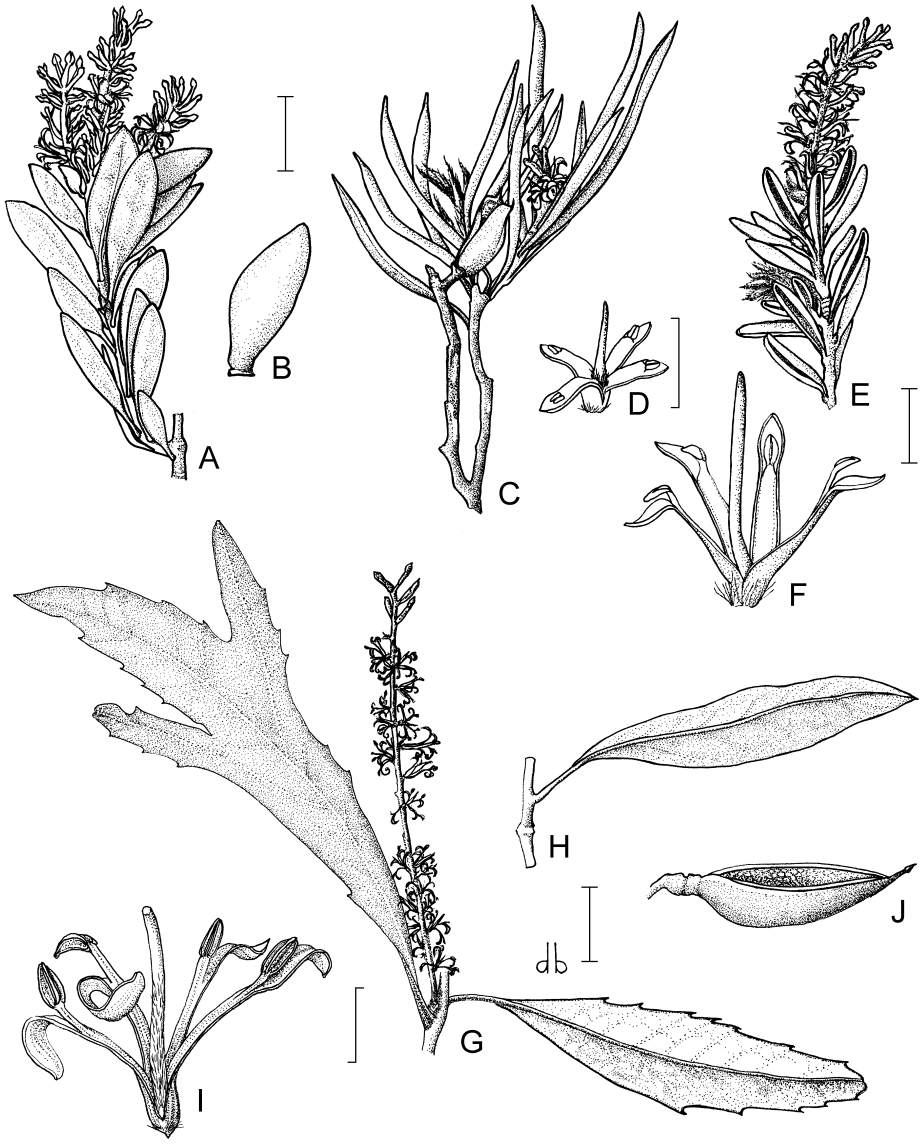



**Figure 161**. *Orites*. **A–B**, *O. lancifolia*. **A**, flowering branchlet; **B**, closed follicle (**A–B**, Walker ANU 968, CANB). **C–D**, *O. acicularis*. **C**, shoot with flowers and follicle; **D**, flower (**C–D**, P.Darbyshire 1054, CANB). **E–F**, *O. revoluta*. **E**, flowering branchlet; **F**, flower (**E–F**, P.Darbyshire 1048, CANB). **G–J**, *O. excelsa*. **G**, flowering branchlet (A.Floyd 1043, CANB); **H**, leaf (L.Smith & L.Webb 3663, CANB); **I**, flower (L.Smith 14677, CANB); **J**, open follicle (L.Smith & L.Webb 3623, CANB). Scale bars: **A–C**, **E**, **J** = 1 cm; **D** = 5 mm; **F**, **I** = 2 mm; **G**, **H** = 2 cm. Drawn by D.Boyer.

Robust shrub or small tree, sometimes to 6 m tall. New shoots glabrous except a few, straight, rusty hairs on upper surface of leaves. Leaves with petiole 5–9 mm long; lamina ovate to obovate, 15–30 mm long, 9–19 mm wide, obtuse but apiculate, serrate, thick; margins flat to slightly recurved. Conflorescence terminal; rachis 2–6 cm long, glabrous or sparsely pubescent; bracts ovate, obtuse to acuminate, 3.5–4.5 mm long, ciliate. Perianth 7–8.5 mm long, white. Hypogynous glands orbicular to square, thick, 0.2 mm long. Gynoecium 6–7 mm long; ovary rusty-villous. Follicle oblong-elliptic, abaxially broadened at base, beaked, 10–20 mm long, glabrous. Seed surrounded by wing.

Endemic in Tas. where it grows on rocky quartzite slopes in heath above 1300 m on the western mountains. Flowers Dec.–Jan. Map 401.

Tas.: Federation Peak area, Bechervaise Plateau, *T. & G.Whaite 2698* (NSW); between Mt La Perouse and Maxwell Ridge, *A.M.Buchanan 3030* (HO); Frenchmans Cap, *I.Olsen 41* (HO); Mt Sedgwick, near Queenstown, *P.Collier 3051* (HO).

Distinctive in the broad, serrate leaves and broad follicle. Sometimes prostrate.

### 6. Orites revoluta R.Br., *Trans. Linn. Soc. London* 10: 190 (1810)

T: on mountain tops, locality not cited [possibly Mt Wellington, Tas.], 1804, *R.Brown s.n.*; *n.v.*

Illustrations: M.Stones *in* W.M.Curtis & M.Stones, *Endemic Fl. Tasmania* IV: t. LXXXIX, no. 149 (1973); M.Cameron (ed.), *Guide Fl. & Pl. Tasmania* 23, pl. 9 (1981); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 471 (1989).

Erect or spreading shrub to 2 m tall, with lignotuber. New shoots silky-pubescent. Stems pubescent. Leaves with petiole 1.5–4 mm long; lamina linear to narrowly elliptic-obovate, 7–25 mm long, 1–1.5 mm wide, obtuse, with entire, revolute margins, thick, glabrous above, tomentose below. Conflorescence terminal; rachis to 3.5 cm long, rusty-pubescent; bracts narrowly ovate, obtuse, pubescent, ciliate. Perianth 4–5 mm long, cream to white, glabrous. Hypogynous glands oblong, thick, 0.2–0.3 mm long. Gynoecium 3.5–4.5 mm long; ovary rusty-villous. Follicle obliquely elliptic, acuminate, 12–18 mm long, 7–8 mm wide, pubescent. Seed wing terminal. Fig. 161E–F.

Endemic in Tas. where it is common from 700 to 1300 m alt. Grows in rocky, doleritic soil in heath, sometimes with scattered mallee eucalypts, and in low woodland and forest, occasionally in boggy areas. Flowers Dec.–Jan. Map 402.

Tas.: Mt Wellington, *E.A.Brown 90/63* (NSW); Mt Field Natl Park, *C.T.White 8264* (BRI); Clumner Bluff, *P.Collier 428* (HO); 2 km E of Mt Mueller, *P.Collier 4965* (HO); Denison Craig Tarn, Ben Lomond Natl Park, *M.G.Noble 28086* (HO).

Some specimens, probably from sheltered sites, have longer, more widely spaced leaves. Flowers have a strong, sour scent.

### 7. Orites acicularis (R.Br.) Roem. & Schult., *Syst. Veg.* 3: 427 (1818)

*Oritina acicularis* R.Br., *Trans. Linn. Soc. London* 10: 224 (1810). T: Table Mtn [Mt Wellington], Tas., 1804, *R.Brown s.n.*; ?iso: BM.

Illustrations: M.Stones *in* W.M.Curtis & M.Stones, *Endemic Fl. Tasmania* III: t. LXX, no. 117 (1971); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 471 (1989).

Erect or sprawling shrub to 1.5 m, with lignotuber. New shoots pubescent, glabrescent. Leaves with petiole 2–5 mm long; lamina terete, with groove on upper surface, 10–35 mm long, yellow-green, acute, pungent, entire, hard, glabrous. Conflorescence terminal or axillary; rachis to 2 cm long, pubescent; bracts ovate, subacute, 3–3.5 mm long, scarious, not striate, with ciliate margins and pubescent tip. Perianth 4–5 mm long, creamy white or pink-tinged, glabrous. Hypogynous glands oblong or linear, 0.2–0.3 mm long. Gynoecium 3.5–4 mm long; ovary silky-pubescent. Follicle oblong, expanded adaxially at base, obliquely beaked, 12–15 mm long, glabrous. Seed surrounded by wing. *Yellow Bush.* Fig. 161C–D.

Endemic in Tas.; common on the mountains on boulder fields (granite and diorite) in heath, herb field and cushion bogs. Flowers Dec. Map 403.

Tas.: near Sitzmark Lodge, Mt Field Natl Park, *E.A.Brown 90/177* (NSW); Ben Lomond, *I.Olsen 184* (NSW); near L. Fenton, Mt Field Natl Park, *J.W.Vickery NSW18859* (NSW); Mt Arthur, towards Collinsvale, *F.H.Long 1060* (HO); Pelion West, *A.M.Buchanan 12779* (HO).

Easily recognised by the adaxially grooved, terete leaves which vary greatly in thickness. Flowers scentless. A probable hybrid between *O. acicularis* and *O. milliganii*, collected by R.J.Carpenter *et al.* at Mt Read, near Roseberry (NSW), has linear but deeply channelled, sparsely serrate leaves and follicles 7–8 mm long.

## 19. NEORITES

*Helen J.Hewson*

*Neorites* L.S.Sm., *Contr. Queensland Herb.* 6: 15 (1969); from the Greek *neos* (new) and *Orites* (a genus of the Proteaceae), in reference to the genus being new and resembling *Orites*.

Type: *N. kevediana* L.S.Sm.

Tree, fluted, channelled or buttressed at base; suckers produced near base of some trees. Leaves alternate, simple, or pinnate on juvenile plants. Conflorescence a bracteate spike, sometimes paniculate, axillary in terminal leaves. Flowers ±actinomorphic, bisexual. Tepals 4, free. Stamens 4. Hypogynous glands 4, alternating with tepals. Ovary sessile, unilocular; style tip swollen; ovules 6–8. Fruit a woody follicle. Seeds 6–8, winged. $n$ = 14, L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 99 (1975).

An endemic, monospecific genus in rainforest in north-eastern Qld.

L.S.Smith, New species of and notes on Queensland plants, V, *Contr. Queensland Herb.* 6: 1–25 (1969); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 463–464 (1989).

### **Neorites kevediana** L.S.Sm., *Contr. Queensland Herb.* 6: 15 (1969)

T: Forest Reserve 315, NNW of Kuranda, Qld, *H.E.Volck & K.J.White AFO/758*; holo: BRI.

Illustration: L.S.Smith, *op. cit.* 23, fig. 2, 25, fig. 3h–n.

Tree 15–30 m tall. Small branches tomentose with small white lenticels. Leaves glabrescent, heteromorphic; petiole 1–6 cm long; mature leaves ovate, 6–25 cm long, 2–11 cm wide, entire, serrate or crenate, attenuate at base, obtuse at apex; juvenile leaves imparipinnate with up to 15 subopposite to alternate pinnae; terminal pinna frequently trifid; each pinna ovate, 4–15 cm long, 1.5–4 cm wide, usually serrate. Conflorescence rusty-tomentose, 6–14 cm long; bracts broadly ovate, c. 6 mm long, striate, ciliate; flowers faintly perfumed. Tepals truncate, narrowly oblong, 4.5–6 mm long, 1–1.6 mm wide, cream, glabrous. Stamens adnate to tepals; anthers c. 3 mm long, not exserted beyond tepals. Hypogynous glands narrowly ovoid, c. 0.5 mm long. Ovary to c. 1 mm long, rusty-pubescent. Follicle slightly compressed, ovoid to obovoid, 5–7 cm long, 1.5–2 cm across, dull green to rusty brown, velvety-tomentose, incompletely glabrescent. Seeds narrowly elliptic to narrowly oblong, 4–4.5 cm long, c. 1 cm wide; wing terminal, c. 3 cm long. Fig. 162.

Grows in complex notophyll vineforest in basic volcanic soils in northern Qld from 15°40' to 16°50'S and 145°00' to 145°40'E between 150 m and 1150 m altitude. Map 404.

Qld: State Forest Reserve 144, *B.Gray 1967* (QRS); T.R. 55, 16°20'E, 145°20'S, *A.K.Irvine 1614* (K, QRS).

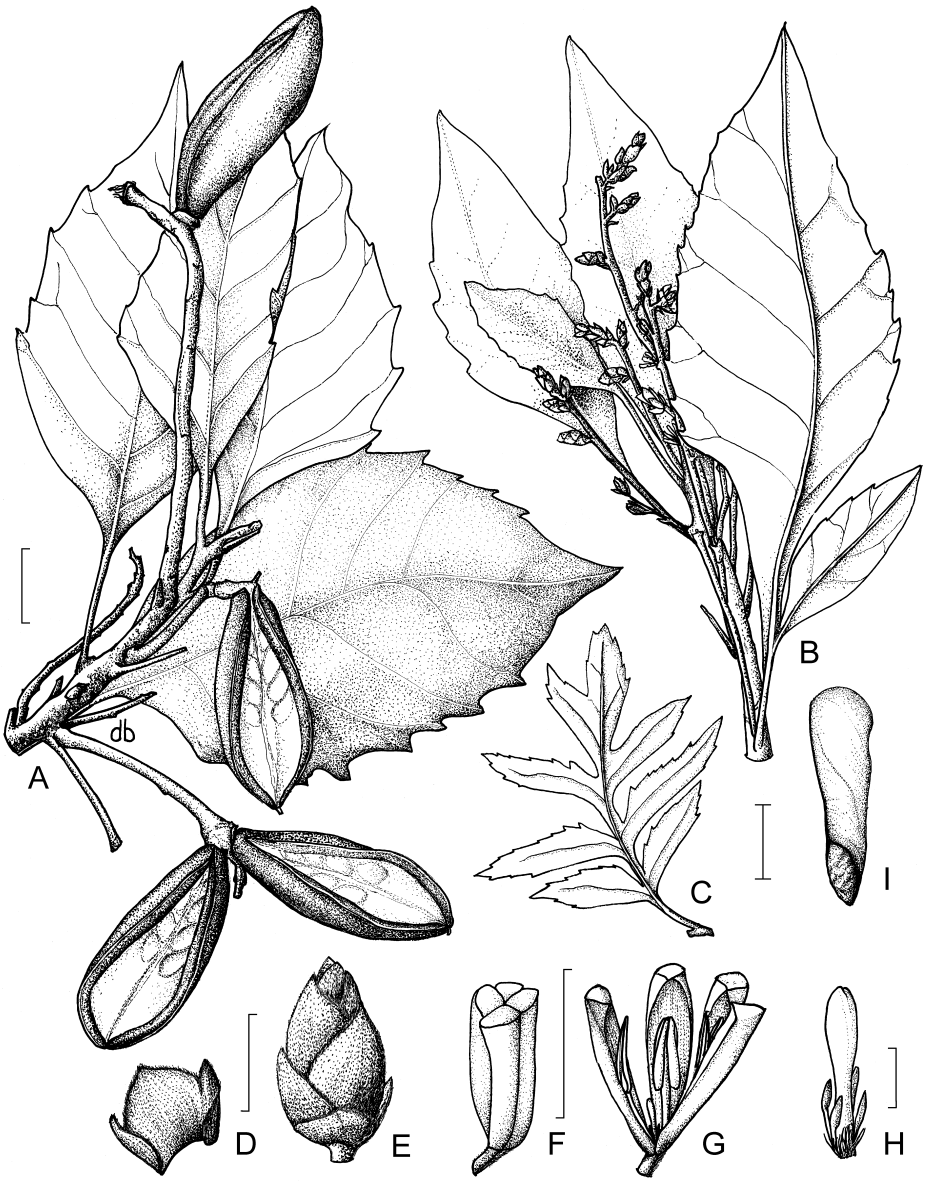



**Figure 162**. *Neorites kevediana*. **A**, fruiting branchlet with open follicles (A.Irvine 1715, QRS); **B**, branchlet with flower buds (B.Gray 1967, QRS); **C**, seedling leaf (A.Irvine 1715, QRS); **D**, floral bract; **E**, conflorescence in bud; **F**, closed flower; **G**, open flower; **H**, gynoecium with hypogynous glands (**D–H**, B.Gray 1967, QRS); **I**, seed. (A.Irvine 1715, QRS). Scale bars: **A**, **B** = 2 cm; **C** = 6 cm; **D–G** = 5 mm; **H** = 1 mm; **I** = 1 cm. Drawn by D.Boyer.

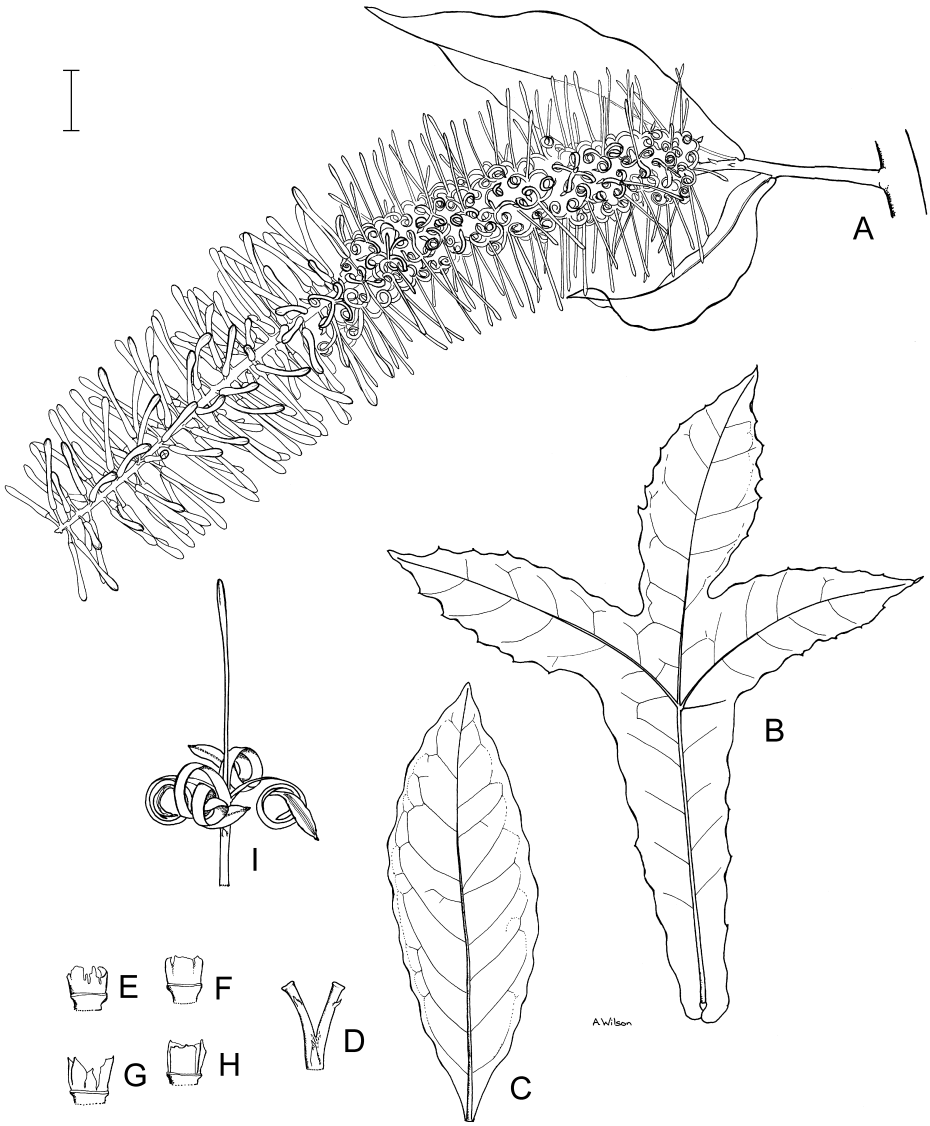



**Figure 163**. *Megahertzia amplexicaulis*. **A**, conflorescence (G.Sankowsky 638 & N.Sankowsky, BRI); **B**, juvenile leaf (L.Webb & J.Tracey 10894, BRI); **C**, mature leaf; **D**, pedicels of a flower pair; **E–H**, hypogynous gland variations; **I**, flower (C–I, G.Sankowsky 638 & N.Sankowsky, BRI). Scale bar: **A–C** = 2 cm; **D–I** = 4 mm. Drawn by A.Wilson.

## 20. MEGAHERTZIA

*A.S.George & B.P.M.Hyland*

*Megahertzia* A.S.George & B.Hyland, *Fl. Australia* 16: 497 (1995); name a pun on Roaring Meg Creek where an early collection was made, derived from the Greek *megas* (large) and *hertz*, the unit of frequency of sound.

Type: *M. amplexicaulis* A.S.George & B.Hyland

Rainforest understorey trees. Leaves alternate, simple. Conflorescence raceme-like, borne below leaves; common bracts and floral bracts present. Perianth actinomorphic; tepals separating almost to base, caducous. Anthers apiculate; filaments adnate to tepals for most of their length. Hypogynous glands irregularly lobed. Gynoecium straight; pollen presenter slightly broadened; stigmatic groove small, terminal; ovules 2. Fruit a follicle, dehiscing at maturity. Seeds 2, winged; wing wider at the ends and on one side.

A monospecific genus, confined to a small area in north-eastern Qld. Its affinities are uncertain but it seems to be closest to tribe Oriteae. Distinguished from *Orites* especially by the racemes borne below the leaves, much larger flowers, slightly enlarged pollen presenter with a terminal stigmatic groove and the presence of floral bracts. Leaf cuticular morphology 'suggests no particularly close relationship to any existing Oriteae, Knighteae or Embothrinae' (R.J.Carpenter, *Bot. J. Linn. Soc.* 116: 249–303, 1994).

### **Megahertzia amplexicaulis** A.S.George & B.Hyland, *Fl. Australia* 16: 497 (1995)

T: branch of Cooper Creek, Qld, 16°10'S, 145°24'E, 22 Aug. 1987, *G.Sankowsky 638 & N.Sankowsky*; holo: BRI.

Tree to 10 m tall. Bark slightly flaky; outer blaze dark red to brown with pale streaks. Branchlets minutely appressed-puberulous. Leaves sessile and amplexicaul, or shortly petiolate; lamina elliptic to lanceolate, obtuse, 8–23 cm long, 2.5–6 cm wide, entire, undulate, discolorous, minutely puberulous, soon glabrous. Conflorescence to 26 cm long; rachis glabrous; common bracts ±triangular, acute, 1–1.3 mm long with sparsely puberulous margins; floral bracts ±triangular, c. 0.5 mm long. Pedicels at c. 90° to rachis, 6–7 mm long, ±glabrous. Perianth 22–29 mm long, white, glabrous; limb 5 mm long; tepals relaxing after anthesis. Anthers 3.5–4 mm long. Hypogynous glands c. 1 mm long, irregularly lobed. Gynoecium 24–28 mm long, straight, glabrous; pollen presenter 4–5 mm long, ribbed, green. Follicle 30–35 mm long, 5–7 mm wide, canoe-shaped after dehiscence. Seeds 22–25 mm long, 4 mm wide, winged; wings much wider on one side than the other and wider at the ends. Fig. 163.

Occurs on Mt Hemmant, at Noah Creek, Roaring Meg Creek and the Pieter Botte Logging Area, north-eastern Qld; grows in granitic soil in rainforest, from sea level to 700 m. Flowers June–Sept.; fruits Dec. Map 405.

Qld: Noah Ck, Parish of Noah, *B.Gray 4550* (QRS); Roaring Meg Ck, *L.W.Jessup 684* (BRI); Mt Hemmant, *L.J.Webb & J.G.Tracey 10894* (BRI).

Flowers have a strong, sour scent. Peduncle with narrow, triangular bracts 1–1.5 mm long with a small basal swelling. Cotyledons obovate with obtuse, basal auricles, 17–20 mm long. Seedling leaves simple, serrate. Juvenile leaves 3-lobed. Referred to as '752 *Orites* sp.' *(=RFK/3196)* by B.P.M.Hyland & T.Whiffin, *Austral. Trop. Rain Forest Trees* 2: 410 (1993).

## Trib. 2. KNIGHTIEAE

*Proteaceae* trib. *Knightieae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 172 (1975).

Type: *Knightia* R.Br.

Juvenile leaves pinnately lobed or divided. Peduncles present. Floral bracts absent. Style tip usually ±modified as a pollen presenter. Ovules 4–many, hemitropous. Fruit follicular. Seeds winged. *n* = 14.

A tribe of 4 genera extending from north-eastern Qld to New Zealand and New Caledonia. In Australia, 2 endemic genera.

## Subtrib. 1. KNIGHTIINAE

*Proteaceae* subtrib. *Knightiinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 172 (1975).

Type: *Knightia* R.Br.

Adult leaves simple. Flowers actinomorphic or slightly curved; pedicels present but sometimes very short. Pollen presenter narrowly cylindrical or fusiform, not oblique. Seeds 4–many.

A subtribe of 3 genera extending from north-eastern Qld to New Zealand and New Caledonia. In Australia, 1 endemic genus.

## 21. DARLINGIA

*B.P.M.Hyland*

*Darlingia* F.Muell., *Fragm.* 5: 152 (1866); named after Sir Charles Henry Darling (1809–1870), Governor of Victoria (1863–1867).

Type: *D. darlingiana* (F.Muell.) L.A.S.Johnson

Trees. Leaves alternate, simple, conspicuously lobed on juveniles and occasionally on mature plants. Conflorescence raceme-like (but almost spicate), axillary, appearing almost terminal, sometimes paniculately branched. Flowers actinomorphic, bisexual, paired, almost sessile; common peduncle very short; common bract developed; floral bracts absent. Tepals valvate, coiled and reflexed at anthesis, dilated at apex, cream, glabrous throughout. Stamens 4; anthers 2-locular, basifixed, sessile, or filaments very short, dehiscing by longitudinal slits. Hypogynous glands 4, patelliform. Ovary sessile; ovules 4; pollen presenter ovoid; stigmatic surface terminal. Fruit a follicle. Seeds flat, winged around margin. *n* = 14, L.A.S.Johnson & B.G.Briggs, *Austral. J. Bot.* 11: 24 (1963).

A genus of 2 species confined to north-eastern Qld.

F.M.Bailey, *Darlingia*, *Queensland Fl.* 4: 1352 (1901); W.D.Francis, *Austral. Rain-forest Trees* 4th edn, 395 (1982); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 148–150 (1989).

Leaves of mature plant glabrous or almost glabrous on the underside; common bracts less than 5 mm long **1. D. darlingiana**

Leaves of mature plant ferruginous-pubescent on the underside; common bracts more than 5 mm long **2. D. ferruginea**

**1. Darlingia darlingiana** (F.Muell.) L.A.S.Johnson, *Contr. New South Wales Natl. Herb.* 3: 93 (1962)

*Helicia darlingiana* F.Muell., *Fragm.* 5: 24 (1865); *Darlingia spectatissima* F.Muell., *Fragm.* 5: 152 (1865), *nom. illeg.* T: Rockingham Bay, Qld, *J.Dallachy s.n.*; ?syn: MEL *n.v.*

Illustrations: K.A.W.Williams, *Native Pl. Queensland* 3rd edn, 1: 85 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 149 (1989).

Tree to 30 m tall. Leaves entire; petiole slender, 1–3.5 cm long; lamina lanceolate to linear-lanceolate, 7–38 cm long, 2.5–8 cm wide, almost completely glabrous; base narrowly attenuate; margin usually smooth (often lobed on small trees); apex usually acuminate, sometimes obtuse; veins 15–40 pairs. Conflorescence ±erect, 15–24 cm long; common bracts c. 3–4 mm long, 4–5 mm wide, absent at anthesis. Tepals 2.5–3 cm long. Anthers 2–3.1 mm long; mucro c. 0.2–0.6 mm long. Ovary 1.2–2.4 mm long, ferruginous-sericeous; style 2–3 cm long; pollen presenter 2–3 mm long. Fruit 4.5–7 cm long, 2–3 cm wide, 1–1.5 cm thick. Seeds 4–6.5 cm long, 2–3 cm wide; wing c. 3–10 mm wide; embryo 1.7–3.5 cm long, 1–2 cm wide. *Brown Silky Oak, Darling Tree.* Fig. 125.

Occurs between Cooktown and Townsville, Qld, from near sea level to 1100 m. Flowers spring and summer. Map 406.

Qld: Timber Reserve 176, Parish of Monkhouse, Lorna Doone Logging Area, *B.P.M.Hyland 12229* (QRS); Mt Lewis, *A.Irvine* 376 (QRS); Gillies Hwy, *B.Gray 2360* (QRS); Fishery Ck, *B.P.M.Hyland 11373* (QRS); Dotswood Holding, Paluma Ra., *B.P.M.Hyland 7264* (QRS).

**2. Darlingia ferruginea** J.F.Bailey, *Queensland Agric. J.* 5: 402 (1899)

*Darlingia spectatissima* var. *ferruginea* (J.F.Bailey) C.T.White, *J. Arnold Arbor.* 11: 231 (1930). T: Evelyn, Qld, June–July 1899, *J.Bailey s.n.*; type: BRI.

Tree to 30 m tall. Leaves entire; petiole 1.2–3.5 cm long; lamina lanceolate, linear-lanceolate to almost spathulate, 20–46 cm long, 5–21 cm wide, glabrous above except for midrib; base narrowly attenuate, densely ferruginous-pubescent below, with both appressed and ascending, erect hairs; margin usually smooth (lobed on small trees); apex usually acuminate, obtuse or emarginate; veins 25–50 pairs. Conflorescence ±erect, 14–22 cm long; mature common bracts c. 10–15 mm long, 10–15 mm wide, absent at anthesis. Tepals 2.5–3.3 cm long. Anthers 2.5–3.5 mm long; mucro c. 0.5–1.3 mm long. Ovary 1.7–2.8 mm long, ferruginous-sericeous; style 2–3 cm long; pollen presenter 2.2–3.5 cm long. Fruit 7–8 cm long, 2.5–3.5 cm wide, 1–1.5 cm thick. Seeds c. 7–8 cm long, 2.5–3 cm wide; wing c. 4–15 mm wide; embryo 3–4 cm long, 1.5–2 cm wide. *Rose Silky Oak, Brown Silky Oak.* *Fig.* 164F–I.

Occurs only on the Atherton Tableland, north-eastern Qld, between 750 and 1250 m alt. Flowers winter to early spring. Map 407.

Qld: State Forest Reserve 194, Parish of Herberton, *B.Gray 1895* (QRS); Reserve 404, Parish of Dirran, Elinjaa Falls, *B.Gray 2615* (QRS); State Forest Reserve 310, Windin Logging Area, *A.W.Dockrill 61* (QRS); State Forest Reserve 650, *B.P.M.Hyland 8272* (QRS); Keough's Block, Evelyn, *J.O'Farrell 118* (QRS).

## Subtrib. 2. CARDWELLIINAE

*Proteaceae* subtrib. *Cardwelliinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 172 (1975).

Type: *Cardwellia* F.Muell.

Adult leaves pinnate. Flowers zygomorphic, with a curved perianth; pedicels absent. Pollen presenter strongly oblique. Seeds many.

A subtribe of 1 monospecific genus endemic in north-eastern Qld.

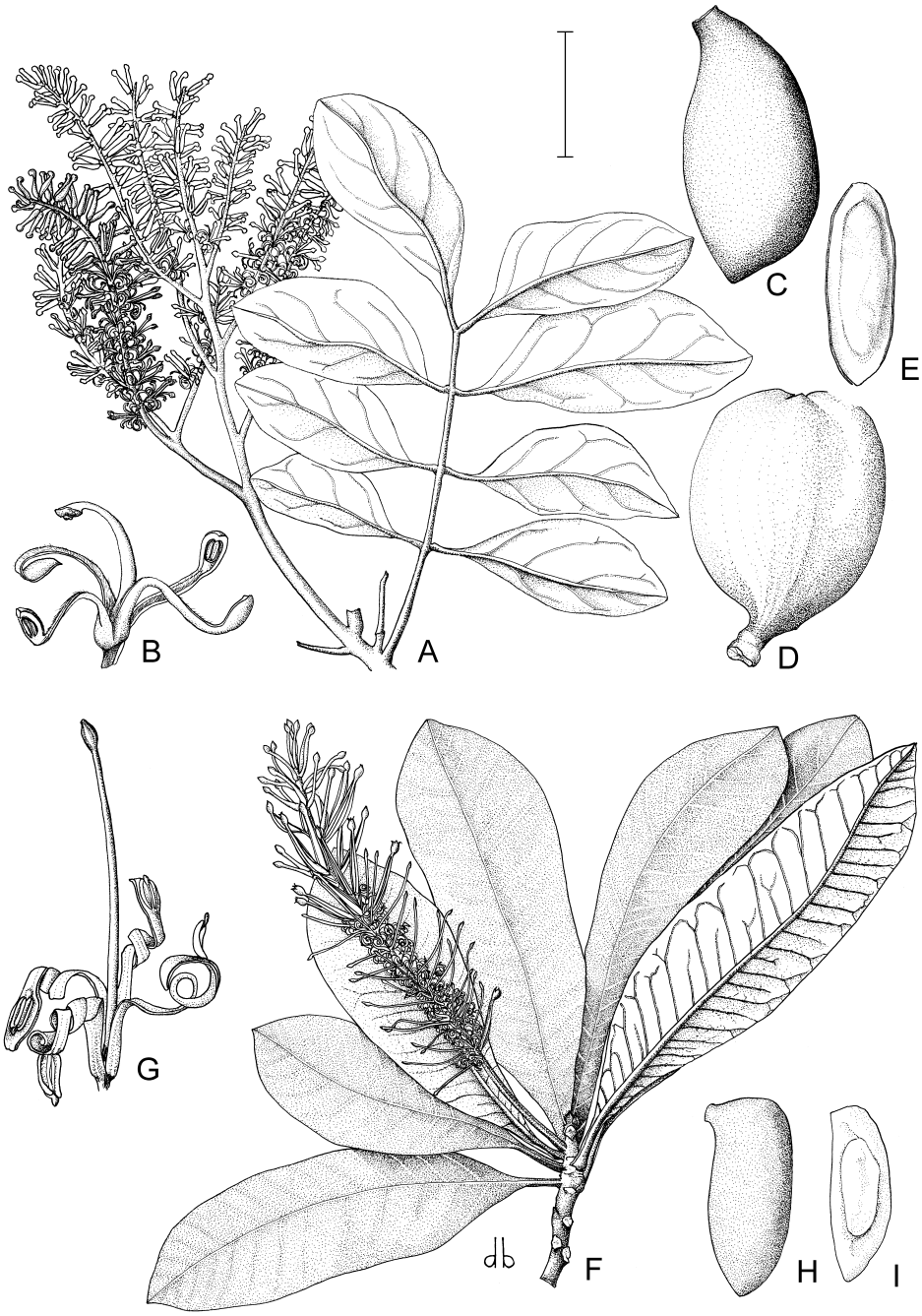



**Figure 164**. **A–E**, *Cardwellia sublimis*. **A**, flowering branchlet; **B**, flower (**A–B**, B.Gray 2288, CANB); **C**, closed fruit; **D**, open fruit; **E**, seed (**C–E**, B.Gray 2299, QRS). **F–I**, *Darlingia ferruginea*. **F**, flowering branchlet; **G**, flower (**F–G**, B.Gray 2534, CANB); **H**, closed fruit; **I**, seed (H–I, B.Gray 1895, CANB). Scale bar: **A**, **C–F**, **H**, **I** = 5 cm; **B**, **G** = 1 cm. Drawn by D.Boyer.

## 22. CARDWELLIA

*B.P.M.Hyland*

*Cardwellia* F.Muell., *Fragm.* 5: 23 (1865); named after Edward Cardwell (1813–1886), Secretary for the Colonies (1864–1866).

Type: *C. sublimis* F.Muell.

Trees. Leaves alternate. Conflorescence raceme-like, terminal, paniculately-branched. Flowers bisexual, zygomorphic, sessile, paired on a common peduncle; peduncle bracts and floral bracts usually absent at anthesis. Tepals valvate, reflexed at anthesis. Stamens 4; anthers 2-locular, basifixed, dehiscing by longitudinal slits. Hypogynous glands 4 (2 large, 2 smaller), ±globular. Ovary stipitate; ovules c. 10–14; pollen presenter dilated; stigmatic surface lateral, ±circular, central, mammiform. Fruit a large, woody follicle. Seeds many, ±elliptic, winged.

Monospecific, confined to north-eastern Qld.

Readily distinguished by the pinnate, adult leaves, numerous ovules, large woody follicles, and seeds with marginal wings.

F.M.Bailey, *Cardwellia*, *Queensland Fl.* 4: 1354–1355 (1901); W.D.Francis, *Austral. Rainforest Trees* 4th edn, 395 (1982); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 126–127 (1989).

### **Cardwellia sublimis** F.Muell., *Fragm.* 5: 24 (1865)

T: Rockingham Bay, Qld, *J.Dallachy s.n.*; holo: MEL.

Illustrations: K.A.W.Williams, *Native Pl. Queensland* 2: 71 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 126 (1989).

Tree at least 30 m tall. Seedling leaves simple. Adult leaves imparipinnate, to 65 cm long; petiole 6–11 cm long; leaflets ±opposite, ovate to oblong, c. 9–18 cm long, 4–7 cm wide, usually 3–10 pairs; base usually attenuate; apex acute or obtuse; veins 7–15 pairs; petiolules 9–22 mm long. Conflorescence 9–16 cm long. Tepals 10–18 mm long, cream, hoary appressed-pubescent, with inflexed hairs abaxially but woolly or villous, with reflexed hairs adaxially. Anthers 1.4–1.7 mm long. Ovary 1.2–2 mm long; style 5–11 mm long; pollen presenter 2–3 mm long. Fruits ovoid-ellipsoidal, 8–11 cm long, 5–6 cm diam. Seeds 8–12, 6–7 cm long, 2.5–3 cm wide; embryo 4.5–5.5 cm long, 1.5–2 cm wide. Seed wing marginal, c. 5 mm wide. $n$ = 14, *fide* L.A.S.Johnson & B.G.Briggs, *Austral. J. Bot.* 11: 24 (1963). *Northern Silky Oak, Bull Oak, Golden Spanglewood, Oongaary*. Figs 127, 164A–E.

Occurs between Cooktown and Townsville, north-eastern Qld; grows in rainforest from near sea level to 1000 m alt. Map 408.

Qld: Timber Reserve 176, Monkhouse, *B.P.M.Hyland 12143* (QRS); Jagan, Malanda–Millaa Millaa road, *B.Gray 2299* (QRS); Dotswood Holding, Paluma Ra., *B.P.M.Hyland 7252* (QRS).

Now used primarily for high quality cabinet timber and veneer, formerly also used for structural timber.

## Trib. 3. EMBOTHRIEAE

*Proteaceae* trib. *Embothrieae* Rchb., *Consp.* 82 (1828).

Type: *Embothrium* J.R.Forst. & G.Forst.

Hypogynous glands 2 or 3 or fused in a ring. Ovules usually 4–many. Fruit follicular. Seeds winged. $n$ = 11.

A tribe of 9 genera extending from eastern Australia to New Guinea and South America. In Australia, 7 genera, with 4 endemic.

## Subtrib. 1. STENOCARPINAE

*Proteaceae* subtrib. *Stenocarpinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc*. 70: 172 (1975).

Type: *Stenocarpus* R.Br.

Conflorescence fasciculate or wheel-like, or reduced to a single flower; rachis absent. Flowers ±zygomorphic. Ovules 2–many. Seeds 1 or many, with 2 adjacent wings; outer wing developed from proximal part of funicle and folded around inner wing which is developed from the inner integument.

A subtribe of 2 genera; one (*Strangea*) endemic in Australia, the other extending from eastern Australia to New Guinea and New Caledonia.

## 23. STRANGEA

*R.J.Hnatiuk*

*Strangea* Meisn., *Hooker's J. Bot. Kew Gard. Misc*. 7: 66 (1855); named after Frederick Strange who discovered the type species near Moreton Bay, Qld.

Type: *S. linearis* Meisn.

Shrubs to 1.5 m tall, glabrous or densely tomentose-villous or with bifid trichomes; frequently multistemmed from underground lignotuber. Leaves alternate, crowded or distant; scarcely petiolate; lamina simple, entire or rarely 3-lobed, obovate to oblanceolate, slightly swollen at base, coriaceous or rigid, pale green or grey-green, densely tomentose when young. Conflorescence 1-flowered or shortly umbel-, raceme- or panicle-like, axillary to previous season's leaves or appearing terminal; bracts present on peduncle. Flowers ±zygomorphic, bisexual, glabrous or densely tomentose outside, glabrous, smooth or wrinkled inside. Perianth tube bulbous at ends, dividing into 4 free lobes. Anthers sessile on inside distal end of tepals. Nectar gland broad or absent. Hypogynous glands absent. Ovary stipitate, oblique to torus, glabrous or densely tomentose or silky-villous; ovules 1–2; style filiform or broad; pollen presenter a large, circular, lateral disc with a central peak. Fruit a woody follicle, tapering at ends. Seed 1, encased in an outer, dark, membranous envelope, split along 1 side and attached at basal end of fruit, flat, winged at ends, pale brown. $n$ = 11, L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 99 (1975).

A genus of 3 species; 2 endemic in south-western W.A. and 1 in the central-eastern coast of Australia.

The genus is isolated except for its apparent close affinity with *Stenocarpus* with which it shares a unique double seed wing.

J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 527–529 (1989).

**1** Plants, including flowers, glabrous **1. S. stenocarpoides**

**1:** Plants with indumentum at least on young parts

**2** Flowers densely hairy; hairs attached at their base; style thick; fruit erect [W.A.] **2. S. cynanchicarpa**

**2:** Flowers sparsely hairy; hairs attached near their middle; style filiform; fruit pendent (or spreading) [Qld, N.S.W.] **3. S. linearis**

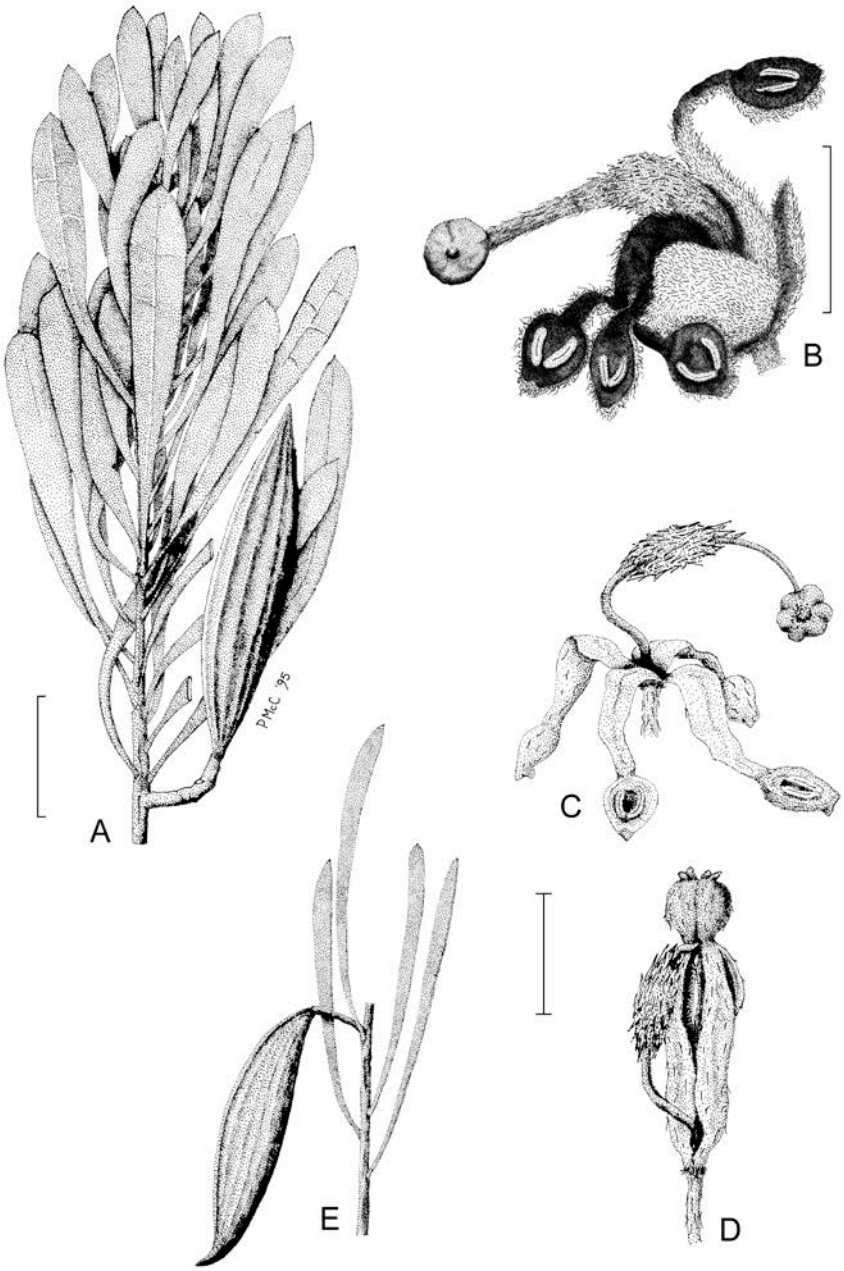



**Figure 165**. *Strangea*. **A–B**, *S. cynanchicarpa*. **A**, fruiting branchlet (M.Phillips 1217, CANB); **B**, flower (H.Demarz 2145, CANB). **C–E**, *S. linearis*. **C**, flower; **D**, flower in bud (**C–D**, I.Telford 11976, CBG); **E**, fruiting branchlet (I.Telford, 11979, CBG). Scale bars: **A**, **E** = 2 cm; **B** = 5 mm; **C**, **D** = 2 mm. Drawn by P.McCarthy.

**1. Strangea stenocarpoides** (Benth.) C.A.Gardner, *J. Proc. Roy. Soc. W. Australia* 27: 171 (1942)

*Hakea stenocarpoides* Benth., *Fl. Austral.* 5: 511 (1870), as ?*Hakea stenocarpoides*; *Diploptera stenocarpoides* (Benth.) C.A.Gardner, *J. Proc. Roy. Soc. W. Australia* 19: 80 (1933). T: locality not known [W.A.], *J.Drummond 5?: Suppl. 15*; syn: MEL, PERTH.

*Strangea steedmanii* Blakely, *Austral. Naturalist* 10: 133 (1938). T: Nornalup district, W.A., Jan. 1931–1938, *H.Steedman*; syn: MEL, NSW.

Illustration: C.A.Gardner, *J. Proc. Roy. Soc. W. Australia* 23: 202, pl. 2 (1941).

Shrub with slender to erect branches, to 1.2 m tall, glabrous in all parts. Leaves narrowly obovate, 4–14 cm long, 8–15 mm wide, erect, firm, entire. Conflorescence umbel-like, axillary; peduncle 10–20 mm long, strongly deflexed, with 1–4 small bracts at base. Flowers 4–8 in umbel, green-yellow; pedicel 3–5 mm long, deflexed, bringing flowers erect; torus oblique, with semi-annular gland; style thick. Fruit erect to spreading, not prominently ridged, opening widely on side. Seeds ovoid with thick, annular wing.

Endemic in south-western W.A., between Busselton and Albany. Grows in gravelly-sandy soil and brown sandy loam on rises in open Jarrah (*Eucalyptus marginata*) forest and woodland, sometimes in dense clumps. Flowers all year but mainly Sept.–Oct. Map 409.

W.A.: Sabina Rd, just NE of junction with Jalbarrgup Rd, Whicher Ra., *A.S.George 11730* (NSW, PERTH); Deep R., 2 Oct. 1959, *H.Purnell* (MEL).

Very little is known about the biology of *S. stenocarpoides*. Fruits were not available to Bentham when he described the species. He placed it in *Hakea* only provisionally.

**2. Strangea cynanchicarpa** (Meisn.) F.Muell., *Fragm.* 7: 132 (1871)

*?Grevillea cynanchicarpa* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 75 (1855); *Molloya cynanchicarpa* (Meisn.) Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 348 (1856). T: Moore River and great sand-plain north of Diamond Spring, W.A., *J.Drummond 6: 190;* syn: NSW.

Illustration: A.S.George, *Intr. Proteaceae W. Australia* 103, fig. 154 (1984).

Shrub to 1.5 m tall, to 2 m wide. Side branches short and upwardly curved, densely white- or pale pinkish brown-tomentose-villous, glabrescent. Leaves linear to narrowly oblanceolate, 5–12 cm long, 2–15 mm wide, grey-green, stiff, crowded, mucronate or acute, entire or with margins slightly toothed near apex, 1–3-veined, glabrescent. Flowers solitary, axillary to last season's leaves, or in terminal, contracted, raceme-like conflorescences, bluish green and dull red to purplish, densely tomentose-villous; peduncle 5 mm long, stout, with 1 narrow bract at base and 4 free or partly fused bracts below perianth; torus elongate. Stipe recumbent, glabrous. Ovary silky-villous; style broad, flat, tomentose at base, glabrescent above; stigma slightly lateral, broadly circular, with prominent, central, conical point. Fruit erect, with 2–3 prominent ridges on each side of opening. *Heath Strangea.* *Fig.* 165A–B.

Endemic in the Eneabba–Gingin area, W.A.; grows in deep, grey, sandy soil or shallow, grey sand over lateritic gravel in kwongan vegetation. Flowers mainly in Jan.–Feb. Map 410.

W.A.: 2 km NW of Mt Lesueur, NE of Jurien, *E.A.Griffin 2670* (PERTH).

Very little appears to be known about the biology of this species.

**3. Strangea linearis** Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 67 (1855)

*Grevillea strangea* Benth., *Fl. Austral.* 5: 453 (1870). T: Moreton Bay, Qld, *F.Strange*; *n.v.*

Illustrations: K.A.W.Williams, *Native Pl. Queensland* 2: 270 (1984); T.D.Stanley & E.M.Ross, *Fl. SE Queensland* 2, fig. 1H (1986); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 518, 528 (1989).

Shrub 0.5–1.5 m tall. Side branches few, 10–20 cm long. Indumentum of bifid trichomes. Leaves linear and terete to flat and narrowly obovate, 2–9 cm long, 1–6 mm wide, pale green, slightly swollen and yellow at base, erect, rigid, crowded, curved, acute. Conflorescence single or raceme- or panicle-like; peduncle 2–8 mm long, with 2–3 bracts at base, 1–several above. Flowers pale yellow, strongly fragrant, with sparse, bifid trichomes; perianth c. 5 mm long; pedicel slender, 10–12 mm long; torus prominent with broad gland. Ovary densely

tomentose with bifid trichomes; style filiform, spreading sharply. Fruit pendant or deflexed, smooth or slightly ribbed along suture. Figs 128, 165C–E.

Occurs from the Bundaberg area, Qld, south to Byron Bay, N.S.W.; grows primarily in sandy soil on ridges, slopes, or lowlands in wallum or similar shrublands, and in low open woodland. Flowers Sept.–Dec. Map 411.

Qld: between L. Binaboon and L. Boemingen, Fraser Is., *D.A.Smith 88* (BRI); Stradbroke Is., *S.T.Blake 7130* (BRI). N.S.W.: Byron Bay, *J.H.Maiden & J.L.Boorman* (NSW).

## 24. STENOCARPUS

*D.B.Foreman*

*Stenocarpus* R.Br., *Trans. Linn. Soc. London* 10: 201 (1810), *nom. cons.*; from the Greek, *stenos* (narrow) and *carpos* (a fruit), referring to the long thin fruits of most species.

Type: *S. forsteri* R.Br., *nom. illeg., typ. cons.* = *S. umbelliferus* (J.R.Forst. & G.Forst.) Druce

*Cybele* Salisb. ex Knight, *Cult. Prot.* xviii, 123 (1809), *nom. rej.* T: *C. umbelliferae* Knight

*Agnostus* A.Cunn. ex Loudon, *Hort. Brit.* 2nd edn, 580 (1832). T: *A. sinuata* Loudon

Trees or shrubs. Leaves simple, variously lobed or compound, alternate, scattered or spirally arranged. Conflorescence terminal or in upper leaf axils, umbellate, sometimes together in umbels or racemes, bracts caducous or absent. Flowers zygomorphic, bisexual; tube opening on lower side; all 4 segments finally separating; limb globular, recurved. Anthers broad, sessile; connective not extended. Hypogynous glands united into a disc or cup, sometimes very reduced. Ovary stipitate; ovules numerous, in 2 rows. Pollen presenter a flattened, oblique disc. Fruit follicular, mostly narrowly oblong or cylindrical, or flattened and semi-circular (1 species), splitting down 1 side. Seeds numerous, in 2 rows, highly compressed, winged. $n$ = 11, H.P.Ramsay, *Austral. J. Bot.* 11: 6 (1963); L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 99 (1975).

A genus of c. 25 species, mostly occurring in New Caledonia; 9 species are presently recognised in Australia with 2 species extending to New Guinea and Aru Is.

*Stenocarpus* shows a great deal of diversity with regards to the morphology of both adult and juvenile leaves. Most Australian species have simple (undivided) adult leaves. The two exceptions to this are *S. sinuatus* which has simple leaves mixed with variously lobed leaves, similar to the juvenile foliage, and *S. davallioides*. The latter species differs from all other species recognised in this treatment by having simple, pinnate, bipinnate or tripinnate adult foliage. Apart from *S. reticulatus*, which appears to have exclusively simple leaves, all other species have variously lobed, divided or compound juvenile leaves.

D.B.Foreman & B.P.M.Hyland, New species of *Buckinghamia* F.Muell. and *Stenocarpus* R.Br. (Proteaceae) from northern Queensland, *Muelleria* 6: 417–424 (1988); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 515–523 (1989).

**1** Leaf margins undulate; flowers bright red — **1. S. sinuatus**

**1:** Leaf margins not undulate; flowers cream, creamy white, creamy green, white, greenish white or yellow

**2** Adult leaves simple, pinnate, bipinnatisect or tripinnatisect — **2. S. davallioides**

**2:** Adult leaves all simple; juvenile leaves may be variously divided or lobed

**3** Leaves with distinct midrib and lateral veins

**4** Petiole of adult leaves 3–8 cm long; follicles narrowly oblong — **3. S. cryptocarpus**

**4:** Petiole to c. 1.8 cm long; follicles flattened, semi-circular — **4. S. reticulatus**

**3:** Leaves often lacking a distinct midrib and with up to 8 longitudinal veins arising from near the lamina base

**5** Adult leaves concolorous, dull above

**6** Perianth yellow, appearing white when open, 4–5 mm long **5. S. cunninghamii**

**6:** Perianth white, 8–15 mm long **6. S. acacioides**

**5:** Adult leaves discolorous, glossy above

**7** Adult leaves narrowly lanceolate, to c. 1.2 cm wide **7. S. angustifolius**

**7:** Adult leaves elliptic, broadly elliptic or broadly lanceolate, 1.7–7 cm wide

**8** Flowers white to greenish white, up to 30 per umbel; leaves elliptic, 6.5–10.5 cm long, 2.5–4.5 cm wide

**8:** Flowers cream, 40–50 per umbel; leaves elliptic, broadly elliptic or broadly lanceolate, 5.5–15 cm long, 1.7–7 cm wide

## 1. Stenocarpus sinuatus (Loudon) Endl., *Gen. Pl. Suppl.* 4(2): 88 (1848)

*Agnostus sinuata* Loudon, *Hort. Brit.* 2nd edn, 580 (1832); *Cybele sinuata* (Loudon) Kuntze, *Revis. Gen. Pl.* 2: 578 (1891). T: Moreton Bay, Qld, [?*A.Cunningham*]; syn: BM, photo seen.

*Stenocarpus cunninghamii* Hook., *Bot. Mag.* 72: t. 4263 (1846), *non* R.Br., as *cunninghami*. T: not designated.

*Stenocarpus sinuosus* F.Muell., *Fragm.* 6: 224 (1868), *nom. nud.*

*Stenocarpus sinuosus* var. *integrifolius* F.Muell., *Fragm.* 5: 154 (1866), *nom. nud.*

*Stenocarpus sinuosus* var. *latifolius* F.Muell., *Fragm.* 5: 154 (1866), *nom. nud.*

*Stenocarpus sinuosus* var. *sectus* F.Muell., *Fragm.* 5: 154 (1866), *nom. inval.* T: Mt Warning, N.S.W., *C.Moore*; holo: MEL.

Illustrations: K.Williams, *Native Pl. Queensland* 1: 265 (1979); D.C.Christophel & B.P.M.Hyland, *Leaf Atlas Austral. Trop. Rain Forest Trees* 199, pl. 137h (1993).

Tree to 30 m tall. Branchlets terete, ferruginous-tomentose, glabrescent. Leaves variable from simple to deeply pinnately-lobed; petiole to c. 2.5 cm long; lamina with undulate margins, discolorous, dark glossy green above, paler beneath; main veins and reticulations well-defined particularly beneath; lobed leaves with lamina to 48 cm long; simple leaves with lamina obovate, oblanceolate to elliptic, to 23 cm long. Conflorescence terminal or in upper leaf axils, minutely hairy; peduncles simple, 4–10 cm long, sometimes several arising from a common axis; umbels of 6–20 flowers. Flowers 25–38 mm long, bright red, with a prominent, globular, yellowish limb in bud; pedicels 14 mm long. Hypogynous gland prominent, encirling c. two-thirds of base of gynophore. Follicles cylindrical, 5–10 cm long, greyish-brown, with short rusty hairs; stalk to 4 cm long overall, forming a knee-like joint at junction of pedicel and gynophore. Seeds ±oblong, to c. 36 mm long including wing. $n$ = 11, H.P.Ramsay, *Austral. J. Bot.* 11: 6 (1963). *Firewheel Tree, Yiel-yiel*. Figs 129, 166A–G.

Extends from north of the Nambucca River on the north coast of N.S.W. to north-eastern Qld; also occurs in New Guinea. Grows in rainforest or in open areas. Flowers Mar.–June. Map 412.

Qld: State Forest Reserve 194, Parish of East Barron, *B.Gray 2476* (MEL, QRS); Atherton, *B.Gray 1881* (MEL, QRS); Moreton Bay, *F.Mueller* (MEL 676471). N.S.W.: Mt Warning, Tweed R., *C.Moore* (MEL 676460); Richmond R., *H.C.Fawcett* (MEL 676475).

The attractive foliage and brilliantly coloured flowers have led to this species being frequently cultivated in gardens and as a street tree in Australia and overseas.

## 2. Stenocarpus davallioides Foreman & B.Hyland, *Muelleria* 6: 419 (1988)

T: State Forest Reserve 143, North Mary Logging Area, Qld, *B.P.M.Hyland 8374*; holo QRS; iso BRI, MEL.

Illustrations: D.B.Foreman & B.P.M.Hyland, *op. cit.* 421, fig. 3; D.C.Christophel & B.P.M.Hyland, *Leaf Atlas Austral. Trop. Rain Forest Trees* 199, pl. 137d–e (1993).

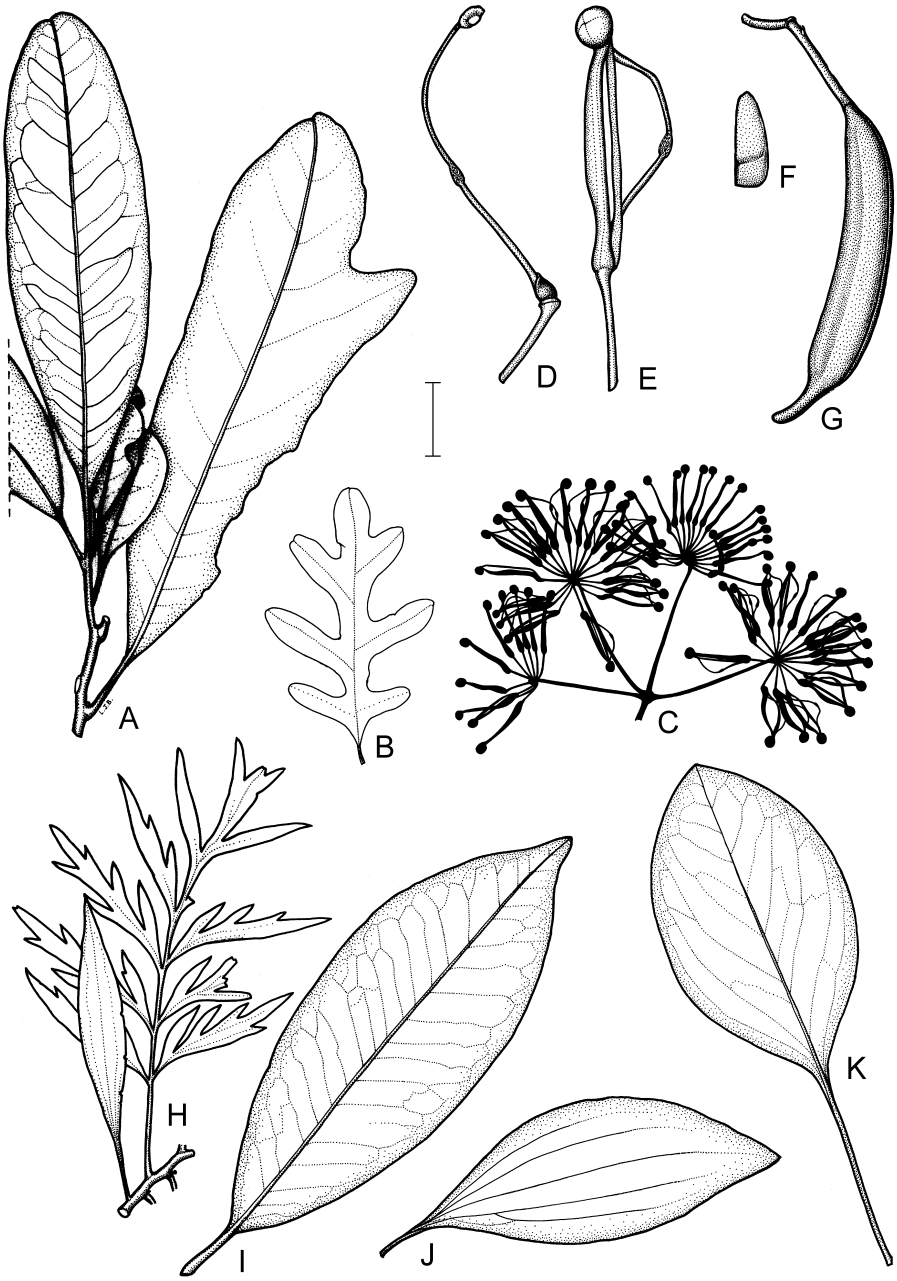



**Figure 166**. *Stenocarpus*. **A–G**, *S. sinuatus*. **A**, leafy branchlet (B.Gray 2476, MEL); **B**, lobed leaf (Moreton Bay, Qld, F.Mueller, MEL); **C**, conflorescence; **D**, gynoecium; **E**, flower (**C–E**, B.Gray 2476, MEL); **F**, seed; **G**, follicle (**F–G**, B.Gray 1881, MEL). **H**, *S. davallioides*, entire and dissected leaves (A.Irvine 1401, MEL). **I**, *S. reticulatus*, leaf (B.Hyland 10646, MEL). **J**, *S. salignus*, leaf (Rocking Bay, Qld, J.Dallachy, MEL). **K**, *S. cryptocarpus*, leaf (B.Hyland 6592, MEL). Scale bar: **A**, **F–K** = 2 cm; **B**, **C** = 4 cm; **D**, **E** = 1 cm. Drawn by L.Button.

Tree to 40 m tall, slightly buttressed. Branchlets terete, ferruginous-pubescent, glabrescent. Juvenile and coppice leaves tripinnatisect, finely divided; petiole 10 cm long; lamina to 42 cm long. Adult leaves simple, pinnate, bipinnatisect or tripinnatisect, with lamina margins not undulate, slightly discolorous, glossy when fresh, glabrescent; simple leaves with petiole 1–2 cm long, lamina lanceolate and 5–13 cm long, with 2 well-defined longitudinal veins; pinnate, bipinnatisect and tripinnatisect leaves with petiole 2–4.5 cm long, lamina 8–20 cm long. Conflorescence axillary, ±ferruginous-puberulous; peduncles 1.5–4 cm long; umbel with up to 15 flowers. Flowers 8–12 mm long, creamy green, sparsely ferruginous-puberulous outside; pedicels 6–12 mm long. Hypogynous gland horse-shoe shaped. Follicles narrowly oblong, to 6.5 cm long, glabrous, with up to 8 seeds. Seeds ±oblong, to c. 10 mm long, 3–4 mm wide. Fig. 166H.

Restricted to the Mt Lewis and Thornton Peak areas in northern Qld; in rainforest from 600–1260 m alt. Flowers chiefly Nov.; buds seen in Feb., Apr., May, July and Oct. Map 413.

Qld: Thornton Peak, *L.J.Brass & C.T.White 304* (BRI); State Forest Reserve 143, North Mary Logging Area, *B.P.M.Hyland 6743* (MEL, QRS); upper Daintree R., *I.Olsen NSW 121587* (BRI).

### 3. **Stenocarpus cryptocarpus** Foreman & B.Hyland, *Muelleria* 6: 422 (1988)

T: State Forest Reserve 310, Swipers Logging Area, Qld, *B.P.M.Hyland 2199 RFK*; holo: QRS; iso: BRI.

Illustrations: D.B.Foreman & B.P.M.Hyland, *op. cit.* 423, fig. 4; D.C.Christophel & B.P.M.Hyland, *Leaf Atlas Austral. Trop. Rain Forest Trees* 199, pl. 137a–b (1993).

Tree to 25 m tall, buttressed. Branchlets terete, dark ferruginous to ferruginous-pubescent, glabrescent. Juvenile and coppice leaves mostly bipinnate with some pinnae further divided; petiole 15–20 cm long; lamina to 115 cm long, with margins not undulate, ferruginous-tomentose, glabrescent. Adult leaves simple; petiole 3–8 cm long; lamina elliptic or ±oblong or obovate, 9–14 cm long, slightly discolorous, glossy when fresh, dark ferruginous to ferruginous-tomentose, glabrescent; midrib well-defined; veins lateral. Conflorescence axillary, towards end of branchlets, dark ferruginous to ferruginous-puberulous, glabrescent; peduncles 5.5–9.5 cm long; umbels with up to 20 flowers. Flowers 20–30 mm long, cream, strongly perfumed, ferruginous-pubescent; pedicels 10–17 mm long. Hypogynous gland ±oblong, fused to base of gynophore. Follicles narrowly oblong, 10–13 cm long, glabrous. Seeds not seen. Fig. 166K.

Restricted to the Boonjee area and from the McDowell Range to the east coast in northern Qld; grows in rainforest from 10 m to 1000 m alt. Flowers Dec.–Apr. Map 414.

Qld: McDowell Ra., *B.P.M.Hyland 2233 RFK* (QRS); State Forest Reserve 755, Boonjee Logging Area, *B.P.M.Hyland 6592* (MEL, QRS); Cooper Ck, *B.Gray 4136* (QRS).

### 4. **Stenocarpus reticulatus** C.T.White, *Queensland Dept. Agric. Bot. Bull.* 21: 17, t. 7 (1919)

T: Atherton District, Qld, Jan. 1918, *H.W.Mocatta s.n.*; holo: BRI; iso: MEL.

Illustration: D.C.Christophel & B.P.M.Hyland, *Leaf Atlas Austral. Trop. Rain Forest Trees* 199, pl. 137f (1993).

Tree to 35 m. Branchlets terete, minutely hairy, soon glabrescent. Leaves simple, minutely hairy, glabrescent; petiole to c. 1.8 cm long; lamina lanceolate to broadly oblanceolate or elliptical, 5–17 cm long, 2–5.8 cm wide, with margins not undulate, glossy dark green, discolorous, midrib and veins conspicuous on both surfaces. Conflorescence axillary, minutely hairy, glabrescent; peduncle 3.2 cm long; umbel with 10–13 flowers. Flowers 20 mm long, creamy white, strongly perfumed, minutely hairy when young, glabrescent outside, covered with long ferruginous hairs inside at base, base of style hairy; pedicel c. 10 mm long. Hypogynous gland a well-developed, semi-circular cup. Follicles flattened, semi-circular, 8.5 cm long, 5.5 cm wide, glabrous at maturity. Seeds ±semi-circular (part of margin straight), to 4.5 cm wide including the almost completely encircling wing. *Black Silky Oak*. Fig. 166 I.

Restricted to the Atherton Tableland, Qld; in rainforest, at altitudes of 660–960 m. Flowers Feb.–Aug. Map 415.

Qld: State Forest Reserve 310, Presley Logging Area, *B.Gray 2469* (MEL, QRS); Tree Reserve 165, Alexandra Logging Area, *B.P.M.Hyland 10646* (MEL, QRS); State Forest Reserve 144, Bowerbird Logging Area, *B.Gray 1703* (MEL, QRS).

### 5. Stenocarpus cunninghamii R.Br., *Suppl. Prod. Fl. Nov. Holl.* 34 (1830)

*Cybele cunninghamii* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 578 (1891). T: orâ septentr.-occid., Vansittart Bay [W.A.], 1819, *A.Cunningham*; syn: BM, photo seen.

Illustrations: B.L.Rye *in* J.R.Wheeler (ed.), *Fl. Kimberley Reg.* 464, fig. 140E (1992); D.C.Christophel & B.P.M.Hyland, *Leaf Atlas Austral. Trop. Rain Forest Trees* 199, pl. 137c (1993); C.R.Dunlop, G.J.Leach & I.D.Cowie, *Fl. Darwin Reg.* 2: 127, fig. 37 (1995).

Tree to 10 m tall. New growth rusty-tomentose, soon glabrescent. Leaves: petiole 4–7 mm long; lamina concolorous, dull, coriaceous; juvenile leaves elliptic or ovate in outline, simply lobed to deeply bipinnately lobed; lobes linear; adult leaves simple, oblanceolate, narrowly oblanceolate or narrowly elliptic, straight or falcate, 2.5–11 cm long, 0.4–1.8 cm wide, attenuate at base, with margins not undulate, acute or obtuse at apex, mucronate; venation faint with 3–5 longitudinal veins. Conflorescence axillary or ramiflorous, arising singly or several together, ferruginous-tomentose, glabrescent; peduncles 3–19 mm long; umbels of 14–21 flowers. Flowers 4–5 mm long, yellow, appearing white when open, strongly perfumed, glabrous; pedicels 4–5 mm long. Hypogynous gland well-developed, horse-shoe shaped, glistening. Follicles linear, 4–6 cm long, woody. Seeds ±oblong, c. 10–12 mm long (including wing), 3–5 mm wide; not often seen.

Extending from the coastal Kimberley region, W.A., to near Port Keats, N.T.; restricted to sandstone areas, found typically in narrow sandstone gorges. Flowers Mar.–May. Map 416.

W.A.: Bougainville Penin., Kimberley Region, *I.Cowie 4208 & Stewart* (CANB, DNA, PERTH); Manning Gorge, near Mt Barnett HS, *P.A.Fryxell 3978* (DNA). N.T.: Fitzmaurice R. area, *M.J.A.Barritt 1372* (BRI, DNA, MEL); tributary of Fitzmaurice R., *G.J.Leach 4206* (DNA, MEL, NSW); Keep River Gorge, Keep River Natl Park, *K.A.Menkhorst 1014* (BRI, DNA, MEL).

This circumscription includes *Stenocarpus* sp. nov. aff. *cunninghamii* R.Br. *sensu* J.W.Wrigley & M.Fagg (*Banksias, Waratahs & Grevilleas* 523, 1989).

### 6. Stenocarpus acacioides F.Muell., *Fragm.* 1: 135 (1859)

*Stenocarpus salignus* var. *acacioides* (F.Muell.) Domin, *Biblioth. Bot.* 89: 40 (1921). T: plains on the Roper River [N.T.], *F.Mueller*; holo: MEL.

[*Stenocarpus cunninghamii auct. non* R.Br.: K.Brennan, *Wildfl. Kakadu* 52, fig. 84 (1986)]

Illustrations: K.Brennan, *Wildfl. Kakadu* 52, fig. 84 (1986), as *S. cunninghamii*; B.L.Rye *in* J.R.Wheeler (ed.), *Fl. Kimberley Reg.* 464, fig. 140F (1992), as *S.* sp. A; C.R.Dunlop, G.J.Leach & I.D.Cowie, *Fl. Darwin Reg.* 2: 127, fig. 37 (1995).

Tree to 12 m tall. New buds rusty tomentose; plants otherwise glabrous. Leaves: petiole 5–20 mm long; lamina concolorous, dull, coriaceous; juvenile leaves simple, deltoid or ovate, 7.3–12 cm long, 5.7–11.1 cm wide, grading into adult leaves; adult leaves simple, elliptic or narrowly elliptic, 4.5–11.5 cm long, 0.7–3 cm wide, long-attenuate at base, with margins not undulate, acute or obtuse at apex; main longitudinal veins 4–8; secondary venation obscure. Conflorescence axillary, glabrous, arising singly or in a cluster of 2–3; peduncle 7–35 mm long; umbel of 19–22 flowers. Flowers 8–15 mm long, white, glabrous; pedicel 6–10 mm long. Hypogynous gland horse-shoe shaped, almost encircling gynophore. Follicles linear, 5.5–15 cm long, woody. Seeds oblong, c. 9 mm long including wing, 2–3 mm wide.

Distributed across northern Australia from the Kimberley region, W.A., eastwards into N.T., north of 16°S. Usually found in skeletal soils in eucalypt woodland; rarely in monsoon thickets. Flowers Apr.–Oct. Map 417.

W.A.: Mt Barker Plateau, *I.D.Cowie 1932* (DNA, MEL, PERTH). N.T.: Brown Point, Bynoe Harbour, *G.J.Leach 2680 & C.R.Dunlop* (DNA, MEL, MO, NSW); Maningrida, *C.Coleman 398* (DNA); Doyndji, East Central Arnhem Land, *N.H.Scarlett 108* (DNA); Moyle R., *C.R.Dunlop 9853 & P.K.Latz* (DNA, MEL).

Typically reproduces by suckers and not often seen as adults. In the past this species has been misidentified in herbaria as *S. cunninghamii*.

**7. Stenocarpus angustifolius** C.T.White, *Queensland Dept. Agric. Bot. Bull.* 21: 16 (1919)

T: Stannary Hills, Qld, *T.L.Bancroft s.n.*; holo: BRI 011419; iso: MEL.

*Stenocarpus cunninghamii* F.M.Bailey *non* R.Br., *Compr. Cat. Queensland Pl.* 454, fig. 442 (1913). T: not designated.

Illustration: F.M.Bailey, *op. cit.* *Fig.* 442, as *S. cunninghamii*.

Shrub or small tree to 4–5 m tall. Branchlets terete, minutely hairy, glabrescent. Juvenile leaves to 10 cm long, finely divided, with narrowly linear lobes; petiole to c. 10 mm long. Adult leaves simple, 5–18 cm long, to c. 1.2 cm wide; petiole to c. 10 mm long; lamina narrowly lanceolate, with margins not undulate, with longitudinal veins, discolorous, glossy dark green above, dull and pale green beneath. Conflorescence axillary, pilose; peduncle 2–4 cm long; umbel of 12–20 flowers. Flowers to c. 10 mm long, creamy white, pilose; pedicel to 12 mm long. Hypogynous gland well-developed, covering most of receptacle, very oblique. Follicles ±cylindrical, to 10 cm long. Seeds oblong, 15–20 mm long including wing, c. 4 mm wide.

Confined to subtropical ranges from the Mingela area south-west of Townsville to the Atherton Tableland west of Cairns, Qld. Occurs in *Eucalyptus* woodland and riparian situations. Flowers Aug.–Dec. Map 418.

Qld: Walsh Bluff on the headwaters of Granite Ck, c. 4 km SSW of Walkamin, *J.R.Clarkson 2847* (BRI, QRS); Walsh R. crossing on the Channel Rd, *B.P.M.Hyland 5593* (QRS); Hidden Valley Holding near Sunset Gap, *B.P.M.Hyland 5907* (QRS).

**8. Stenocarpus salignus** R.Br., *Trans. Linn. Soc. London* 10: 202 (1810)

*Cybele salignus* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 578 (1891). T: in Novae Hollandiae ora orientali; prope Port Jackson, N.S.W., *R.Brown s.n.*; syn: BM, photo seen.

*Hakea rubricaulis* Colla, *Hortus Ripul.* 63 (1824); *Hortus Ripul. Appendice* 1: 114, t. 3 (1824). T: N. Holl: ... Hoc titulo ab H. Cels. anno 1822 accepta; ?syn: MEL.

*Stenocarpus moorei* F.Muell., *Fragm.* 1: 134 (1859); *Stenocarpus salignus* var. *moorei* (F.Muell.) Benth., *Fl. Austral.* 5: 540 (1870). T: Illawarra, N.S.W., *C.Moore*; holo: MEL.

*Stenocarpus concolor* F.Muell., *Fragm.* 3: 147 (1863); *Stenocarpus salignus* var. *concolor* (F.Muell.) Benth., *Fl. Austral.* 5: 540 (1870). T: Broad Sound, Qld, [*E.M.*]*Bowman 24*; holo: MEL.

*Stenocarpus salignus* var. *brachycarpus* F.Muell., *Fragm.* 5: 154 (1866). T: Illawarra, N.S.W., no date given, [?*T.W.*]*Shepherd s.n.*; syn: MEL 1538577, 1538578.

Illustrations: K.Williams, *Native Pl. Queensland* 2: 269 (1984), as *S. salingnus*; D.C.Christophel & B.P.M.Hyland, *Leaf Atlas Austral. Trop. Rain Forest Trees* 199, pl. 137g (1993).

Tall shrubs to trees 30 m tall. Juvenile leaves variable, sometimes deeply lobed. Adult leaves simple, glabrous; petiole to 8–20 mm long; lamina elliptic, 6.5–10.5 cm long, 2.5–4.5 cm wide, with margins not undulate, acute at apex, usually 3 sometimes more longitudinal veins arising near base, joined by fainter, reticulate veins, discolorous, dark green glossy above, pale green and dull beneath. Conflorescence axillary, glabrous to pilose, borne either singly or 2–3 umbels arranged in a monochasial cyme; peduncle 2.5–6 cm long; umbel with up to 30 flowers. Flowers to 8–12 mm long, white or greenish white, glabrous to pilose; pedicel 10–20 mm long. Hypogynous gland semi-circular, glistening, pale yellowish green. Follicles oblong, c. 7 cm long. Seeds ±oblong, 12–15 mm long including wing, c. 5 mm wide. *Scrub Beefwood, Red Silky Oak*. Figs 130, 166J.

As presently circumscribed this species extends from Cape York in north-eastern Qld to the south coast of N.S.W. Occurs in a variety of habitats ranging from rainforest or monsoon forest to open *Eucalyptus* forest with a dense mesophyll understorey. Flowers May, July, Aug., Oct.–Jan. Map 419.

Qld: Natl Park Reserve 8, *B.P.M.Hyland 12433* (MEL, QRS); Lyrebird Ridge Rd Pottery, Springbrook area, *P.I.Forster 7691* (BRI, MEL, QRS); between Gordon Ck and Scrub Hen Ck, *A.K.Irvine 684* (QRS). N.S.W.: 1.5 km W of Termeil, *I.R.Telford 10751* (CANB, MEL, NSW); Illawarra, *C.Moore* (MEL).

Frequently cultivated in Australia and overseas. The circumscription of *S. salignus* is far from resolved at the present time. It appears from preliminary studies that there may be a number of closely allied taxa ranging from the south coast of N.S.W. to northern Australia and New Guinea. One of the taxa occurring in New Guinea has been variously referred to this species or *Stenocarpus moorei* (here regarded as a synonym of *S. salignus*) but the application of either of these names to the New Guinean entity is at present uncertain.

### 9. Stenocarpus verticis Foreman, *Fl. Australia* 16: 498 (1995)

T: Gunn Point, N.T., 2 May 1984, *G.Wightman 1298 & C.R.Dunlop*; holo: DNA; iso: BRI, CANB, DNA, K, MEL.

Illustration: C.R.Dunlop, G.J.Leach & I.D.Cowie, *Fl. Darwin Reg.* 2: 127, fig. 37 (1995), as *S.* 'Top End'.

Tree to 20 m tall. Young growth rusty- or rusty- and grey-sericeous; indumentum often persisting on leaves and branchlets. Leaves: petiole 2–35 mm long; lamina with margins not undulate, discolorous, shiny above, dull below; juvenile leaves pinnately 3–7-lobed, lanceolate or elliptic, 1.8–3 cm wide; adult leaves simple, elliptic, broadly elliptic or broadly lanceolate, 5.5–15 cm long, 1.7–7 cm wide, attenuate at base, obtuse or acute at apex, with 3–5 major longitudinal veins. Conflorescence axillary, borne singly or in dichasial cymes, ferruginous or grey-tomentose; peduncle 12–27 mm long; umbel of 40–50 flowers. Flowers 7–9 mm long, cream, ferruginous or grey-tomentose; pedicel 5–12 mm long. Hypogynous gland well-developed, covering most of receptacle, oblique, horse-shoe shaped. Follicles linear, 3–8 cm long, woody. Seeds not seen.

Distributed from Melville Island to Gove Peninsula, N.T. Occurs in monsoon thicket usually in laterite or on sandstone. Flowers Mar.–May. Map 420.

N.T.: Deaf Adder Gorge, *C.R.Dunlop 5458* (AD, BRI, CANB, DNA, MEL, NSW, PERTH); Nabarlek, *R.Hinz 663* (DNA); Brogden Point, *C.R.Dunlop 6274* (CANB, DNA, K, MEL, NSW); 8 km NNE of Mt Evelyn, Kakadu Natl Park, *K.A.Menkhorst 313* (DNA, MEL); Bowen Strait, Cobourg Penin., *C.R.Dunlop 7042 & P.F.Munns* (DNA, MEL, NSW).

This is *Stenocarpus* 'Top End' *sensu* C.R.Dunlop, G.J.Leach & I.D.Cowie, *Fl. Darwin Reg.* The species is similar in adult foliage to *Stenocarpus salignus* of Qld and N.S.W., but, unlike in *S. verticis*, the juvenile foliage of *S. salignus* is similar to the adult foliage.

## Excluded name

*Stenocarpus milnei* Hook., *Hooker's J. Bot. Kew Gard. Misc.* 6: 359 (1854)

T: near the summit of the main peak of the Isle of Pines, *W.Milne 118*.

The Isle of Pines of the type locality refers to an islet just off the coast of New Caledonia, not Norfolk Island as mistakenly believed by some authors.

## Subtrib. 2. BUCKINGHAMIINAE

*Proteaceae* subtrib. *Buckinghamiinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 173 (1975).

Type: *Buckinghamia* F.Muell.

Conflorescence ±racemose, simple or branched. Flowers zygomorphic, with anteroposterior orientation. Ovules 4–many. Seeds 4–many, simply winged.

A subtribe of 2 genera, both endemic in north-eastern Qld rainforests.

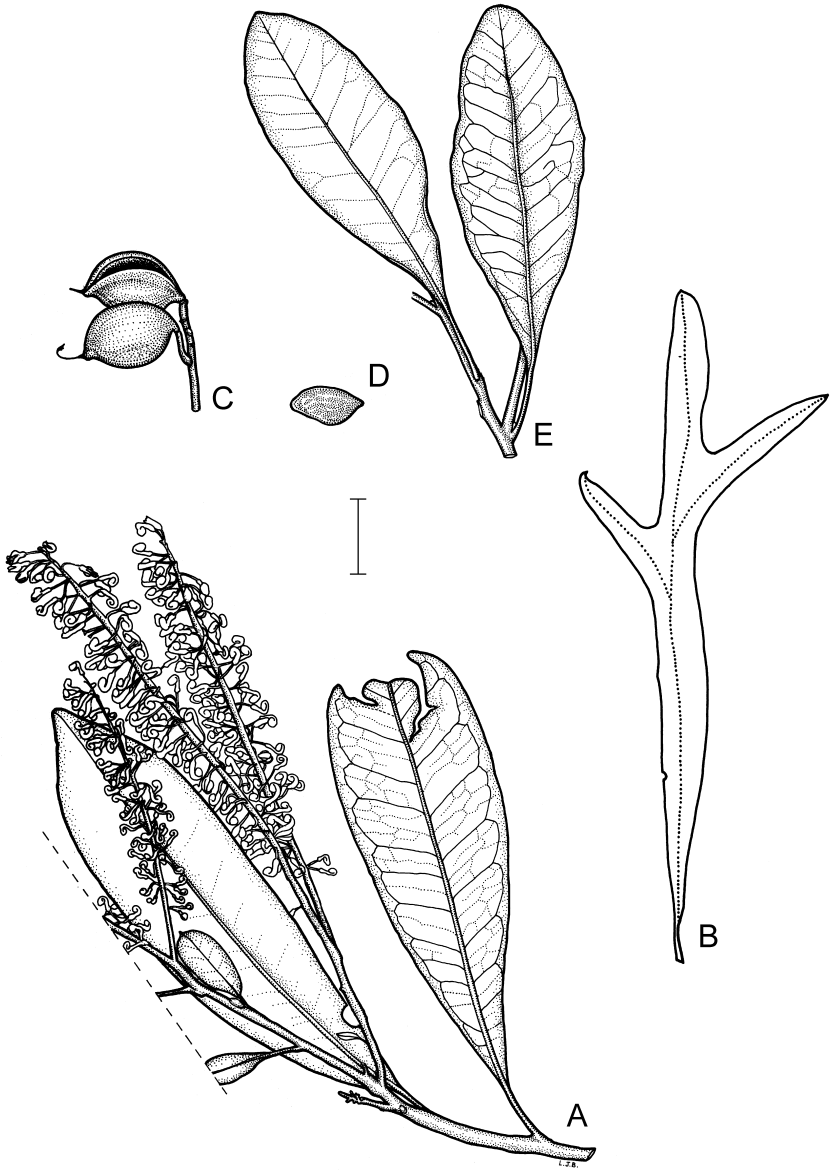



**Figure 167**. *Buckinghamia*. **A–D**, *B. ferruginiflora*. **A**, flowering branchlet (G.Sankowsky 411, QRS); **B**, coppice leaf (B.Hyland 7035, QRS); **C**, follicles; **D**, seed (**C–D**, B.Hyland 6614, QRS). **E**, *B. celsissima*, branchlet (B.Hyland 12526, QRS). Scale bar = 2 cm. Drawn by L.Button.

# 25. BUCKINGHAMIA

*D.B.Foreman & B.P.M.Hyland*

*Buckinghamia* F.Muell., *Fragm.* 6: 248 (1868); named after the Third Duke of Buckingham and Chandos, Richard Grenville (1823–1889), Secretary of State for the Colonies (1866–1868).

Type: *B. celsissima* F.Muell.

Trees to 30 m tall. Branchlets terete. Leaves simple, spiral; margins entire or sometimes lobed on coppice shoots or juvenile plants. Conflorescence terminal or axillary, raceme-like or paniculate; involucral bracts caducous; floral bracts absent. Flowers zygomorphic, bisexual, strongly perfumed. Receptacle straight. Perianth recurved; tepals separating at anthesis. Stamens 4, adnate to perianth; connective short. Hypogynous glands fused into a horseshoe-shaped structure, anterior. Ovary stipitate, glabrous; suture opposite anterior tepal; locule 1; style slender, recurved; pollen presenter a broad, oblique disk; stigma small, ±central; ovules 4. Follicles bilaterally symmetrical, broadly ovate, ±striate, dehiscing along upper suture, 20–30 mm long, 15–20 mm wide. Seeds flat, ±rhomboid, with a narrow marginal wing. *n* = 11, L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 99 (1975).

An endemic genus with 2 species; confined to small areas of north-eastern Qld.

*Buckinghamia* is characterised by a combination of several characters, including its irregular flowers which arise directly from the rachis, and its flattened, winged seeds.

W.D.Francis, *Austral. Rain-forest Trees*, 4th edn, 394 (1982); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 124–125 (1989).

Conflorescence, including outer surface of tepals, densely ferruginous-pubescent; conflorescence lax; style 7–8 mm long **1. B. ferruginiflora**

Conflorescence, including outer surface of tepals, grey- to brown-puberulous; conflorescence dense; style 15–20 mm long **2. B. celsissima**

## 1. Buckinghamia ferruginiflora Foreman & B.Hyland, *Muelleria* 6: 417, 419 (1988)

T: Portion 62, Parish of Alexandra (Noah Creek), Qld, 16°10'S, 145°10'E, 13 July 1972, *B.P.M.Hyland 6245*; holo: QRS; iso: BRI, NSW.

Illustration: D.B.Foreman & B.P.M.Hyland, *op. cit.* 418, fig. 1.

Branchlets ferruginous-pubescent, glabrescent. Leaves: petiole 10–25 mm long; lamina elliptic-oblong, 9–20 cm long, 2–6 cm wide, shiny green beneath, acuminate, acute or ±obtuse. Conflorescence open, 8–20 cm long, densely ferruginous-pubescent. Flowers creamy brown. Tepals c. 10 mm long, densely ferruginous-pubescent on outer surface, glabrous inside. Pedicels 4–6 mm long. Style c. 7–8 mm long. Seeds dappled cream and brown. Fig. 167A–D.

Restricted to rainforest and gallery forest around Noah Creek in north-eastern Qld, at altitudes up to 350 m. Flowers June–Nov. Map 421.

Qld: Noah Ck, *B.Gray 1088* (MEL, QRS); National Park Reserve 164, *B.Gray 4164* (MEL, QRS); Roaring Meg Ck, *G.Sankowsky 411* (QRS).

Apart from the obvious differences in indumentum, *B. ferruginiflora* is distinguished from *B. celsissima* by its slightly larger fruits.

## 2. Buckinghamia celsissima F.Muell., *Fragm.* 6: 248 (1868)

T: Six Mile Creek, Qld, 11 Jan. 1865, *J.Dallachy s.n.*; lecto: MEL 1538566, *fide* D.B.Foreman, *Fl. Australia* 16: 498 (1995); Rockingham Bay; syn: MEL.

Illustrations: K.A.W.Williams, *Native Pl. Queensland* 3rd edn, 1: 43 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 124 (1989).


**Figure 168**. *Opisthiolepis heterophylla*. **A**, flowering branchlet (L.Smith & L.Webb 4853, BRI); **B**, pinnate leaf (Malanda, Qld, C.White, BRI); **C**, flower (based on L.Smith, Proc. Roy. Soc. Queensland 62: pl. 4, fig. 4, 1952); **D**, fruit (Gadgarra, Qld, Anon, BRI); **E**, seed (G.Stocker 1519, QRS). Scale bars: **A**, **D**, **E** = 2 cm; **B** = 4 cm; **C** = 2 mm. Drawn by L.Button.

Branchlets grey- to brown-puberulous, glabrescent. Leaves: petiole 10–20 mm long; lamina elliptic, 8–16 cm long, 3–7 cm wide, ±glaucous beneath, acute to obtuse. Conflorescence dense, 10–27 cm long, grey- to brown-puberulous. Flowers cream. Tepals 7–10 mm long, grey- to brown-puberulous on outer surface, glabrous inside. Pedicels 6–8 mm long. Style 15–20 mm long. Seeds brown, with cream markings. *Ivory Curl Flower*, *Ivory Curl*, *Spotted Silky Oak*. *Figs* 132, 167E.

Common in rainforest, and sometimes in drier areas in the Atherton Tableland, north-eastern Qld; scattered from the Mt Finnigan area in the north to the Paluma Range in the south; grows in deep, red, well-drained volcanic soils. Flowers Jan.–Apr. Map 422.

Qld: Dotswood Holding, Paluma Ra., *B.P.M.Hyland 7281* (QRS); Timber Reserve 176, Monkhouse, Lorna Doone Logging Area, *B.P.M.Hyland 12594* (QRS); Python Logging Area, *A.Irvine 524* (QRS); Black Gin Ck, Font Hills, 17 Dec. 1984, *G.Sankowsky* (QRS).

*Buckinghamia celsissima* has been used as a commercial timber tree, and has recently been widely planted in streets, parks and gardens. Leaf form is variable.

## 26. OPISTHIOLEPIS

*D.B.Foreman*

*Opisthiolepis* L.S.Sm., *Proc. Roy. Soc. Queensland* 62: 79 (1952); from the Greek *opisthios* (to hinder) and *lepis* (a scale), referring to the apparently solitary, adaxial hypogynous gland.

Type: *O. heterophylla* L.S.Sm.

Trees. Bark pale brown, with fine longitudinal lines of lenticels. Leaves alternate, dimorphic; margins entire or sparsely dentate. Conflorescence spike-like, axillary, simple or branched, solitary or 2 or 3 together, laxly flowered, ferruginous-tomentose; subtending bract oblong, obtuse or emarginate, caducous; floral bracts absent. Flowers zygomorphic, bisexual; receptacle straight. Tepals unequal in length, incurved, shedding soon after anthesis. Stamens 4, small, almost sessile. Hypogynous glands 2, fused, forked, adaxial. Ovary shortly stipitate; locule 1; ovules 10–12, in 2 overlapping rows; pollen presenter disc-like; stigma small, terminal. Fruit a follicle, flattened laterally. Seeds flattened, winged on three sides. $n$ = 11, L.A.S.Johnson & B.G.Briggs, *Austral. J. Bot.* 11: 24 (1963).

An endemic, monospecific genus confined to north-eastern Qld, sometimes reaching a size useful for timber.

L.S.Smith, *Opisthiolepis*, a new genus of Proteaceae from Queensland, *Proc. Roy. Soc. Queensland* 62: 79–81 (1952); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 465–466 (1989).

### **Opisthiolepis heterophylla** L.S.Sm., *Proc. Roy. Soc. Queensland* 62: 79 (1952)

T: Atherton, Qld, Feb. 1950, *A.G.Hanson 21/1*; holo: BRI; iso: BRI.

Illustrations: L.S.Smith, *op. cit.* 82, t. 4; J.W.Wrigley & M.Fagg, *op. cit.* 465.

Tree to 30 m tall. Branchlets ±terete, with appressed, ferruginous tomentum. Simple leaves elliptic to oblong-elliptic; petiole 12–50 mm long; lamina 6–20 cm long, 2–8 cm wide, with appressed, shiny, ferruginous tomentum beneath, becoming silvery; base attenuate to cuneate; tips usually acute; lateral veins 10–18 pairs. Imparipinnate leaves to 60 cm long; petiole 4.5–9 cm long. Leaflets 5–18; petiolules to 8 mm long; lamina lanceolate or oblong-lanceolate, sometimes unequal, 4.5–23 cm long, 2–5.5 cm wide; base oblique to unequal; venation and indumentum as for simple leaves. Conflorescence 3–15 cm long. Flowers almost sessile, glabrous; tepals 1.7–5 mm long. Fruit 5–6 cm long; pericarp coriaceous to slightly woody. *Blush Silky Oak*. *Figs* 131, 168.

Rather common on the Atherton Tableland, Qld, from near Cardwell in the south to near Mossman in the north; occurs in rainforest at altitudes to 780 m. Map 423.

Qld: Copperlode Falls Dam area, Cairns, *W.R.Birch 47* (BRI); Davis Creek forestry area, near Mareeba, *L.A.S.Johnson* (NSW 151314); State Forest Reserve 756, West Downey Logging Area, *T.S.Risley 25* (BRI, QRS); Lacey Ck, Mission Beach area, *L.S.Smith & L.J.Webb 4853* (BRI); State Forest Reserve 755, North Johnstone Logging Area, *G.C.Stocker 1519* (BRI, QRS).

## Subtrib. 3. LOMATIINAE

*Proteaceae* subtrib. *Lomatiinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc*. 70: 173 (1975).

Type: *Lomatia* R.Br.

Conflorescence pseudo-racemose. Flowers strongly zygomorphic, white to cream, with diagonal orientation in divergent pairs. Ovules many. Seeds many, winged, with raphe running around margin of wing.

A monogeneric subtribe from eastern Australia and South America.

## 27. LOMATIA

*A.J.G.Wilson, Helen J.Hewson & J.Mowatt*

*Lomatia* R.Br., *Trans. Linn. Soc. London* 10: 199 (1810), *nom. cons.*; from the Greek *loma* (a fringe or border), in reference to the raphe forming a border around the seed wing.

Type: *L. silaifolia* (Sm.) R.Br., *typ. cons.*

*Tricondylus* Salisb. ex Knight, *Cult. Prot*. 121 (1809), *nom. rej.* T: not designated.

Trees or shrubs; young growth rusty-tomentose. Leaves alternate, simple or compound, entire or divided, sometimes heteromorphic. Conflorescences axillary or terminal, pseudo-racemose, laterally bearing flower pairs, basitonic or acrotonic, solitary or aggregated. Flowers usually fragrant, bisexual; bracts small, caducous or absent. Perianth zygomorphic, slit on lower side in bud; limb globular, recurved in bud; segments eventually separating. Anthers sessile. Hypogynous glands 3. Style long, bent at 90° to ovary; pollen-presenter a flat, oblique disc. Ovary on a long gynophore, glabrous; ovules many in 2 rows, imbricate upwards. Fruit an ovoid follicle with persistent style, coriaceous, opening flat. Seeds ±triangular, flat, covered with greenish yellow granular material, with a translucent wing, surrounded by marginal raphe.

A genus of 12 species; 3 endemic in South America and 9 endemic in eastern Australia from northern Qld to Tas.

S.F.L.Endlicher (*Gen. Pl*. 342, 1837) divided the genus into 2 sections, of which only *Eulomatia* occurs in Australia. Several species form polymorphic complexes and hybrid swarms. *Lomatia tinctoria* was used as a dye and *L. silaifolia* leaves are used in flower arrangements. The arrangement of species in this treatment is based on that of P.H.Weston & M.D.Crisp (see below).

J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 447–452 (1989); P.H.Weston & M.D.Crisp, Cladistic biogeography of waratahs (Proteaceae: Embothrieae) and their allies across the Pacific, *Austral. Syst. Bot*. 7: 225–249 (1994).

**1** Leaves simple

**2** Leaves densely pubescent below

**3** Leaves entire, rarely lobed or toothed at apex, usually linear to narrowly ovate, elliptic or obovate, 2–8 cm long [Tas.] **7. L. polymorpha**

**3:** Leaves shallowly to deeply toothed, sometimes entire, lobed or pinnatisect, usually narrowly elliptic to elliptic, (4–) 6.5–15 (–18) cm long [Qld & N.S.W.] **2. L. fraseri**

**2:** Leaves glabrous, sparsely hairy or with hairs on midrib only

**4** Conflorescence terminal, exceeding leaves; leaves holly-like with prominent raised venation on upper surface **5. L. ilicifolia**

**4:** Conflorescence usually upper axillary, not exceeding leaves; leaves not holly-like, with venation conspicuous or inconspicuous, but not raised

**5** Leaves narrowly to broadly ovate, elliptic or obovate, with venation conspicuous [southern Qld to New England, N.S.W.] **1. L. arborescens**

**5:** Leaves usually linear, sometimes narrowly elliptic or oblong, with venation inconspicuous [Sydney and southwards in N.S.W., A.C.T. and eastern Vic.] **3. L. myricoides**

**1:** Leaves compound

**6** Leaves pinnatisect to 3-pinnatisect

**7** Leaves glabrous; gynophore 4–5 mm long; follicle 1–3 cm long; flowering not dependent on fire [Tas.] **8. L. tinctoria**

**7:** Leaves glabrous to densely hairy on lower surface; gynophore (6–) 7–10 mm long; follicle 2.5–4 cm long; flowers in the season after a fire [Blackdown Tableland, Qld, to south of Sydney, N.S.W.] **6. L. silaifolia**

**6:** Leaves mostly pinnate or bipinnate, sometimes pinnatisect towards apex

**8** Flowers red; spindly shrub or tree to 5 m tall [Tas.] **9. L. tasmanica**

**8:** Flowers white or cream, sometimes tinged red

**9** Tall shrub or tree to 24 m tall; follicle 5–8 cm long [northern Qld] **4. L. fraxinifolia**

**9:** Shrub to 2 m tall

**10** Leaves glabrous to densely hairy on lower surface; gynophore (6–) 7–10 mm long; follicle 2.5–4 cm long; flowers in the season after a fire [Blackdown Tableland, Qld, to south of Sydney, N.S.W.] **6. L. silaifolia**

**10:** Leaves glabrous; gynophore 4–5 mm long; follicle 1–3 cm long; flowering not fire-dependent [Tas.] **8. L. tinctoria**

## 1. Lomatia arborescens L.R.Fraser & Vickery, *Proc. Linn. Soc. New South Wales* ser. 2, 62: 286, fig. 1 (1937)

T: Williams River, N.S.W., 12 Jan. 1934, *L.Fraser & J.Vickery*; holo: NSW.

[*Lomatia ilicifolia auct. non* R.Br.: F.M.Bailey, *Queensland Fl.* 4: 1357 (1901)]

Illustrations: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 455 (1989); G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: pl. 2 opp. 11, 29 (1991).

Shrub or tree to 12 m tall. Leaves simple, entire to serrate or dentate; petiole to 2.5 cm long; lamina narrowly to broadly ovate, elliptic or obovate, 4–12 cm long, (0.9–) 1.5–3.5 (–6) cm wide, broadly cuneate to attenuate at base, acute to obtuse or rounded at apex, discolorous, glossy above, glabrous; venation conspicuous. Conflorescence in upper axils, solitary or aggregated, to c. 8 cm long, not exceeding leaves; peduncle and pedicel with scattered to dense ferruginous hairs; pedicel c. 5–7 mm long. Perianth 7–10 mm long, white or cream, usually with appressed hairs externally. Gynophore c. 4 mm long. Style c. 4 mm long. Follicle to 4 cm long, dark brown to black. Seeds c. 5 mm long; wing 8–24 mm long. *Tree Lomatia*. Fig. 135.

Occurs from the McPherson Range in south-eastern Qld to the New England area of N.S.W.; in rainforest, and also in more exposed areas at higher altitudes. Flowers Dec.–Feb. (–May); fruits about 3 months later. Map 424.

Qld: c. 1 km N of repeater Station, Springbrook, *W.J.F.McDonald 1425 & W.G.Whiteman* (BRI); Mt Cordeaux, *G.P.Guymer 1665 & L.W.Jessup* (BRI, CANB). N.S.W.: 55 km from Gloucester on road to

Scone, Barrington Tops Natl Park, *P.Hind 5304 & G.D'Aubert* (BRI, CBG, NSW); Ellenborough Falls, Bulgar Plateau, *I.R.Telford 1071* (CBG, MEL).

Specimens from New England with small ovate leaves, referred to *L. ilicifolia* by G.Bentham in *Fl. Austral*. 5: 538 (1870), are in fact *L. arborescens*.

## 2. Lomatia fraseri R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 34 (1830)

*Tricondylus fraseri* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 582 (1891). T: near Port Jackson, N.S.W., 1818, *C.Fraser*; holo: BM? *n.v.*

*Lomatia fraseri* var. *pinnatipartita* F.Muell., *Fragm.* 5: 153 (1866). T: Guy Fox [Guy Fawkes] Waters, N.S.W., *Beckler*; syn: MEL? *n.v.*; Annes River, N.S.W., *Beckler*; syn: MEL? *n.v.*

*Lomatia fraseri* var. *velutina* F.Muell., *Fragm.* 5: 153 (1866). T: Bellinger River, N.S.W., *C.Moore*; syn: MEL? *n.v.*; Clarence River, N.S.W., *C.Moore*; syn: MEL? *n.v.*

Illustrations: N.C.W.Beadle, *Students Fl. NE New South Wales* 2: 240, fig. 111A (1972); G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: pl. 2 opp. 11, 29 (1991); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 455 (1989).

Shrub or small tree to 8 (–11) m tall. Leaves simple and shallowly to deeply toothed, sometimes entire, lobed or pinnatisect; petiole to 2 cm long; lamina usually narrowly elliptic to elliptic, sometimes ovate or obovate, (4–) 6.5–15 (–18) cm long, (1–) 1.5–3 (–5) cm wide, cuneate to ±attenuate at base, obtuse to acute at apex, glabrous to sparsely hairy above, densely pale to ferruginous silky tomentose below; venation more prominent below. Conflorescence axillary, solitary or aggregated, to 12 (–15) cm long, not exceeding leaves; peduncle and pedicel with dense appressed, sometimes ferruginous hairs; pedicel 5–10 mm long. Perianth 7–9 mm long, white to cream, densely externally pubescent (sometimes hairs ferruginous). Gynophore 4–7 mm long. Style 4–6 mm long. Follicle 15–30 mm long, grey-black. Seeds c. 4 mm long; wing 9–11 mm long. *Tree Lomatia*, *Forest Lomatia*, *Silky Lomatia*.

A disjunct distribution. Occurs in the New England area of N.S.W., and from the Budawang National Park, N.S.W., to the Otway Ranges in Vic.; in tableland and montane areas. Flowers Dec.–Feb.; fruits Apr.–Oct. Map 425.

N.S.W.: Pikes Saddle, Deua Natl Park, *P.Ollerenshaw 1791* (CBG, NSW); c. 5 km along Point Lookout road from Armidale–Dorrigo road, *A.Richards 234* (CBG); 1 km NE of Woolpack Rocks, Cathedral Rocks Natl Park, *I.R.Telford 10774* (BISH, CBG, MEL). Vic.: c. 8 km S of Harrietville on Alpine Hwy, *L.A.Craven 1556* (CANB, K, MEL, NSW); Macleod Rd, 2 km N from Reservoir Rd, Buffalo Plateau, *N.G.Walsh 766* (CBG, MEL).

This species hybridises with *L. silaifolia* in the northern part of its range in the New England area, producing plants with leaves densely hairy on the underside and ranging from narrowly elliptic to deeply lobed to bipinnatisect, sometimes all on the same plant. It may also hybridise with *L. myricoides* where they co-occur, producing plants with leaves less densely hairy than those of *L. fraseri*, and with *L. ilicifolia*, producing plants with leaves variably hairy and variably prickly. Bentham (1870) considered *L. fraseri* synonymous with *L. ilicifolia*.

## 3. Lomatia myricoides (C.F.Gaertn.) Domin, *Biblioth. Bot.* 89: 596 (1921)

*Embothrium myricoides* C.F.Gaertn., *Suppl. Carp.* 2: 215, t. 218 (1807); *Lomatia longifolia* R.Br., *Prodr.* 390 (1810), *nom. illeg.*; *Embothrium longifolium* (R.Br.) Poir. *in* J.B.A.P. de M. de Lamarck, *Encycl. Suppl.* 2: 551 (1812), *nom. illeg.*; *Tricondylus myricoides* (C.F.Gaertn.) Kuntze, *Revis. Gen. Pl.* 2: 582 (1891). T: North Rocks, Parramatta, N.S.W., *R.Brown Iter Australiense (Britten 3428)*; syn: BM, K.

*Tricondylus myricifolius* Salisb. ex Knight, *Cult. Prot.* 122 (1809), as *myricaefolius*. T: not designated.

*Lomatia longifolia* var. *reticulata* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 448 (1856), as α *reticulata*. T: Port Jackson [N.S.W.], *R.Brown s.n.*; syn: G-DC, photo seen; *sine loc.*, *Phillip*; syn: *n.v.*

*Lomatia longifolia* var. *subevenia* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 448 (1856), as β *subevenia*. T: *sine loc.*, *Sieber 16*; holo: G-DC, photo seen.

*Lomatia longifolia* var. *arborescens* Benth., *Fl. Austral.* 5: 537 (1870). T: Sydney woods [N.S.W.], Paris Exhibition, 1855, *Mr Arthur n. 219*; holo: ?BM *n.v.*

*Lomatia arguta* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: Mt Wilson, N.S.W., Dec. 1898, *Gregson*, holo: LY *n.v.*, photo NSW; ?iso: NSW.

*Lomatia densa* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: Delegate Mtn, N.S.W., *W.Bäuerlen*; holo: LY *n.v.*, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 346 (1973).

*Lomatia fallacina* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: Victoria, 1902, *C.Walter*; holo: LY *n.v.*, photo NSW.

*Lomatia praelonga* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: East Gippsland, Vic., *C.Walter*; holo: LY *n.v.*, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 346 (1973).

*Lomatia stenophylla* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: East Gippsland, Vic., *Pescott*; holo: LY *n.v.*, photo NSW.

Illustrations: N.T.Burbidge & M.Gray, *Fl. Austral. Cap. Terr.* 149, fig. 126 (1976); A.Fairley & P.Moore, *Native Pl. Sydney Distr.* pl. 539 (1989).

Shrub or small tree to 6 (–8) m tall. Leaves simple, entire to coarsely serrate or dentate, very rarely irregularly lobed towards base, sessile or subsessile; lamina usually linear, sometimes narrowly ovate, elliptic or oblong, 5–16 (–20) cm long, 0.3–1.5 (–2.5) cm wide, attenuate at base, acute to acuminate at apex, glabrous or rarely with sparse hairs below; venation inconspicuous above. Conflorescence solitary in upper axils, rarely appearing terminal, ±equal to leaves; peduncle and pedicel usually ±glabrous, rarely sparsely to densely ferruginous-hairy; pedicel to 10 mm long. Perianth 6–8 mm long, white, cream or green-yellow, with appressed hairs. Gynophore 4–5 mm long. Style c. 4 mm long. Follicle (2–) 2.5–3.5 (–4) cm long, dark grey-brown. Seeds c. 5 mm long; wing to 13 mm long. *Mountain Beech, River Lomatia, Long-leaf Lomatia*. Fig. 134.

In montane areas below c. 1000 m, and along waterways, from north of Sydney, N.S.W., to the Dandenong Ranges in Vic. Flowers Dec.–Feb.; fruits Mar.–July (–Oct.). Map 426.

N.S.W.: Bridle Track crossing of upper Wog Wog Ck, 1.7 km SE of Wog Wog HS, *J.D.Briggs 1466* (AD, CBG, MEL); Mongarlowe R. valley, c. 0.5 km NW of Half Moon Flat, *M.D.Crisp 7928* (CBG, NSW). A.C.T.: S of Bulls Head, Brindabella Ra., *L.G.Adams 2044* (CANB, K, L, MEL, NSW, US). Vic.: c. 45 km from Corryong towards Omeo, *E.M.Canning 1427* (CBG).

This species hybridises with *L. ilicifolia* and *L. fraseri* where their distributions overlap, producing plants with rather broader leaves and variably prickly (with *L. ilicifolia*) or hairy (*L. fraseri*). Plants with sparsely and irregularly lobed leaves in the northern part of the species range may represent hybrids with *L. silaifolia*.

### 4. **Lomatia fraxinifolia** F.Muell. ex Benth., *Fl. Austral.* 5: 536 (1870)

T: Rockingham Bay, Qld, 1870, *J.Dallachy*; holo: K.

Shrub or tree to 24 m tall, glabrescent. Juvenile leaves simple. Mature leaves to 65 cm long including petiole, usually pinnate with (2–) 3–10 (–13) pinnae, rarely pinnae irregularly divided; petiolule to 1 cm long; pinnae narrowly ovate to elliptic or obovate, (3–) 5–10 (–12) cm long, (1.5–) 2–3.5 cm wide, coarsely irregularly dentate or serrate, cuneate to oblique at base, obtuse to bluntly acuminate at apex, ±glabrous; venation not markedly conspicuous. Conflorescence terminal, solitary or aggregated, to 30 cm long, exceeding leaves, with ferruginous hairs; pedicel to 1 cm long. Perianth 10–12 mm long, cream or white, with sparse to dense, appressed, ±ferruginous hairs externally. Gynophore 8–10 mm long. Style 6–7 mm long. Follicle 5–8 cm long, leathery, dark brown to black. Seeds c. 5 mm long; wing 15–20 mm long. *Lomatia Silky Oak, Black-leaved Silky Oak*. Fig. 133.

Occurs at higher altitudes in rainforest from inland of Cooktown to the Cardwell Range, north-eastern Qld. Flowers Jan.–Mar.; fruits July–Oct. Map 427.

Qld: Atherton, *A.K.Irvine 1228* (BRI); Malanda, Jan. 1923, *C.T.White s.n.* (BRI, K); road between L. Eacham–Gadgarra, *C.T.White 1581* (BRI, CANB, K, MO).

The common name Black-leaved Silky Oak refers to the fact that the leaves apparently blacken on herbarium specimens.

## 5. **Lomatia ilicifolia** R.Br., *Trans. Linn. Soc. London* 10: 200 (1810)

*Embothrium ilicifolium* (R.Br.) Poir. *in* J.B.A.P. de M. de Lamarck, *Encycl. Suppl.* 2: 551 (1812); *Tricondylus ilicifolius* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 582 (1891), as *ilicifolia*. T: Arthurs Seat [Vic.], 24 Jan. 1804, *R.Brown Iter Australiense (Britten 3429)*; holo: BM; iso: K, ?NSW.

*Lomatia ilicifolia* var. *axillaris* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 32 (1830), as γ *axillaris*. T: Wilson's Promontory [Vic.], *W.Baxter*; holo: ?BM.

*Lomatia ilicifolia* var. *glabrata* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 33 (1830), as *β glabrata*. T: Port Jackson, N.S.W., *coll. unknown*; *n.v.*

*Lomatia ilicifolia* var. *ovata* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 33 (1830), as α *ovata*. T: Port Phillip, 'N.S.W.' [Melbourne, Vic.], 1802, *R.Brown s.n.*; syn: BM?; Twofold Bay, N.S.W., 1818, *A.Cunningham*; syn: BM?

*Lomatia ilicifolia* var. *pinnatifida* Hook., *Bot. Mag.* 69: t. 4023 (1843). T: cult. Kew; *n.v.*

*Lomatia ilicifolia* var. *hyposericea* F.Muell., *Fragm.* 5: 153 (1866). T: Twofold Bay, N.S.W., *coll. unknown*; *n.v.*

*Lomatia ilicifolia* var. *integrifolia* F.Muell., *Fragm.* 5: 153 (1866), *nom. nud.*

*Lomatia ilicifolia* var. *pinnatisecta* F.Muell., *Fragm.* 5: 153 (1866), *nom. nud.*

Illustration: A.Fairley & P.Moore, *Native Pl. Sydney Distr.* pl. 540 (1989).

Shrub to 3 m tall, flowering seasonal shoots arising directly from lignotuber, glabrescent. Leaves simple, entire to coarsely pungent-serrate or -dentate; petiole to 1.5 cm long; lamina ovate to elliptic, sometimes narrowly so, 10–18 cm long, 2.5–5.5 cm wide, cuneate to attenuate at base, rounded to acuminate at apex, pungent, glabrous except for ferruginous hairs on midrib below; venation conspicuous and raised above. Conflorescence terminal, solitary or aggregated, to 20 cm long, usually greatly exceeding leaves; peduncle and pedicel glabrous to densely ferruginous-hairy; pedicel 8–11 (–13) mm long. Perianth 8–10 mm long, white or cream to yellow, glabrous or ferruginous-hairy externally. Gynophore 8–11 (–13) mm long. Style 4–5 (–6) mm long. Follicle 2.5–4 cm long, dark brown-grey. Seeds c. 5 mm long; wing to 18 mm long. *Holly Lomatia*, *Native Holly*.

Occurs from mid-coastal N.S.W. west to the Otway Range in southern Vic.; grows in lowland and montane areas. Flowers Dec.–Mar.; fruits about 3 months later. Map 428.

N.S.W.: Clyde Mtn, 20 Mar. 1951, *E.Gauba* (CBG); Australian Natl Bot. Gard. Annexe, Jervis Bay, *R.J.Rudd 162* (CBG, NSW). Vic.: 1.5 km SW of summit, Mt Elizabeth, *F.E.Davies 655 et al.* (CBG); Labertouche, *C.T.White 12924* (BRI).

This is a distinctive species with its prickly leaves. It flowers after fire, when conflorescences are borne at the apex of new shoots arising from the lignotuber. Occasional conflorescences are produced in other years. The large number of subspecific names applied to this species probably refer to intermediate hybrid forms between *L. ilicifolia* and *L. myricoides* or *L. fraseri*.

## 6. **Lomatia silaifolia** (Sm.) R.Br., *Trans. Linn. Soc. London* 10: 199 (1810)

*Embothrium silaifolium* Sm., *Spec. Bot. New Holland* 2: 23, t. 8 (1793); *Grevillea silaifolia* Donn, *Hortus Cantabrig.* 4th edn, 26 (1807), as *silauifolia*; *Tricondylus silaifolius* (Sm.) Salisb. ex Knight, *Cult. Prot.* 122 (1809); *Embothrium crithmifolium* Sm. ex Steud., *Nomencl. Bot.* 2nd edn, 1: 552 (1840), *nom. inval.*; *Lomatia silaifolia* var. *typica* Domin, *Biblioth. Bot.* 89: 41 (1921), *nom. illeg.* T: probably collected near Sydney, N.S.W., cultivated at Kensington, England, *Grimwood*; holo: LINN.

*Embothrium herbaceum* Cav., *Icon.* 4: 58, t. 384 (1798). T: Port Jackson, N.S.W.; *n.v.*

*Lomatia silaifolia* var. *angustifolia* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 33: (1830), as *α angustifolia*; *L. silaifolia* f. *angustifolia* (R.Br.) Domin, *Biblioth. Bot.* 89: 41 (1921). T: Port Jackson, N.S.W., *coll. unknown*; holo: ?BM.

*Lomatia silaifolia* var. *divaricata* Domin, *Biblioth. Bot.* 89: 42 (1921). T: Jamison Valley, Blue Mtns, N.S.W., *Domin IV, 1910*; syn: PR, photo NSW; Port Jackson District, N.S.W., Nat. Herb. N.S.Wal., leg.? XII, 1897, syn: ?NSW.

*Lomatia silaifolia* var. *induta* F.Muell. ex Benth., *Fl. Austral.* 5: 537 (1870). T: Brisbane River, Moreton Bay, Qld, *L.Leichhardt*, *F.Mueller*; syn: ?BM, ?K.

*Lomatia silaifolia* var. *latifolia* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 33 (1830), as *β latifolia*; *L. silaifolia* f. *latifolia* (R.Br.) Domin, *Biblioth. Bot.* 89: 41 (1921). T: Port Jackson, N.S.W., *coll. unknown*; holo: ?BM.

*Lomatia silaifolia* var. *pinnata* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 33 (1830), as *γ pinnata*; *L. silaifolia* f. *pinnata* (R.Br.) Domin, *Biblioth. Bot.* 89: 42 (1921). T: Moreton Bay [Qld], *C.Fraser*; holo: ?BM.

*Lomatia silaifolia* var. *stenoloba* Domin, *Biblioth. Bot.* 89: 42 (1921). T: Wentworth Falls, Blue Mtns, N.S.W., *Domin IV. 1910*; holo: PR, photo NSW.

Illustrations: K.A.W.Williams, *Native Pl. Queensland* 2nd edn, 1: 179 (1980); T.D.Stanley & E.M.Ross, *Fl. SE Queensland* 2: 18, fig. 2F (1986); G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: pl. 2 opp. 11, 28 (1991).

Shrub to 2 m tall; flowering seasonal shoots arising directly from lignotuber. Leaves usually broadly ovate to obovate in outline, to 30 (–50) cm long including petiole, pinnate or pinnatisect to 3-pinnate or 3-pinnatisect, glabrous to densely ferruginous-hairy on rachis; pinnae or lobes 7–17 (–23), sessile to petiolulate, linear to ovate, to 10 cm long, cuneate to decurrent, entire to deeply toothed with teeth sometimes pungent, glabrous to densely hairy below; venation usually conspicuous. Conflorescence terminal, solitary or aggregated, to 45 cm long, exceeding leaves; peduncle and pedicel usually glabrous, sometimes ferruginous-hairy; pedicel 8–13 mm long. Perianth 8–12 mm long, white or cream, glabrous. Gynophore (6–) 7–10 mm long. Style 4–6 mm long. Follicle 2.5–4 cm long, dark grey-brown. Seeds 4–6 mm long; wing 10–15 mm long. *Crinkle Bush, Fern-leaved Lomatia, Parsley Bush, Wild Parsley.*

This species has a disjunct distribution. Occurs in the Blackdown Tableland, Qld; from Gympie, south-eastern Qld to the New England area, north-eastern N.S.W.; also in central-coastal N.S.W. from the Hunter Valley, to Jervis Bay and inland to the Great Dividing Range. Flowers Nov.–Apr. (–June); fruits about 3 months later. Map 429.

Qld: S of Crows Nest on Toowoomba–Burnett Hwy, 8 Dec. 1965, *B.Lebler* (BRI, CANB); Rainbow Falls, Blackdown Tableland, *I.R.Telford 5683* (CBG). N.S.W.: c. 750 m S of Railway Stn, Valley Heights, *F.E.Davies 373 & T.Mulcahy* (CBG, NSW); c. 29 km NE of Rylstone, *R.Story 6878* (CANB); Whian Whian State Forest, Nov. 1949, *C.T.White* (BISH, BRI, MO, NSW).

This species resembles *L. ilicifolia* in usually flowering after fire, with conflorescences borne at the apex of new shoots arising from the lignotuber. It differs from *L. ilicifolia* in its divided leaves. Numerous subspecific names have been applied in an attempt to make sense of the wide variation in leaf shape of this species. Plants in a single population usually have consistent leaf morphology, but plants in adjacent populations may have very different leaves. This variation does not conform to any recognisable geographical pattern, therefore the use of subspecific names has been avoided in this treatment. Stanley & Ross (*Fl. SE Queensland*, 1986) recognise *L. silaifolia* f. *pinnata* and f. *silaifolia* based on the degree of segmentation of the leaves, and *L. silaifolia* var. *induta* for specimens with leaves pubescent on the lower surface. *Lomatia silaifolia* hybridises with *L. fraseri* and *L. myricoides.* See notes under those species.

### 7. **Lomatia polymorpha** R.Br., *Trans. Linn. Soc. London* 10: 200 (1810)

*Tricondylus polymorphus* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 582 (1891), as *polymorpha*. T: banks of Port de l'Esperance, Tas., 1804, *R.Brown Iter Australiense (Britten 3431)*; syn: BM; Table Mountain, Tas., 1804, *R.Brown Iter Australiense (Britten 2431)*; syn: K.

*Lomatia polymorpha* var. *cinerea* R.Br., *Trans. Linn. Soc. London* 10: 200 (1810), as *α cinerea*. T: not designated.

*Lomatia polymorpha* var. *rufa* R.Br., *Trans. Linn. Soc. London* 10: 200 (1810), as β *rufa*. T: not designated.

Illustration: M.Cameron (ed.), *Guide Fl. & Pl. Tasmania* 37, pl. 54 (1981).

Shrub or small tree to 2.5 (–4) m tall; stems sometimes tomentose. Leaves simple, subsessile or petiole to 0.5 cm; lamina ±linear to narrowly ovate, elliptic or obovate, rarely broader, 2–8 cm long, 2.5–10 mm wide, attenuate, entire, acute to rounded or sometimes 3- or 5-lobed or toothed at apex, mucronate, densely ferruginous-tomentose below; venation inconspicuous

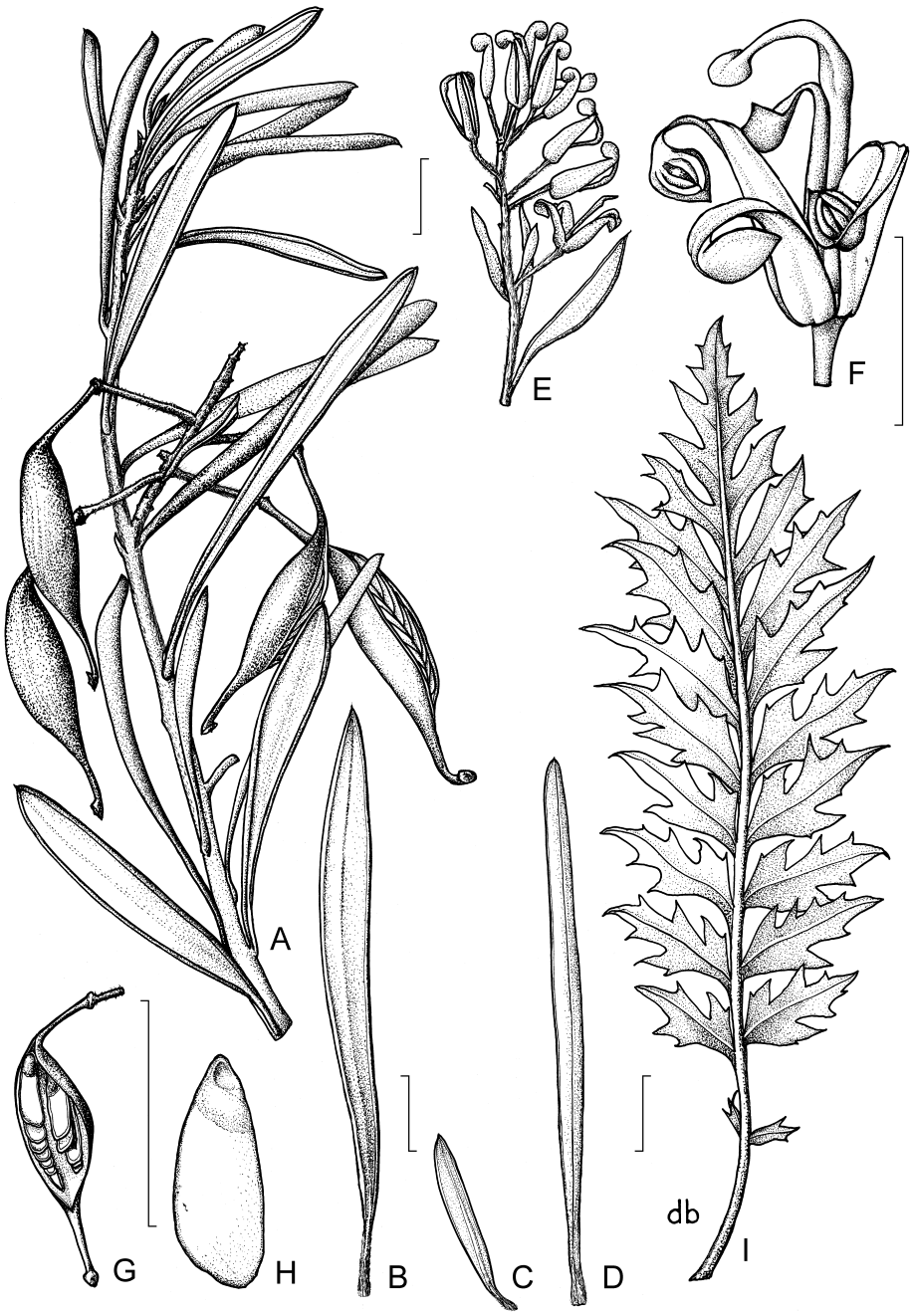



**Figure 169**. *Lomatia*. **A–H**, *L. polymorpha*. **A**, branchlet with open and closed follicles (A.M.Buchanan 3190, HO); **B–D**, leaf variations (**B**, A.M.Buchanan 3135, HO; **C**, J.H.Hemsley 6540, HO; **D**, near Deloraine, Tas., L.Rodway, HO); **E**, conflorescence; **F**, flower (**E–F**, A.M.Buchanan 2296, HO); **G**, open follicle; **H**, seed (**G–H**, A.M.Buchanan 3135, HO). **I**, *L. tasmanica*, leaf (A.Moscal 131, HO). Scale bars: **A–F**, **H**, **I** = 1 cm; **G** = 3 cm. Drawn by D.Boyer.

above. Conflorescence solitary or rarely aggregated, terminal and sometimes axillary, barely exceeding leaves; peduncle and pedicel sparsely to densely ferruginous-hairy; pedicel 6–12 (–15) mm long. Perianth 1–1.5 cm long, white, cream or greenish white, sparsely tomentose. Gynophore 5–7 mm long. Style 3–5 mm long. Follicle 2–3 cm long, dark grey to black, usually glaucous. Seeds 3–4 mm long; wing 6–9 mm long. Fig. 169A–H.

Endemic in Tas. where it occurs approximately south of the Pieman River and west of the Derwent River. Flowers Jan.–Mar.; fruits about 3 months later. Map 430.

Tas.: near Kiosk, L. St Clair, *E.M.Canning 2130* (CBG); Hartz Rd, c. 1 km N of Arve R., Hartz Mountains Natl Park, *F.E.Davies 871 & P.Ollerenshaw* (AD, CBG, HO, MEL); Scotts Dam Rd–Condominium Ck crossing, South West Natl Park, *S.J.Forbes 1247* (CBG, HO, MEL); Rosebery, 23 Jan. 1949, *J.Somerville* (HO).

This species hybridises with *L. tinctoria*, where their ranges overlap, to produce plants with variably divided leaves and conflorescences sometimes exceeding the leaves. Variability in leaf shape has also been recorded for plants in recently severely burnt areas.

### 8. **Lomatia tinctoria** (Labill.) R.Br., *Trans. Linn. Soc. London* 10: 199 (1810)

*Embothrium tinctorium* Labill., *Nov. Holl. Pl.* 1: 31, t. 42, t. 43 (1805); *Tricondylus tinctorius* (Labill.) Salisb. ex Knight, *Cult. Prot.* 122 (1809). T: Tasmania, *J.J.H. de Labillardière*; syn: FI, photo NSW.

Illustrations: W.M.Curtis, *Students Fl. Tasmania* 3: 613, fig. 130 (1967); M.Cameron (ed.), *Guide Fl. & Pl. Tasmania* 81, pl. 188 (1981).

Shrub to 1.5 (–2) m tall, spreading by rhizomes, glabrous or glabrescent. Leaves pinnate or pinnatisect to bipinnate or bipinnatisect, ovate to broadly ovate in outline, to 10 cm long including petiole; primary lobes (3–) 9–17; ultimate lobes usually linear to narrowly oblong, 1–3 (–5) cm long, decurrent, entire, rounded, mucronate, glabrous; venation obscure above. Conflorescences solitary or rarely aggregated, terminal and upper axillary, usually exceeding leaves, glabrous; pedicel 9–15 (–18) mm long. Perianth 7–9 mm long, white or cream, often tinged red, glabrous. Gynophore 4–5 mm long. Style 3–4.5 mm long. Follicle 1–3 cm long, dark grey, sometimes glaucous. Seeds 3–4 mm long; wing 6–9 mm long. *Guitar Plant*.

Endemic in Tas. occurring mostly north and east of the Pieman and Derwent Rivers and on Flinders and Cape Barren Is. Its range is approximately complementary to that of L. polymorpha within Tas. Flowers Nov.–Feb.; fruits about 3 months later. Map 431.

Tas.: Murchison R., c. 7 km ENE of Rosebery, *L.G.Adams & C.J.Adams 3394* (CANB); Patriarchs Wildlife Refuge, Flinders Is., *I.Crawford 1182* (CBG, HO, MEL); c. 1 km SE of Guildford, 1.5 km W of Talbots Lagoon, *F.E.Davies 1137 & P.Ollerenshaw* (AD, CBG, HO, MEL); between Thumb Point and Dolomieu Point, *A.E.Orchard 5049* (CANB, HO).

*Lomatia tinctoria* hybridises with *L. polymorpha*. See notes under that species. Plants on the Tasman Peninsula have more variable leaves, with lobes sometimes dentate.

Labillardière's material of *L. tinctoria* (in FI, photo seen courtesy of P.Weston) is a mixture of *L. tinctoria* and *L. polymorpha* and both currently recognised species are illustrated in the protologue. Brown refers to '*Embothrium* tinctorii var. Labill.' in his description of *L. polymorpha*. A lectotype for *L. tinctoria* preserving current usage needs to be chosen from the material in FI.

### 9. **Lomatia tasmanica** W.M.Curtis, *Students Fl. Tasmania* 3: 651, fig. 131 (1967)

T: Cox's [Cox] Bight, Port Davey, Tas., 11 Feb. 1965, *D.King*; holo: K; iso: HO.

Illustration: W.M.Curtis, *Students Fl. Tasmania* 3: 614, fig. 131 (1967).

Spindly shrub or tree to 5 m tall; upper stems ferruginous-pilose. Leaves pinnate, sometimes pinnatisect towards apex, ovate to obovate in outline, 10–18 cm long including petiole; pinnae (7–) 11–25, sessile, decurrent, oblong or ovate, irregularly toothed, with scattered hairs below, denser on midrib, reticulate-veined above. Conflorescence terminal, solitary, 9–10 cm long, usually exceeding leaves, ±glabrous; pedicel 6–10 mm long. Perianth c. 8 mm long, dull red, glabrous. Gynophore c. 4 mm long. Style c. 2 mm long. Fruit never seen, apparently not set. Fig. 169 I.

Endemic in south-western Tas. Flowers Feb. Map 432.

Tas.: gully between Luttrell & Burke Cks, 21 Apr. 1984, *A.M.Buchanan s.n.* (CANB, HO); Cox Ck, 1.5 km NNE of Point Eric, Cox Bight, *R.Burns 293A* (CBG); SW Cox Bight, 15 Feb. 1965, *C.D.King* (HO); Bathurst Ra., Cox Bight, 10 Jan. 1977, *A.Moscal & A.Strappazon* (K).

This rare species has never been observed to set fruit and the three known populations, found within about 5 km of one another, may represent a single sterile clone.

## Doubtful and excluded names

*Lomatia* sp. aff. *fraxinifolia* and *L. sp. nov.* in J.W.Wrigley and M.Fagg (*Banksias, Waratahs & Grevilleas* 452, 1989) are now considered by J.Tracey (*pers. comm.*) not to represent new taxa but rather juvenile forms of some rainforest proteaceous species.

*Lomatia angustifolia* Schnizl., *Iconogr. Fam. Regn. Veg.* 2: t. 113, figs 57–61 (1843–1870)

T: not designated.

There is no description and the illustration is of the fruit only, which is insufficient for identification. R.Brown (*Suppl. Prodr. Fl. Nov. Holl.* 33, 1830) proposed the infraspecific taxon *L. silaifolia* α *angustifolia*, but there is no indication that Schnizlein was referring to this taxon. G.Bentham (*Fl. Austral.* 5: 537, 1870) lists it doubtfully as a synonym of *L. longifolia* (= *L. myricoides*).

*Lomatia elegantissima* Hend. ex R.Hogg, *Gardeners' Yearbook* 1860: 75 (1860)

See D.J.Mabberley, *Feddes Repert.* 101: 271 (1990), who suggests it may be *L. silaifolia*.

*Lomatia ferruginea* (Cav.) R.Br., *Trans. Linn. Soc. London* 10: 200 (1810)

*Embothrium ferrugineum* Cav., *Icon.* 4: 59, t. 385 (1798); *Tricondylus ferrugineus* (Cav.) Knight, *Cult. Prot.* 123 (1809). T: not designated.

A South American species.

*Lomatia sinuata* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 33 (1830)

*Tricondylus sinuata* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 582 (1891). T: Lachlan River, N.S.W., 1817, *Fraser*; holo: ?BM.

G.Bentham, *Fl. Austral.* 5: 535–538 (1870) and later authors ignore this name. With sinuate-pinnatifid leaves, if it is a *Lomatia* it would most likely be *L. silaifolia* but the locality is somewhat west of the known range of *L. silaifolia* in N.S.W.

## Subtrib. 4. EMBOTHRIINAE

*Proteaceae* subtrib. *Embothriinae* Endl., *Gen. Pl.* 342 (1837).

Type: *Embothrium* J.R.Forst. & G.Forst.

Conflorescence shortly racemose to capitate. Flowers strongly zygomorphic, usually pink to red, with diagonal orientation in parallel pairs. Ovules many. Seeds many, winged, with raphe running through wing.

A subtribe of 4 genera, extending from eastern Australia to New Guinea and South America. In Australia, 2 genera; 1 endemic in eastern Australia, the other extending from north-eastern Qld to New Guinea.

# 28. ALLOXYLON

*M.D.Crisp & P.H.Weston*

*Alloxylon* P.H.Weston & Crisp, *Telopea* 4: 498 (1991); from the Greek *allo* (other) and *xylon* (wood); in reference to the unique wood anatomy of the genus.

Type: *A. flammeum* P.H.Weston & Crisp

Small to tall rainforest trees. Adult leaves simple or pinnate, entire (some pinnatisect in *A. pinnatum*), tapered to petiole; intermediate leaves simple, pinnate or sinuate-lobed to pinnatifid. Conflorescence axillary or terminal, raceme-like to corymb-like, on basitonic or acrotonic seasonal growth units, usually aggregated into distinct panicle-like bunches (except in *A. pinnatum*), without involucral bracts. Flowers strongly zygomorphic, bisexual, weakly incurved in bud, orange-red, crimson or pink; floral orientation diagonal. Receptacle oblique. Tepals coherent in a split tube after anthesis. Hypogynous glands fused, crescentic to horseshoe-shaped. Pollen presenter strongly oblique. Follicle woody, canoe-shaped after dehiscence. Seed wing with raphe on inner side.

Three species endemic in eastern Australia, and 1 endemic in New Guinea. All are spectacular flowering trees (especially *A. flammeum*), suitable for cultivation in warm areas. This genus was formerly included in *Oreocallis* R.Br. which now comprises 2 species in Peru and Ecuador. Weston & Crisp (1987) reported that *Oreocallis s. lat.* was likely to be paraphyletic. Subsequently *Oreocallis s. str.* and *Alloxylon*, well-corroborated monophyletic taxa, were recognised at generic rank. *Alloxylon* is distinguished morphologically from *Oreocallis* by its fleshy cotyledons, woody, canoe-shaped follicle and unique wood anatomy.

F.M.Bailey, *Embothrium*, *Queensland Fl.* 4: 1357–1358 (1901); H.Sleumer, Proteaceae Americanae, *Bot. Jahrb. Syst.* 76: 200–204 (1954); H.Sleumer, Proteaceae, *Fl. Males.* ser. I, 5: 147–203 (1955); P.H.Weston & M.D.Crisp, Evolution and biogeography of the Waratahs, *in* J.A.Armstrong (ed.), *Waratahs – their Biology, Cultivation and Conservation* 17–34 (1987); P.H.Weston & M.D.Crisp, *Alloxylon* (Proteaceae), a new genus from New Guinea and eastern Australia, *Telopea* 4: 497–507 (1991).

**1** Adult leaves mostly pinnate, but usually some simple leaves present below conflorescence; intermediate leaves simple, entire to pinnatisect; leaf(-let) apices attenuate **1. A. pinnatum**

**1:** Adult leaves simple and entire; intermediate leaves simple and entire or pinnatifid; apices obtuse to acute

**2** Perianths, pedicels, conflorescence axes, petiole bases and young branchlets ferruginous-tomentose; flowers bright orange-red; intermediate leaves pinnatifid **2. A. flammeum**

**2:** All parts glabrate; flowers dull pink-red; intermediate leaves entire **3. A. wickhamii**

## 1. Alloxylon pinnatum (Maiden & Betche) P.H.Weston & Crisp, *Telopea* 4: 499 (1991)

*Embothrium wickhamii* var. *pinnatum* Maiden & Betche, *Proc. Linn. Soc. New South Wales* 35: 795 (1911); *Embothrium pinnatum* (Maiden & Betche) C.T.White, *Proc. Roy. Soc. Queensland* 60: 43 (1949); *Oreocallis pinnata* (Maiden & Betche) Sleumer, *Bot. Jahrb. Syst.* 76: 203 (1954). T: Dorrigo, N.S.W., Dec. 1909, *J.L.Boorman*; lecto: NSW, *fide* P.H.Weston & M.D.Crisp, *loc. cit.*; syn: B, BRI, MEL, NSW.

Illustrations: J.H.Maiden, *Forest Fl. New South Wales* 5: t. 167 (1911), as *Embothrium wickhamii* var. *pinnatum*; N.C.W.Beadle, *Students Fl. NE New South Wales* part 2: fig. 109, A1–A2 (1972), as *Oreocallis pinnata*; J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 481 (1989), as *Oreocallis pinnata*.

Trees to 25 m tall, 1.5 m d.b.h., glabrate. Adult leaves mostly pinnate; usually some simple leaves present immediately below conflorescence. Pinnate leaves with 2–11 leaflets, 10–50 cm long. Simple leaves (and leaflets) sessile or petiol(ul)ate, narrowly elliptic, 8–23 cm long, 1–5 cm wide, tapered to both ends; venation of terminal leaflets and simple leaves eucamptodromous, that of lateral leaflets brochidodromous. Intermediate leaves pinnate or pinnatisect. Conflorescence open (raceme-like) to rather condensed (corymb-like), 50–140-

flowered, not aggregated; bracts subulate to (lower down the rachis) leaf-like. Flowers pink or crimson; tepals 3–3.8 cm long; pedicels 3–6 cm long. Body of follicle 5–9 cm long. *Dorrigo Waratah, Tree Waratah*. Fig. 170H–I.

Occurs from Missabotti and Dorrigo areas, N.S.W. to the McPherson Range, Qld; grows on mountain slopes and plateaus, at 700–1250 m altitude, in soils derived from sedimentary rocks, metasediments or volcanics, in warm-temperate rainforest (e.g., dominated by *Ceratopetalum apetalum* or *Nothofagus moorei*), rarely in wet eucalypt forest. Flowers Nov.–Jan. Map 433.

Qld: Binna Burra–Coomera Falls track, McPherson Ra., *I.R.Telford 2610* (CBG). N.S.W.: Mt Hyland Nature Reserve, *P.G.Richards 93 & P.H.Weston* (BRI, CBG, K, MEL, MO, NSW, QRS); 8 km along road to Never Never from Ranger Station, Dorrigo Natl Park, *M.D.Crisp 7590 & J.M.Taylor* (CBG, MEL, NSW).

## 2. **Alloxylon flammeum** P.H.Weston & Crisp, *Telopea* 4: 503 (1991)

T: Tolga Scrub, Qld, 17°14'S, 145°29'E, Aug. 1987, *G.Sankowsky 626 & P.Radke*; holo: NSW; iso: BRI, CBG, K, MEL.

[*Embothrium wickhamii auct. non* W.Hill ex F.Muell.: F.M.Bailey, *Queensland Agric. J.* 5: 403 (1899)]

Illustration: F.M.Bailey, *op. cit.* t. 143, as *Embothrium wickhamii*; P.Valder *in* M.E.White, *Greening of Gondwana* 199, t. 298 (1986), as *Oreocallis wickhamii*.

Trees to 33 m tall, 0.6 m d.b.h., ferruginous-tomentose on upper parts of branchlets, petiole bases, conflorescence axes, bracts, pedicels and perianths. Adult leaves simple, petiolate, narrowly elliptic or narrowly obovate, 8–25 cm long, 2–4.5 cm wide, tapered to petiole; apices obtuse or occasionally acute; venation brochidodromous. Intermediate leaves strongly pinnatifid, to 50 cm long. Conflorescence corymb-like, 10–52-flowered, aggregated in bunches of 2–20 or more; bracts subulate. Flowers bright orange-red; tepals 3.5–5 cm long; pedicels 2.5–4.3 cm long. Body of follicle 7–10 cm long. *Red Silky Oak, Queensland Waratah*. Figs 136, 170A–G.

Occurs on Atherton Tableland, Qld, where it is restricted to within a few kilometres of Atherton, at 700–820 m altitude; grows in rainforest, usually in basalt-derived soil. Flowers Aug.–Oct. Map 434.

Qld: State Forest Reserve 191, Barron, *B.P.M.Hyland 7878* (BRI, CANB, NSW, QRS); Python Hill, Danbulla Forest Reserve, *G.C.Stocker 944* (BRI, QRS); Belson Rd, 0.8 km from Kennedy Hwy, *P.H.Weston 923 & G.Sankowsky* (NSW); cult. Bellingen, N.S.W., *M.D.Crisp 7589 & J.M.Taylor* (CBG, NSW).

Although *A. flammeum* has been confused with *A. wickhamii* from since Bailey (1899), these species are readily distinguished, even vegetatively by the ferruginous-tomentose indumentum on upper parts of the branchlets and petiole bases of *A. flammeum*, contrasted with the virtual absence of hairs in *A. wickhamii*. *Alloxylon brachycarpum*, which occurs in New Guinea and the Aru Is., is more closely related to *A. flammeum*, but may be distinguished by its shorter, broader leaves, duller red or pinkish flowers and much shorter, sparser, appressed hairs on the perianth.

## 3. **Alloxylon wickhamii** (W.Hill ex F.Muell.) P.H.Weston & Crisp, *Telopea* 4: 502 (1991)

*Embothrium wickhamii* W.Hill ex F.Muell., *Fragm.* 8: 164 (1874); *Oreocallis wickhamii* (W.Hill ex F.Muell.) Sleumer, *Bot. Jahrb. Syst.* 76: 203 (1954). T: Bellenden Ker, 2500 ft [762 m] altitude, Qld, [date unknown], *W.Hill 204*; lecto: MEL, *fide* P.H.Weston & M.D.Crisp, *loc. cit.*; Bellenden Ker, Qld, *W.Hill 41*; syn: MEL.

Illustration: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 481 (1989), as *Oreocallis wickhamii*.

Trees to 30 m tall, 0.6 m d.b.h., glabrate. Adult leaves simple, petiolate, narrowly obovate or occasionally narrowly elliptic, 5–17 cm long, 1–3.5 cm wide, more coriaceous than in *A. flammeum*, tapered to petiole; apices obtuse or rounded; venation brochidodromous. Intermediate leaves entire, to 41 cm long. Conflorescence corymb-like, 4–20-flowered, solitary or in loosely aggregated bunches of up to 6; bracts subulate or resembling very reduced leaves. Flowers dull pink-red; tepals 2.5–4 cm long; pedicels 1.5–4 cm long. Body

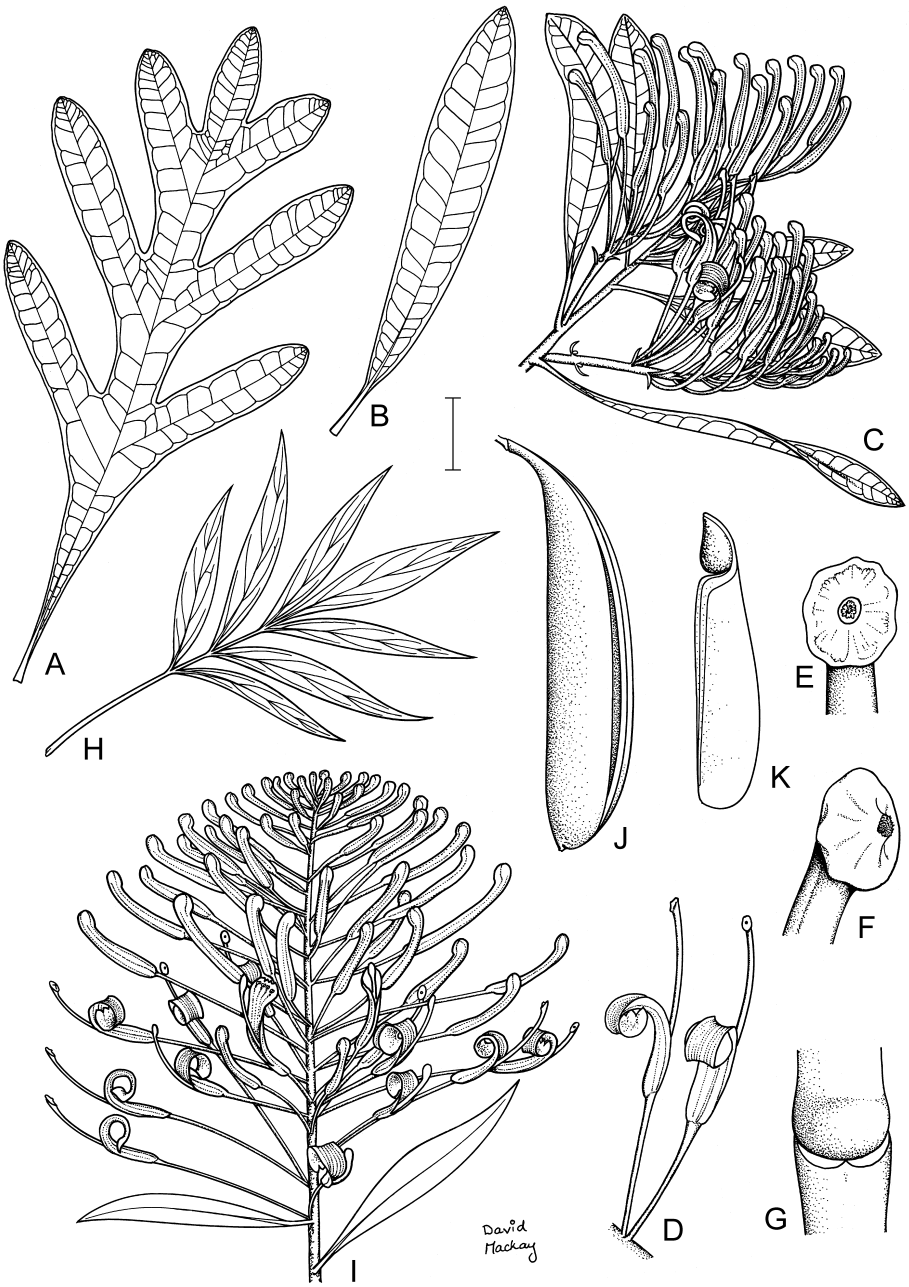



**Figure 170**. *Alloxylon*. **A–G**, *A. flammeum*. **A**, intermediate leaf; **B**, adult leaf (**A–B**, cult. Royal Botanic Gardens, Sydney, N.S.W., E.Constable, NSW); **C**, shoot with conflorescences (P.Weston 402, NSW); **D**, flower pair; **E**, pollen presenter, anterior view; **F**, pollen presenter, oblique view; **G**, hypogynous gland (**D–G**, P.Weston 406, NSW). **H–I**, *A. pinnatum*. **H**, leaf (A.Floyd 1957, NSW); **I**, conflorescence (H.Salasoo 1878, NSW). **J–K**, *A. wickhamii*. **J**, follicle; **K**, seed (**J–K**, L.Smith 4162A, NSW). Scale bar: **A**, **B**, **H** = 4 cm; **C**, **D**, **I–K** = 2 cm; **E–G** = 2 mm. Drawn by D.Mackay.

of follicle 5.5–12 cm long. *n* = 11, L.A.S.Johnson & B.G.Briggs, *Austral. J. Bot.* 11: 24 (1963), as *Oreocallis wickhamii*. *Fig.* 170J–K.

Endemic in northern Qld, from Mt Bartle Frere to Cape Tribulation. Found on mountain slopes, at 200–1220 m alt.; grows in rainforest, usually in soils derived from granite or metamorphics. Flowers Oct.–Nov. Map 435.

Qld: Compartment 52, State Forest Reserve 194, *B.P.M.Hyland 3133* (BRI, CANB, NSW, QRS); Timber Reserve 55, Whyanbeel, *B.P.M.Hyland 7748* (BRI, CANB, NSW, QRS); McDowall Ra., 14 Oct. 1984, *G.Sankowsky* (QRS); above Bobbin Bobbin Falls, WNW ridge of Mt Bartle Frere, *P.H.Weston 954 & G.Sankowsky* (NSW).

## 29. TELOPEA

*M.D.Crisp & P.H.Weston*

*Telopea* R.Br., *Trans. Linn. Soc. London* 10: 197 (1810), *nom. cons.*; from the Greek *telopos* (seen from afar), in reference to the conspicuous red conflorescences of *T. speciosissima*.

*Hylogyne* Salisb. ex Knight, *Cult. Prot.* 126 (1809), *nom. rej.* T: *Embothrium speciosissimum* Sm. = *Telopea speciosissima* (Sm.) R.Br.

Shrubs, rarely small trees, usually multi-stemmed from a lignotuber. Adult leaves simple, entire or toothed, tapered or abruptly contracted to petiole; intermediate leaves simple or sinuate-lobed, pinnatifid or pinnatisect, occasionally present on flowering seasonal growth units. Conflorescence terminal, capitate on basitonic seasonal growth units, not aggregated, with red to pink involucral bracts. Flowers strongly incurved in bud, red, crimson, scarlet or pink, rarely white or yellow; floral orientation diagonal. Receptacle oblique. Tepals coherent in a split tube after anthesis (separating in *T. truncata*). Hypogynous glands fused, crescentic to horseshoe-shaped. Pollen presenter strongly oblique. Follicle woody, splayed nearly flat after dehiscence. Seed wing with internal raphe.

Five species endemic in south-eastern Australia. *Telopea speciosissima* is used extensively in the cut flower industry, and is the floral emblem of N.S.W.

M.D.Crisp & P.H.Weston, Waratahs – how many species?, *in* J.A.Armstrong (ed.), *Waratahs – their Biology, Cultivation and Conservation* 3–15 (1987); P.H.Weston & M.D.Crisp, Evolution and biogeography of the Waratahs, *in* J.A.Armstrong (ed.), *Waratahs – their Biology, Cultivation and Conservation* 17–34 (1987); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 537–542 (1989); R.J.Whelan & R.L.Goldingay, Factors affecting fruit-set in *Telopea speciosissima* (Proteaceae): the importance of pollen limitation, *J. Ecol.* 77: 1123–1134 (1989); M.D.Crisp & P.H.Weston, Geographic and ontogenetic variation in morphology of Australian Waratahs (*Telopea*: Proteaceae), *Syst. Biol.* 42: 49–76 (1993); R.L.Goldingay & R.J.Whelan, The influence of pollinators on fruit positioning in the Australian shrub *Telopea speciosissima*, *Oikos* 68: 501–509 (1993); P.H.Weston & M.D.Crisp, Cladistic biogeography of Waratahs (Proteaceae: Embothrieae) and their allies across the Pacific, *Austral. Syst. Bot.* 7: 225–249 (1994).

**1** Leaves mostly with toothed margins; veins prominently raised on upper surface; involucral bracts conspicuous; anthesis acropetal

**2** Adult leaf lamina narrowly obovate to narrowly spathulate, with 1–3 teeth below middle of either margin, glabrous or rarely moderately ferruginous-hairy beneath (usually with less than 35 hairs per $mm^2$) **1. T. speciosissima**

**2:** Adult leaf lamina elliptic to obovate-elliptic, usually with 3–11 teeth below middle of either margin, moderately to extensively ferruginous-hairy beneath (usually with more than 35 hairs per $mm^2$) **2. T. aspera**

**1:** Leaves never toothed; veins not or only moderately raised on upper surface; involucral bracts inconspicuous; anthesis basipetal

**3** Bracts ferruginous-hairy outside; tepals separating from the base at anthesis; style inflexed at base **3. T. truncata**

**3:** Bracts glabrous except at tips; tepals cohering along their margins in a slit tube; style incurved, not sharply bent

**4** Adult leaves mostly 25–60 mm wide; surfaces (when dry) minutely granulate **4. T. oreades**

**4:** Adult leaves mostly 10–20 mm wide; surfaces (when dry) quite smooth between veins **5. T. mongaensis**

## 1. Telopea speciosissima (Sm.) R.Br., *Trans. Linn. Soc. London* 10: 198 (1810)

*Embothrium speciosissimum* Sm., *Spec. Bot. New Holland* 2: 19, t. 7 (1793); *Embothrium speciosum* Salisb., *Parad. Lond.* 2: t. 111 (1808), *nom. illeg.*; *Hylogyne speciosa* (Salisb.) Salisb. ex Knight, *Cult. Prot.* 126 (1809), *nom. illeg.* T: Port Jackson, N.S.W., 1791 & 1793, *J.White*; syn: LINN (3 specimens).

*Embothrium spathulatum* Cav., *Icon.* 4: 60, t. 388 (1798); *Hylogyne spathulata* (Cav.) Kuntze, *Revis. Gen. Pl.* 2: 578 (1891). T: near Port Jackson, *L.Née*; syn. MA (4 specimens); *n.v.*, *fide* R.Garilleti, *Fontqueria* 38: 63 (1993).

Illustrations: E.R.Rotherham *et al.*, *Fl. & Pl. New South Wales & Southern Queensland* 62, t. 165 (1975); A.Blombery & B.Maloney, *Proteaceae Sydney Reg.* t. 32 (1981); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 520 (1989).

Erect shrubs to 3 m tall, with 1–few stems, slender, sparingly branched, glabrous except at bract tips. Adult leaves narrowly obovate to narrowly spathulate, 8–28 cm long, 2–6.5 cm wide, serrate, with 1–3 teeth in basal halves of margins, rarely entire, tapered to very attenuate at base, coriaceous, but usually not harsh to the touch; apices acute to truncate; veins prominently raised; surfaces minutely granulate when dried due to sclereids in mesophyll. Intermediate leaves pinnatifid to pinnatisect. Conflorescences few, very broadly to depressed-ovoid, 90–240-flowered, 4–11 cm diam. (excluding bracts); anthesis acropetal; involucral bracts conspicuous, mostly 50–90 mm long, bright red, glabrous except tips. Flowers usually scarlet; pedicels 3–25 mm long; tepals 10–34 mm long, cohering along margins in a slit tube; style incurved. Body of follicle 8–15 cm long. *Waratah*. Fig. 171I–J.

Endemic in N.S.W., along the coast from Ulladulla to Watagan Mountains, and in the Blue Mountains; grows in soils with sand on the surface and brown or yellow clay at depth over sandstone, in eucalypt forest with sclerophyll shrub understorey. Flowers Aug.–Nov. Map 436.

N.S.W.: Royal Natl Park, near Engadine Railway Station, *R.G.Coveny 11915a–f & P.H.Weston* (CBG, NSW); Watagan Mtns, 10 km W of Cooranbong, *M.D.Crisp 7406–11 & I.R.Telford* (CBG, NSW); Carrington Falls, 7 km ESE of Robertson, *M.D.Crisp 7442–7 & G.A.Butler* (CBG, NSW); Kings Tableland, Blue Mtns, *M.D.Crisp 7486–91, J.M.Taylor & P.H.Weston* (CBG, NSW).

This species is closely related to *T. aspera*, and differs in the usually glabrous leaves, the shape of the leaf apex and base, the less toothed basal half of the leaf, and less harsh leaf texture (Crisp & Weston, 1993). Very rarely plants with greenish white conflorescences are found.

Plants north of Hawkesbury River have 0–42 hairs per mm² on lower leaf surfaces.

## 2. Telopea aspera Crisp & P.H.Weston, *Fl. Australia* 16: 498 (1995)

T: Gibraltar Ra., N.S.W., 1 Nov. 1984, *M.D.Crisp 7536 & J.M.Taylor*; holo: CBG; iso: AD, K, MEL, NSW.

Illustrations: M.Morcombe, *Australia's National Parks* 39 (1969, 1978); N.C.W.Beadle, *Students Fl. NE New South Wales* part 2: fig. 109, B1–B3 (1972).

Erect shrubs to 3 m tall, with 1–few stems, slender, sparingly branched, ferruginous-hairy on axes and especially on abaxial leaf surfaces (with 30–80 hairs per mm²). Adult leaves elliptic to obovate-elliptic or narrowly so, 6–24 cm long, 2–8 cm wide; margins serrate in apical half, with 3–11 teeth extending to basal halves, ±abruptly contracted to petiole, very coriaceous and harsh to the touch; apices acute to truncate; veins prominently raised; surfaces minutely granulate when dried. Intermediate leaves pinnatisect to pinnatifid. Conflorescences few, very broadly to depressed-ovoid, 100–180-flowered, 6–8.5 cm diam. (excluding bracts); anthesis acropetal; involucral bracts conspicuous, mostly 30–75 mm long, bright red,

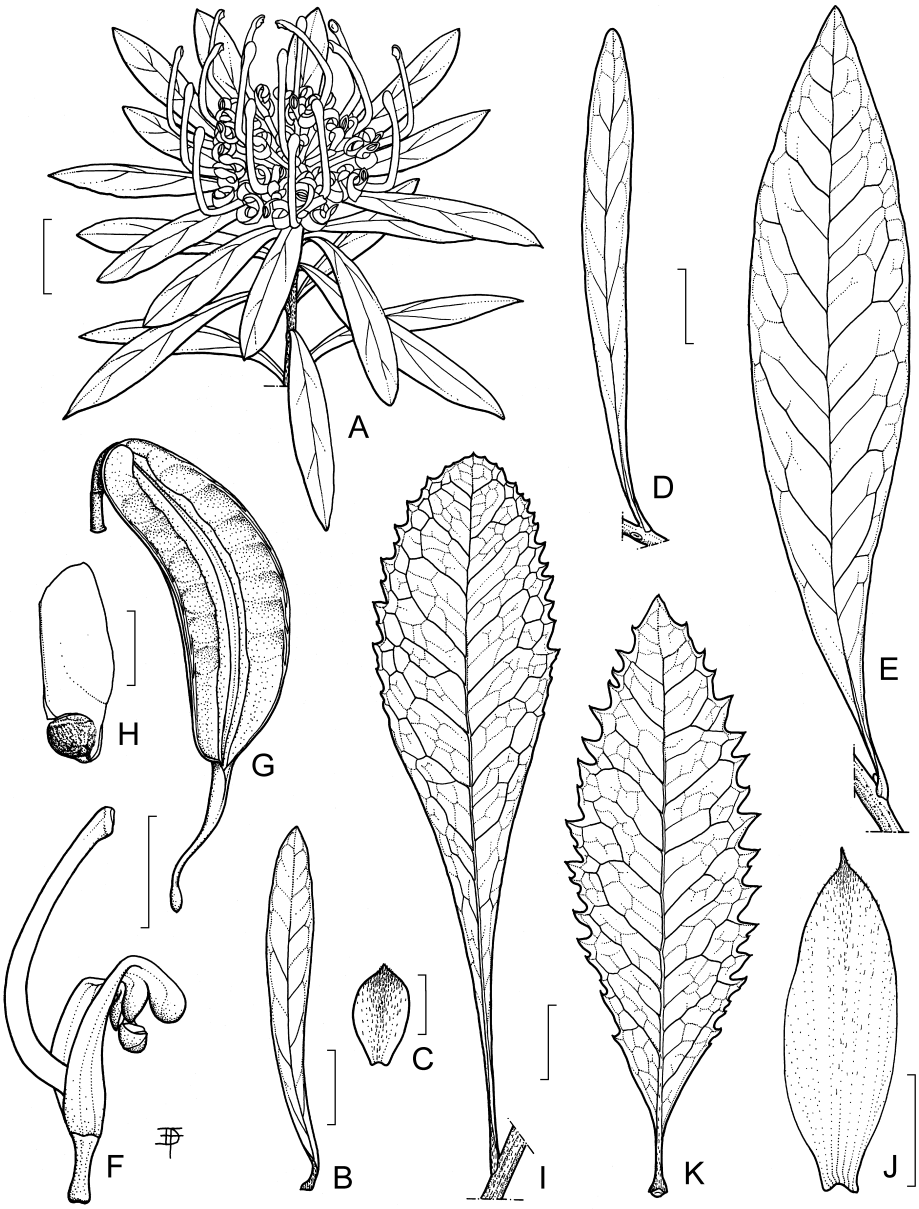



**Figure 171**. *Telopea*. **A–C**, *T. truncata*. **A**, branchlet with conflorescence (from a photograph, supplemented by specimen: 1 mile [1.5 km] from Trial Harbour, Tas., M.Phillips, CBG); **B**, leaf; **C**, involucral bract (**B–C**, 1 mile [1.5 km] from Trial Harbour, Tas., M.Phillips, CBG). **D**, *T. mongaensis*, leaf (M.Crisp 7453, CBG). **E–H**, *T. oreades*. **E**, leaf (M.Crisp 7645, CBG); **F**, flower; **G**, follicle; **H**, seed (**F–H**, M.Crisp 7646, CBG). **I–J**, *T. speciosissima*. **I**, leaf; **J**, involucral bract (**I–J**, M.Crisp 7410, CBG). **K**, *T. aspera*, leaf (M.Crisp 7388, CBG). Scale bars: **A**, **B**, **D**, **E**, **G**, **I–K** = 2 cm; **C**, **F**, **H** = 1 cm. Drawn by D.Fortescue.

glabrous except tips. Flowers usually scarlet; pedicels 3–27 mm long; tepals 20–30 mm long, cohering along margins in a slit tube; style incurved. Body of follicle 7–11 cm long. Fig. 171K.

Grows in sandy soils over granite, in dry sclerophyll forest. Endemic in the Gibraltar Range, northern N.S.W. Flowers Oct.–Dec. Map 437.

N.S.W.: 4 km from Ranger Station (on Gwydir Hwy), along road to Mulligans Hut, *M.D.Crisp 7560–5 & J.M.Taylor* (CBG, NE, NSW); The Needles Lookout, Gibraltar Range Natl Park, *M.D.Crisp 7571–4 & J.M.Taylor* (CBG, NSW); Pheasant Ck, Glen Elgin, Dec. 1913, *J.L.Boorman* (NSW).

This species is closely related to *T. speciosissima*, and differs mainly in the ferruginous-hairy leaves, the shape of the leaf apex and base, the greater number of teeth on the basal portion of the leaf, and the harsh leaf texture.

### 3. Telopea truncata (Labill.) R.Br., *Trans. Linn. Soc. London* 10: 198 (1810)

*Embothrium truncatum* Labill., *Nov. Holl. Pl.* 1: 32, t. 44 (1805); *Hylogyne australis* Salisb. ex Knight, *Cult. Prot.* 127 (1809), *nom. superfl. & illeg.* T: in capite Van-Diemen [Tas.], 1792–93, *J.J.H. de Labillardière*; syn.: B, FI (6 specimens), TCD (2 specimens).

*Telopea tasmaniana* Ross, *Hobart Town Almanack* 110 (1835). T: not cited; specimen unknown.

*Telopea truncata* f. *lutea* A.M.Gray, *Muelleria* 3: 63 (1974). T: cultivated at Longley, Tas., 11 Nov. 1972, *E.Huxley s.n.*; holo: CANB; iso: HO.

Illustrations: F.Hurley, *Austral. Pl.* 1: 16 (1959); M.Stones *in* W.M.Curtis & M.Stones, *Endemic Fl. Tasmania* t. 141 (1973); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 520 (1989).

Shrubs to 3 m tall or, rarely, trees to 8 m, multi-stemmed, much-branched, densely rusty-sericeous to glabrescent on axes, bracts and beneath leaves. Adult leaves narrowly obovate to narrowly spathulate, 3–14 cm long, 5–22 mm wide, coriaceous, entire; margins recurved; apices acute or obtuse; upper surface without prominent veins, obscurely granulate. Intermediate leaves irregularly lobed, pinnatifid. Conflorescences many, depressed-obovoid, 10–35-flowered, 3.5–6 cm diam.; anthesis basipetal; involucral bracts inconspicuous, mostly 10–25 mm long, reddish and/or green, ferruginous-hairy outside. Flowers usually scarlet to crimson; pedicels 5–30 mm long; tepals 15–40 mm long, separating from base; style inflexed. Body of follicle 3.5–6.5 cm long. *Tasmanian Waratah*. Figs 137, 171A–C.

Endemic in Tas. and widespread except in the north and east. Occurs in montane and subalpine regions at 600–1200 m altitude, in wet eucalypt forest or heath. Flowers Nov.–Feb. Map 438.

Tas.: 1.6 km below L. Fenton, Mt Field Natl Park, *R.Melville 2364B et al.* (K, NSW); Mt Wellington, 9 Nov. 1960, *M.E.Phillips* (CBG); 3.2–6.4 km from Cradle Mtn, on road to Wilmot, 12 Nov. 1965, *M.E.Phillips* (CBG, NSW); Scarlet Ck, 38.5 km from Queenstown towards Hobart, 21 Nov. 1965, *M.E.Phillips* (CBG); Mt Barrow, 8 Dec. 1965, *M.E.Phillips* (CBG).

The yellow-flowered variant (f. *lutea*) occurs sporadically only in normal red-flowered populations. When grown from seed it produces both red- and yellow-flowered offspring and so does not warrant formal taxonomic recognition.

### 4. Telopea oreades F.Muell., *Fragm.* 2: 170 (1861)

*Hylogyne oreades* (F.Muell.) Kuntze, *Revis. Gen. Pl.* 2: 578 (1891). T: ad originem amnis Nungatta Creek in tergo alpestri tractus [Nungatta Mtns], N.S.W., [date unknown], *F.Mueller*; syn: MEL? *n.v.*; Weatherhead, N.S.W., *F.Mueller*; syn: MEL? *n.v.*

Illustration: G.R.Cochrane *et al.*, *Fl. & Pl. Victoria* fig. 472 (1973).

Shrubs or trees to 12 m tall, with few to many stems, much-branched, glabrous except bract tips which are ferruginous-hairy. Adult leaves narrowly obovate to narrowly spathulate, 11–28 cm long, 15–60 mm wide, entire, chartaceous; apices acuminate; venation obscure above, conspicuous beneath, but scarcely raised; surfaces minutely granulate when dry. Intermediate leaves simple, entire. Conflorescences many, transversely ellipsoidal, 36–60-flowered, 5–8 cm diam.; anthesis basipetal; involucral bracts inconspicuous, mostly 15–75 mm long, pink and/or green. Flowers with pedicels 10–29 mm long; tepals 28–36 mm long,

cohering along their margins in a slit tube, pink to crimson outside, bright red inside; style incurved. Body of follicle 5–7 cm long. *Gippsland Waratah*. Fig. 171E–H.

Occurs in East Gippsland, Vic., and the adjacent coastal ranges of south-eastern N.S.W., with a disjunct occurrence in the Monga Valley, near Braidwood, N.S.W.; grows in moist coastal ranges and tableland escarpments in rainforest or wet eucalypt forest at 200–1200 m alt. Flowers Aug., Oct.–Dec. Map 439.

N.S.W.: 6.7 km S of Monga along River Rd, *M.D.Crisp 7470 & G.P.Richards* (CBG, MEL, NSW); c. 36 km W of Eden, Letts Mtn, *I.R.Telford 6739 & M.D.Crisp* (AD, BISH, CBG, MEL, NSW). Vic.: ascent to Errinundra Plateau, *M.D.Crisp 7645* (CBG, K, MEL, NSW).

*Telopea oreades* occurs sympatrically with *T. mongaensis* in the vicinity of Monga, N.S.W., where it flowers about a month earlier than the latter. A few putative hybrids combining characters of both species have been found in this area e.g. *Butler 1334 & 1338* (CBG).

### 5. Telopea mongaensis Cheel, *Proc. Linn. Soc. New South Wales* 71: 270, fig. 1 (1947)

T: Sugar-loaf Mtn, near Braidwood, N.S.W., Oct. 1915, *J.L.Boorman s.n.*; holo: NSW.

[*Telopea oreades auct. non* F.Muell.: N.C.W.Beadle *et al.*, *Fl. Sydney Reg.* 3rd edn, 225 (1982)]

Illustrations: A.Blombery & B.Maloney, *Proteaceae Sydney Reg.* t. 33 (1981); P.Sellars, *Bot. Mag.* n.s. 184: t. 851 (1982), as *T. oreades*; J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 519 (1989).

Shrubs to 6 m tall, multistemmed, much-branched, glabrous except that young branchlets and bract tips are ferruginous-hairy. Adult leaves linear to narrowly obovate, 4–18 cm long, 5–20 mm wide, entire or slightly sinuate-lobed, somewhat coriaceous; apices obtuse or acute, rarely acuminate; quite smooth when dry, between moderately raised veins. Intermediate leaves irregularly pinnatifid. Conflorescences many, depressed-obovoid, 28–65-flowered, 6–10 cm diam.; anthesis basipetal; involucral bracts inconspicuous, mostly 12–45 mm long, pink and/or green. Flowers with pedicels 10–40 mm long; tepals 25–40 mm long, cohering along margins in a slit tube, pink to deep crimson outside, bright red inside; style incurved. Body of follicle 4.5–7 cm long. *Monga Waratah*, *Braidwood Waratah*. Figs 138, 171D.

Endemic in N.S.W. along the tableland escarpment from Monga (near Braidwood) to the vicinity of Fitzroy Falls; grows in the margins of streams or, occasionally, on mountain slopes, at 540–760 m altitude, in fringing temperate rainforest or wet eucalypt forest. Flowers Oct.–Dec. Map 440.

N.S.W.: 1.5 km N of Monga, *M.D.Crisp 7193 & G.A.Butler* (CBG, MEL, NSW); 14 km S of Moss Vale, 2.2 km E of Spring Hill trig., *M.D.Crisp 7828 & P.H.Weston 446* (CBG, MEL, MO, NSW); Gun Rock Ck, 9.5 km SE of Moss Vale, *M.D.Crisp 7865 & P.H.Weston 1047* (AD, CBG, HO, K, MO, NSW); Budawang Ra., 12 km S of Sassafras, *J.W.Wrigley 518* (CBG, K, US).

## Trib. 4. HELICIEAE

*Proteaceae* trib. *Helicieae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 173 (1975).

Type: *Helicia* Lour.

Juvenile leaves simple. Peduncles and floral bracts present or absent. Flowers actinomorphic or zygomorphic. Ovules 2–many, laterally or basally inserted, hemitropous or anatropous. Fruit follicular or indehiscent. Seeds 1–many. $n = 14$.

A tribe of 3 subtribes and 4 genera. Three genera endemic in Australia, the fourth extending from Australia through Malesia to southern India, Sri Lanka, SE Asia and southern Japan.

## Subtrib. 1. HOLLANDAEINAE

*Proteaceae* subtrib. *Hollandaeinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc*. 70: 173 (1975).

Type: *Hollandaea* F.Muell.

Peduncles usually present; floral bracts present. Flowers actinomorphic. Ovules many, laterally inserted, anatropous. Fruit follicular. Seeds many and thick, wingless.

A monogeneric subtribe from the rainforests of north-eastern Qld.

## 30. HOLLANDAEA

*B.P.M.Hyland*

*Hollandaea* F.Muell., *Chem. & Druggist Australasia* 2: 173 (1887); named after Sir Henry Holland (1825–1914), Secretary of State for the Colonies (1888–1892).

Type: *H. sayeriana* (F.Muell.) L.S.Sm.

Trees. Leaves alternate, simple. Conflorescence raceme-like, axillary, pendulous. Flowers actinomorphic, bisexual, usually paired, sessile on a common peduncle, or pedicellate with no peduncle, or on a very short peduncle; common and floral bracts present at anthesis. Tepals valvate, coiled and reflexed at anthesis, dilated at apex. Stamens 4; anthers 2-locular, basifixed, dehiscing by longitudinal slits. Hypogynous glands 4. Ovary sessile; ovules c. 4–14; pollen presenter clavate; stigmatic surface terminal. Fruit a follicle, green when ripe. Seeds wingless.

A genus of 2 species confined to north-eastern Qld.

Readily distinguished by the simple leaves, red or purplish tepals, follicular fruits, wingless angular seeds and thin testa.

F.M.Bailey, *Hollandaea*, *Queensland Fl*. 4: 1353–1354 (1901); W.D.Francis, *Austral. Rainforest Trees* 4th edn, 394 (1982); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 423–424 (1989).

Leaves less than 4 cm wide; ovules fewer than 6; fruits verrucose, less than 6 cm long **1. H. riparia**

Leaves more than 4 cm wide; ovules more than 6; fruits ±smooth, more than 6 cm long **2. H. sayeriana**

### 1. Hollandaea riparia B.Hyland, *Fl. Australia* 16: 499 (1995)

T: Timber Reserve 165, Baird Logging Area, Qld, 16°02'S, 145°19'E, 22 Sept. 1980, *B.P.M.Hyland 10626*; holo: QRS.

Shrub or small tree. Leaves: petiole slender, 10–12 mm long; lamina lanceolate, 8–20 cm long, 1.5–3 cm wide, glabrous; base attenuate; margin entire; apex obtuse or obtusely acuminate; veins 5–11 pairs. Conflorescence c. 15 cm long; flowers sessile on a common peduncle. Tepals 2–3 cm long, purplish, glabrous except for short, appressed pubescence near apex abaxially. Anthers 4–5 mm long; mucro c. 0.5 mm long; filament c. 0.3 mm long. Hypogynous glands ±scutelliform. Ovary c. 2 cm long; ovules c. 4; style 2–2.5 cm long; pollen presenter 3–4 mm long. Fruit ±ovoid or hemispherical (or at least flat on one side), 3.5–5 cm long, verrucose. Seeds c. 4, ±angular, c. 1.8 cm long, 1.5–1.8 cm wide. Fig. 139.

Occurs as a rheophyte at Roaring Meg Creek near China Camp, south of Cooktown, Qld, at an altitude of 300–500 m. Map 441.

Qld: Timber Reserve 165, Alexandra Logging Area, *B.P.M.Hyland 9390* (QRS); Roaring Meg Ck, *G.Sankowsky* (QRS 77799).

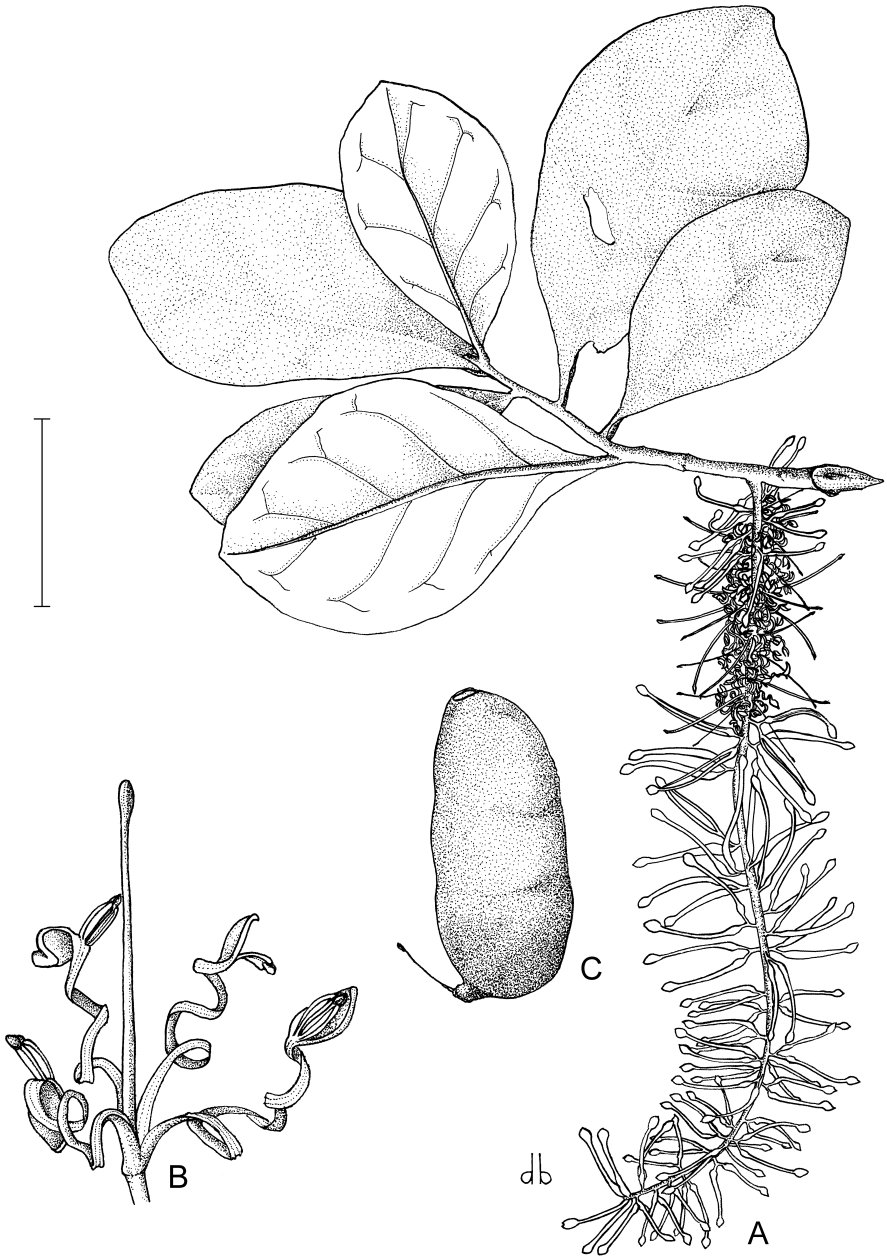



**Figure 172**. *Hollandaea sayeriana*. **A**, branchlet with conflorescence; **B**, flower (**A–B**, B.Gray 2551, QRS); **C**, fruit (B.Gray 1316, QRS). Scale bar: **A**, **C** = 5 cm; **B** = 1 cm. Drawn by D.Boyer.

**2. Hollandaea sayeriana** (F.Muell.) L.S.Sm., *Proc. Roy. Soc. Queensland* 67: 39 (1956)

*Helicia sayeriana* F.Muell., *Victorian Naturalist* 3: 93 (1886); *Hollandaea sayeri* F.Muell., *Chem. & Druggist Australasia* 2: 173 (1887), *nom. illeg.* T: Mt Bellenden Ker, Qld, *W.Sayer s.n.*; holo: MEL.

Illustrations: K.A.W.Williams, *Native Pl. Queensland* 3rd edn, 1, 159 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 423 (1989).

Small tree. Leaves: petiole swollen, 2–11 mm long; lamina ovate to almost orbicular, 10–22 cm long, 6–14 cm wide, glabrous; base cuneate; margin usually toothed; apex usually obtuse, sometimes abruptly acuminate; veins 6–11 pairs. Conflorescence 20–40 cm long; flowers pedicellate on a very short, common peduncle, or peduncle absent. Tepals 2–3 cm long, crimson or purple, sparsely appressed-pubescent abaxially, glabrous adaxially. Anthers 2–3 mm long; mucro 0.3–0.4 mm long; filament 0.2–0.8 mm long. Hypogynous glands scutelliform or linguiform. Ovary 1.8–2.4 mm long; ovules c. 12–16; style 1.5–2 cm long; pollen presenter 1.7–2.4 mm long. Fruit allantoid to somewhat cylindrical, 8–10 cm long, with one rib on one side, ±smooth. Seeds 3–6, ±angular, 2.5–3 cm long, 2–2.5 cm wide. *n* = 14, L.A.S.Johnson & B.G.Briggs, *Austral. J. Bot.* 11: 24 (1963). *Sayer's Silky Oak.* *Fig.* 172.

Restricted to an area of north-eastern Qld between Cairns and Innisfail, ascending to the edge of the Atherton Tableland, from near sea level to 750 m. Map 442.

Qld: Topaz Rd, *G.C.Stocker 1158* (QRS); The Boulders, Babinda Ck, *L.J.Brass 33813* (QRS); State Forest Reserve 755, Boonjee Logging Area, *B.P.M.Hyland 5935* (QRS).

## Subtrib. 2. HELICIINAE

*Proteaceae* subtrib. *Heliciinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 173 (1975).

Type: *Helicia* Lour.

Peduncles and floral bracts present or absent. Flowers actinomorphic. Ovules 2, ±basally inserted, ±anatropous. Fruit follicular and woody or indehiscent. Seeds 2, flat and winged or 1, thick and wingless.

A subtribe of 2 genera, 1 endemic in Australia, the other extending from eastern Australia through Malesia to southern India, Sri Lanka, SE Asia and southern Japan.

## 31. HELICIA

*D.B.Foreman*

*Helicia* Lour., *Fl. Cochinch.* 1: 83 (1790); from the Greek *helix* (a spiral), referring to the tepals which are spirally coiled at anthesis.

Type: *H. cochinchinensis* Lour.

*Helittophyllum* Blume, *Bijdr. Fl. Ned. Ind.* 652 (1825). T: *H. javanicum* Blume

*Cyanocarpus* F.M.Bailey, *Rep. Govt Sci. Exped. Bellenden-Ker Ra.* 55 (1889). T: *C. nortoniana* F.M.Bailey

Trees or shrubs. Branchlets terete. Leaves simple, spiral (rarely opposite); margin entire or variously toothed. Conflorescence raceme-like, terminal or subterminal, axillary, ramiflorous or rarely cauliflorous. Involucral and floral bracts small to minute, rarely persisting. Flowers actinomorphic, bisexual or andromonoecious. Receptacle straight. Perianth straight; tube slender; limb slightly expanded; tepals separate and revolute at anthesis. Hypogynous glands 4, free or fused into a cup. Stamens 4, adnate at limb base; filaments short. Ovary sessile, glabrous or tomentose; style straight; pollen presenter fusiform. Fruit drupe-like, indehiscent or splitting irregularly. Seed 1, rarely 2, globose or ovoid. *n* = 14, L.A.S.Johnson & B.G.Briggs, *Austral. J. Bot.* 11: 24 (1963).

A widespread genus of c. 90 species, extending from the south coast of N.S.W. to north-eastern Qld and northern Australia, throughout Malesia and SE Asia, southern India and Sri Lanka, and southern Japan. Nine species occur in Australia; 8 are endemic, with 1 northern Australian species extending to southern New Guinea.

The often brightly coloured, regular flowers borne in raceme-like conflorescences and the drupe-like fruits are among the more conspicuous features of the genus.

H.Sleumer, Studies on Old World Proteaceae, *Blumea* 8: 2–95 (1955); W.D.Francis, *Austral. Rain-forest Trees* 4th edn, 87, 91, 390 (1982); D.B.Foreman, A review of the genus *Helicia* Lour. (Proteaceae) in Australia, *Brunonia* 6: 59–72 (1983); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 414–419 (1989); P.G.Ladd & S.W.Connell, Andromonoecy and fruit set in three genere of the Proteaceae, *Bot. J. Linn. Soc.* 116: 77–88 (1994).

**1** Leaf lamina glabrous beneath or very nearly so, a few sparse hairs may persist along the midrib and main lateral veins

**2** Petiole often reduced, usually less than 3 mm long; venation dense — **1. H. glabriflora**

**2:** Petiole distinct, usually more than 3 mm long; venation dense or lax

**3** Ovary hairy

**4** Tepals glabrous, to 18 mm long; pedicels c. 5 mm long — **4. H. grayi**

**4:** Tepals ferruginous-pilose, sometimes sparsely so, to 15 mm long; pedicels to 3 mm long

**5** Leaf margin recurved; lamina coriaceous — **3. H. recurva**

**5:** Leaf margin not recurved; lamina chartaceous — **2. H. australasica**

**3:** Ovary glabrous

**6** Twigs glabrous; leaf lamina lanceolate to narrowly elliptic; petiole 10–20 mm long — **5. H. blakei**

**6:** Twigs with appressed reddish brown hairs; leaf lamina elliptic; petiole 8–12 mm long — **6. H. lewisensis**

**1:** Leaf lamina persistently hairy beneath, particularly along midrib and lateral veins

**7** Tepals 12–18 mm long; leaf lamina orbicular, with irregularly toothed margins — **7. H. lamingtoniana**

**7:** Tepals 6–8.5 mm long; leaf lamina variously shaped, with regularly toothed margins

**8** Leaf lamina ±elliptic; indumentum not persistent, often sparse; lateral veins 6–10 pairs; tepals c. 8.5 mm long — **8. H. nortoniana**

**8:** Leaf lamina oblong or oblong-lanceolate; indumentum persistent and dense; lateral veins 10–20 pairs; tepals c. 6 mm long — **9. H. ferruginea**

## 1. Helicia glabriflora F.Muell., *Fragm.* 2: 91 (1860)

T: Leycester Creek, Richmond River, N.S.W., *H.Beckler s.n.*; holo: MEL.

*Helicia conjunctiflora* F.Muell., *Fragm.* 5: 38 (1865); *H. glabriflora* var. *conjunctiflora* (F.Muell.) Domin, *Biblioth. Bot.* 89: 30 (1921). T: Balina [Ballina], Richmond River, N.S.W., *C.Moore s.n.*; holo: MEL.

*Helicia subrhombifolia* Domin, *Biblioth. Bot.* 89: 31 (1921). T: Tamborine Mtns, Qld, Mar. 1910, *K.Domin s.n.*; holo: PR *n.v.*, *fide* H.Sleumer, *Blumea* 8: 16–17 (1955).

Illustrations: K.A.W.Williams, *Native Pl. Queensland* 2: 155 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 417 (1989).

Tree to c. 10 m tall. Branchlets laxly ferruginous-pilose, glabrescent. Leaves: petiole 1–3 mm long; lamina oblong-lanceolate to rhomboidal-elliptic, 5–16 cm long, 1.5–4.5 cm wide, glabrous; tips acute to obtusely acuminate; margin entire or with a few irregular teeth; venation dense and prominent on both surfaces; lateral veins 8–12 pairs. Conflorescence axillary, 4–10 cm long, densely flowered, glabrous; pedicels 1.5–3 mm long. Tepals 8–13

mm long, cream to pink, glabrous; limb c. 3 mm long, c. 1 mm wide. Anthers c. 2 mm long. Hypogynous glands truncate, free or fused into cup. Ovary laxly ferruginous-tomentose to almost glabrous. Fruit ovoid, c. 12 mm diam., becoming dark blue. *Smooth Helicia*, *Pale Oak*, *Leather Oak*, *Brown Oak*. Fig. 173E.

Occurs from the central coast and nearby ranges in Qld to eastern-coastal N.S.W.; grows in a wide range of soil types in rainforest to 1130 m altitude. Map 443.

Qld: Caley State Forest, W of Cathu, between Mackay and Proserpine, *L.J.Webb & J.G.Tracey 7770* (BRI); Mt Tamborine, Mar. 1947, *M.Clemens* (BRI). N.S.W.: 16 km W of Dorrigo on Armidale road, *D.B.Foreman 4* (NE); c. 4 km ESE of Robertson, on road to Carrington Falls, *R.G.Coveny 918* (NSW); Minnamurra Falls, 19 Feb. 1954, *H.M.R.Judd* (NSW).

*Helicia glabriflora* is the most southerly-occurring species in the genus. The succulent part of the fruit is edible. The timber is pale, medium hard and tough. It is a somewhat variable species, particularly with regard to leaf size and hairiness of the ovary which ranges from almost glabrous to ferruginous-tomentose.

### 2. **Helicia australasica** F.Muell., *Hooker's J. Bot. Kew Gard. Misc.* 9: 22 (1857)

T: ad rivulorum ripas, towards Macadam Range [N.T.], 3 Oct. 1855, *F.Mueller*; holo: K.

*Helicia dentellata* Sleumer, *Bot. Jahrb. Syst.* 70: 147 (1939). T: Lake Daviumbu, Middle Fly River, Western District, New Guinea, Sept. 1936, *L.J.Brass 7917*; iso: BRI.

*Helicia glabrescens* C.T.White, *Proc. Roy. Soc. Queensland* 55: 81 (1944). T: Barron River, Qld, Sept. 1892, *E.Cowley 74B*; holo: BRI.

Illustrations: J.Brock, *Top End Native Pl.* 216 (1988); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 414 (1989).

Shrub or tree 3–20 m tall. Branchlets rufous to ferruginous-tomentose distally. Leaves: petiole 2–10 mm long; lamina oblong, elliptic-oblong, lanceolate or oblong-lanceolate, 6–23 cm long, 4–8.5 cm wide, chartaceous, glabrous to laxly ferruginous-tomentose beneath; tips acuminate, acute or sometimes obtuse; margin irregularly serrate to dentate, not recurved; venation mostly lax; lateral veins 6–10 pairs. Conflorescence axillary or ramiflorous, 7–17 cm long, densely flowered, rufous- or ferruginous-pilose; pedicels 1–3 mm long. Tepals 8–15 mm long, cream, ferruginous-pilose; limb c. 3 mm long, 1–1.5 mm wide. Anthers 2–2.5 mm long. Hypogynous glands broad, truncate, free or fused at base. Ovary ferruginous-tomentose. Fruit ovoid, 8–11 mm long, 5–7.5 mm diam., becoming dark blue. Fig. 173A–D.

Widespread in northern Australia in N.T. and Qld; grows in patches of rainforest along rivers and streams to altitudes over 1000 m. Extends to central New Guinea. Flowers Aug.–Dec. and fruits Jan.–Apr. in N.T. Map 444.

N.T.: East Spring, Green Ant Ck, *N.B.Byrnes 927* (BRI); Port Darwin, Oct. 1888, *M.Holtze* (MEL). Qld: Dulcie R., Gulf side of Cape York Peninsula, *F.W.Whitehouse s.n.* (BRI 164221); Leo Ck Rd, *B.P.M.Hyland* 6375 (BRI); Marmoss Ck, Weipa concession, *A.Dockrill* 858 (BRI, CANB, QRS).

The fruit is eaten raw by Aborigines. While there is some variation in leaf dimensions and length of the tepals, as might be expected from such a widespread species, it is insufficient to warrant recognition of infraspecific taxa.

### 3. **Helicia recurva** Foreman, *Muelleria* 6: 193 (1986)

T: Mt Spurgeon, Qld, Sept. 1936, *C.T.White 10643*; holo: BRI; iso: BRI.

Illustration: D.B.Foreman, *op. cit.* 194, fig. 1.

Tree to 10 m tall. Branchlets ferruginous-tomentose towards tips, glabrescent lower down. Leaves: petiole 5–8 mm long; lamina usually elliptic, 5–13.5 cm long, 2–5.5 cm wide, sparsely ferruginous-pilose, particularly on midrib and lateral veins; tips acute to acuminate; margin recurved, entire or sparsely dentate apically, sub-bullate, leathery; venation dense, obscure; lateral veins 8–12 pairs. Conflorescence axillary, 7–11.5 cm long, laxly flowered, ferruginous-pilose; pedicels c. 2 mm long. Tepals 10–13 mm long, sparsely ferruginous-pilose; colour unknown; limb c. 3 mm long, c. 1.5 mm wide. Anthers c. 1.5 mm long.

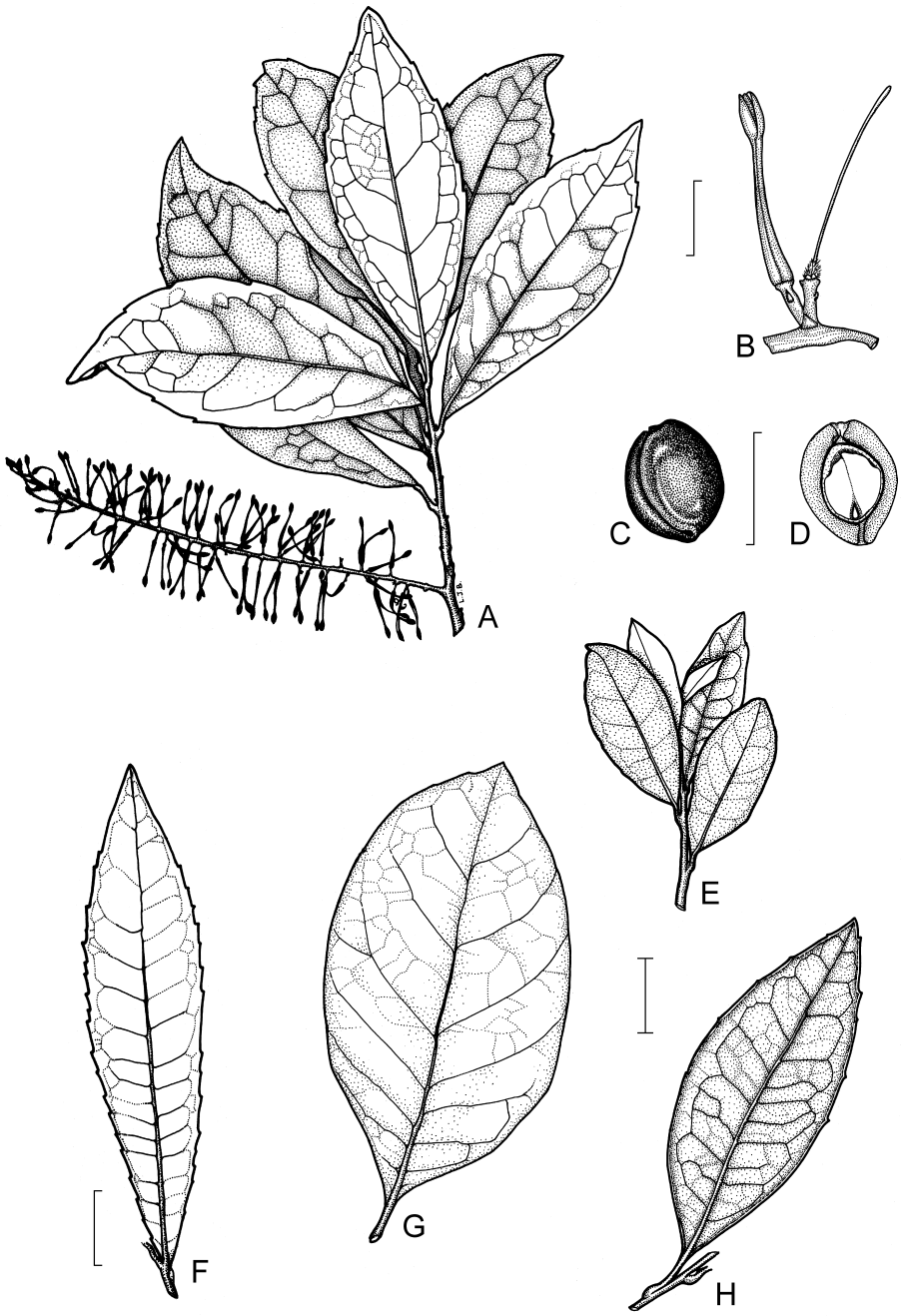



**Figure 173**. *Helicia*. **A–D**, *H. australasica*. **A**, flowering branchlet; **B**, flower pair (**A–B**, V.Moriarty 1133, MEL); **C**, fruit; **D**, L.S. through fruit (**C–D**, B.Hyland RFK 3586, QRS). **E**, *H. glabriflora*, branchlet (R.Coveny 918, MEL). **F**, *H. ferruginea*, leaf (Tweed R., N.S.W., W.Bauerlen s.n., MEL). **G**, *H. lamingtoniana*, leaf (Evelyn, Qld, J.Bailey, MEL). **H**, *H. recurva*, leaf (C.White 10643, MEL). Scale bars: **A**, **E–H** = 2 cm; **B** = 5 mm; **C**, **D** = 1 cm. Drawn by L.Button.

Hypogynous glands rounded, free. Ovary sparsely ferruginous- to rufous-pilose. Fruit ovoid, 8–11 mm long, 5–7.5 mm diam., becoming dark blue. Fig. 173H.

Known only from Mt Spurgeon and the upper reaches of the Mossman River, Qld; grows in simple notophyll vine forest in soils derived from granite at altitudes to 1250 m. Map 445.

Qld: upper Mossman R., 21 Oct. 1938, *H.Flecker s.n.* (QRS); Platypus Ck, head of Mossman R., *J.G.Tracey 14883* (BRI); near Schillers Hut, Mt Spurgeon, *L.J.Webb & J.G.Tracey 13370* (BRI).

Distinguished from *H. australasica* by having more coriaceous leaves. The veins are impressed above, giving them a sub-bullate appearance.

### 4. **Helicia grayi** Foreman, *Brunonia* 6: 64 (1983)

T: State Forest Reserve 143, Leichhardt Logging Area, Mt Lewis, Qld, 11 Aug. 1976, *B.Gray 178;* holo: QRS.

Illustration: D.B.Foreman, *op. cit.* 65, fig. 1.

Tree 10 m tall; most parts glabrous. Leaves: petiole 5–7 mm long; lamina narrowly elliptic to oblanceolate, 7.5–13.5 cm long, 2–4 cm wide, glabrous; tips acuminate; margin entire or irregularly dentate (especially in juvenile leaves); venation dense, prominent on both surfaces; lateral veins 7 or 8 pairs. Conflorescence axillary or ramiflorous, 6.5–12 cm long, densely flowered, ferruginous-pilose; pedicels c. 5 mm long. Tepals c. 18 mm long, cream, glabrous; limb 4.5–6 mm long, c. 1.5 mm wide. Anthers 4–5.5 mm long. Hypogynous glands obtuse, 4-lobed, fused at base. Ovary rufous-tomentose. Fruit (immature) ovoid, c. 14 mm long, c. 10 mm diam., becoming blue to purple.

Known from only a few localities in northern Qld; grows in subtropical rainforest at c. 1000 m alt. Map 446.

Qld: State Forest Reserve 143, North Mary Logging Area, Mt Lewis, *B.P.M.Hyland 3247* (NE, QRS, RFK); Thornton Peak, *B.P.M.Hyland 7057* (QRS); Mt Finnigan, *J.M.Powell & J.A.Armstrong 704* (QRS); Mt Lewis Forestry Rd, 5 km from Mossman–Mt Molloy road, *J.W.Wrigley & I.R.Telford 223* (BRI, CBG).

This species is readily distinguished from both *H. australasica* and *H. glabriflora* by its longer tepals and pedicels. There is insufficient variation to warrant the recognition of infraspecific taxa.

### 5. **Helicia blakei** Foreman, *Brunonia* 6: 66 (1983)

T: Boonjee, near Malanda, Qld, 29 July 1943, *S.T.Blake 15226*; holo: BRI; iso: MEL.

Illustration: D.B.Foreman, *op. cit.* 66, fig. 2.

Small tree; most parts glabrous. Leaves: petiole 10–20 mm long; lamina narrowly elliptic to ±lanceolate, 5.5–12.5 cm long, 2–4 cm wide, glabrous; tips acuminate; margin entire or irregularly and sparsely dentate; venation dense; lateral veins 5–8 pairs. Conflorescence axillary or ramiflorous, 8–14 cm long, densely flowered, ferruginous-pilose; pedicels 4–5 mm long. Tepals 15–17 mm long, dull yellow, sparsely ferruginous-pilose; limb c. 3.5 mm long. Anthers c. 3 mm long. Hypogynous glands 4-lobed, fused into a cup. Ovary glabrous. Fruit not seen.

Known only from Boonjee and Mt Bellenden Ker in north-eastern Qld; grows in rainforest at altitudes of 730–915 m. Map 447.

Qld: Mt Bellenden Ker, *R.H.Cambage 3822* (NSW).

Specimens are morphologically very homogeneous. More material is required to determine infraspecific variation.

### 6. **Helicia lewisensis** Foreman, *Brunonia* 6: 67 (1983)

T: Forest Reserve 143, North Mary Logging Area, Mt Lewis, Qld, 15 Apr. 1974, *A.K.Irvine 1333*; holo: QRS.

Illustration: D.B.Foreman, *op. cit.* 68, fig. 3.

Tree 15 m tall; most parts ferruginous-pilose, sometimes sparsely so. Leaves: petiole 8–12 mm long; lamina broadly elliptic, 7.5–15.5 cm long, 3–7 cm wide, glabrous except for a few ferruginous hairs on midrib and veins; tips abruptly acuminate or acute; margin irregularly dentate; venation dense, most clearly visible beneath; lateral veins 5–7 pairs. Conflorescence axillary or ramiflorous, 9–11.5 cm long, densely flowered, laxly ferruginous-pilose; pedicels c. 5 mm long. Tepals c. 15 mm long, cream to various shades of mauve or purple, ferruginous-pilose; limb 3–4 mm long, c. 1 mm wide. Anthers 2.5–3 mm long. Hypogynous glands distinctly 4-lobed, fused at base. Ovary glabrous. Fruit (immature) globose, c. 6 mm diam.; colour at maturity not known. Fig. 140.

Known only from Mt Lewis in northern Qld, in rainforest at altitudes of 1000–1140 m. Map 448.

Qld: State Forest Reserve 144, Mt Lewis, *B.P.M.Hyland 9190* (QRS); State Forest Reserve 143, Mt Lewis, *K.D.Sanderson 498* (QRS).

A very distinctive species. The specimens that have been seen are morphologically homogeneous, as is often the case for a species with a restricted distribution.

### 7. **Helicia lamingtoniana** (F.M.Bailey) C.T.White ex L.S.Sm., *Proc. Roy. Soc. Queensland* 62: 79 (1952)

*Hollandaea lamingtoniana* F.M.Bailey, *Queensland Agric. J.* 5: 390 (1889). T: Evelyn, Qld, 6 Aug. 1899, *F.M.Bailey s.n.*; holo: BRI.

Tree to 15 m tall; all parts ±dark ferruginous or rufous-tomentose. Leaves: petiole 5–7 mm long; lamina orbicular, 6–15.5 cm long, 4–9 cm wide; tips acute, abruptly acuminate to obtuse; margin ±denticulate; venation dense, visible on both surfaces; lateral veins 8 or 9 pairs. Conflorescence axillary, 7–9 cm long, laxly flowered; pedicels 2–5 mm long. Tepals 12–18 mm long, cream colour visible beneath indumentum; limb c. 3 mm long, c. 2 mm wide. Anthers c. 2.5 mm long. Hypogynous glands ovate-oblong, free. Ovary densely rufous-tomentose. Fruit ovoid, c. 10 mm long, c. 8 mm diam., becoming dark blue to almost black. *Lamington's Silky Oak, Silky Oak*. Fig. 173G.

Apparently restricted to the Atherton Tableland, Qld where it grows in rainforest at altitudes of 300–1100 m. Map 449.

Qld: Tableland Logging Area, *G.C.Stocker 914* (BRI, QRS); near the Crater, between Atherton and Ravenshoe, *L.J.Webb & J.G.Tracey 6271* (BRI); Atherton Tableland, *K.White 53/262* (BRI).

*Helicia lamingtoniana* shows little infraspecific variation. Its longer flowers distinguish it from *H. nortoniana* which also has rust-coloured indumentum covering the flowers.

### 8. **Helicia nortoniana** (F.M.Bailey) F.M.Bailey, *Queensland Fl.* 4: 1328 (1901)

*Cyanocarpus nortoniana* F.M.Bailey, *Rep. Govt Sci. Exped. Bellenden-Ker Ra.* 55 (1889). T: Tringilburra Creek and creeks off Russell River, Qld, *F.M.Bailey s.n.*; holo: BRI; iso: MEL.

*Helicia ferruginea* var. *tropica* F.M.Bailey, *Compr. Cat. Queensland Pl.* 452 (1913); *H. tropica* (F.M.Bailey) Domin, *Biblioth. Bot.* 89: 30 (1921). T: Johnstone River, Qld, 1889, *S.Johnson s.n.*; holo: MEL.

[*Helicia ferruginea auct. non* F.Muell.: G.Bentham, *Fl. Austral.* 5: 405 (1870) *p.p.*]

Illustration: K.A.W.Williams, *Native Pl. Queensland* 2: 155 (1984).

Shrub or tree to 20 m tall; all parts rufous- to ferruginous-tomentose, but indumentum often not persisting on leaves, or becoming sparse. Leaves: petiole 5–10 mm long; lamina ovate-elliptic to oblong-lanceolate, 5.5–14 cm long, 2–7.5 cm wide; tips acuminate to subacute; margin irregularly serrate; venation lax to dense; lateral veins 6–10 pairs. Conflorescence axillary to subterminal, to 10 cm long, densely flowered; pedicels 1–2 mm long. Tepals c. 8.5 mm long, creamy brown; colour hidden by indumentum; limb c. 2 mm long, c. 1 mm wide. Anthers c. 1.5 mm long. Hypogynous glands broadly ovate-oblong, free. Ovary rufous-tomentose. Fruit ovoid, 10–13 mm long, 8–10 mm diam., becoming blue. *Norton's Silky Oak*.

Occurs mostly on the Atherton Tableland, but extends to just south of Cooktown, Qld; grows in rainforest at altitudes to c. 900 m. Map 450.

Qld: Big Tableland, c. 27 km SE of Cooktown, *L.S.Smith 11188* (BRI); near Jaggan, S of Malanda, *L.S.Smith & L.J.Webb 3330* (BRI); Portion 92, Malanda, *G.C.Stocker 1418* (NE); Boonjee area, *L.J.Webb & J.G.Tracey 6153* (NSW); Mt Bellenden Ker, *C.T.White 1290* (NSW).

*Helicia nortoniana* is very variable in leaf size and conflorescence length. However, this variation is insufficient to warrant recognition of infraspecific taxa.

### 9. Helicia ferruginea F.Muell., *Fragm.* 3: 37 (1862)

T: Clarence River, N.S.W., *C.Moore 235*; holo: MEL 93809.

*Helicia bauerlenii* C.T.White, *Proc. Roy. Soc. Queensland* 55: 80 (1944). T: Uralba [Ballina], N.S.W., Nov. 1891, *W.Bäuerlen 629*; holo: BRI; iso: MEL, NSW.

Shrub or small tree 2.4–10 m tall; all parts ±densely ferruginous or rufous-tomentose. Leaves: petiole 2–10 mm long; lamina lanceolate to oblong-lanceolate, 9–35 cm long, 3–9 cm wide; tips acute; margin serrate; venation dense, prominent on both surfaces; lateral veins 12–20 pairs. Conflorescence axillary, to 8 cm long, densely flowered; pedicels 1–2 mm long. Tepals c. 6 mm long, completely covered with rusty hairs; limb c. 2.5 mm long, c. 1.5 mm wide. Anthers 1.5–2 mm long. Hypogynous glands ovate, free or fused at base. Ovary ferruginous-hirsute. Fruit ovoid, 10–13 mm long, c. 10 mm diam., turning blue. *Rusty Helicia, Rusty Oak, Hairy Honeysuckle.* Fig. 173F.

Occurs in south-eastern Qld and north-eastern N.S.W.; grows on the coast and nearby ranges in rainforest to altitudes of 900 m. Map 451.

Qld: upper Coomera R., 21 May 1951, *L.A.S.Johnson* (NSW); Lamington Natl Park, 28 Nov. 1942, *C.T.White* (BRI). N.S.W.: Red Scrub, Whian Whian State Forest, c. 16 km SW of Mullumbimby, *H.C.Hayes et al. 2617* (NSW).

The brown to pinkish, close-grained timber is used for cabinet work. Although there is considerable range in leaf size in this species, most other diagnostic characters are much less variable.

## Excluded names

*Helicia cribbiana* (F.M.Bailey) F.M.Bailey, *Queensland Fl.* 4: 1327 (1901).

T: Gadgarra Reserve, Peeramon, Qld, May 1929, *S.F.Kajewski 1024;* holo: BRI.

This is *Corynocarpus cribbiana* (F.M.Bailey) L.S.Sm., *Proc. Roy. Soc. Queensland* 67: 31 (1956).

*Helicia verticillata* F.Muell., *Fragm.* 6: 191 (1868).

T: eastern Australia [cultivated material introduced from South Africa], *F.W.L.Leichhardt s.n.*; holo: MEL.

This is *Brabejum stellatifolium* L., *Sp. Pl.* 121 (1753).

## 32. XYLOMELUM

*D.B.Foreman*

*Xylomelum* Sm., *Trans. Linn. Soc. London* 4: 214 (1798); from the Greek *xylon* (wood) and *melon* (tree-fruit), in reference to the woody fruit.

Type: *X. pyriforme* (Gaertn.) R.Br.

Tall shrubs to small trees. Branchlets and leaves villous to tomentose when young, glabrescent. Leaves opposite, simple; margin entire to variously lobed or toothed. Conflorescence spike-like, axillary, in opposite pairs, appearing terminal at first, becoming lateral by elongation of branchlets, or conflorescence robust, terminal, densely-flowered and paniculately-branched; involucral bracts oblong or ovate to orbicular, caducous; floral bracts

small, caducous, sometimes apparently absent. Flowers actinomorphic, bisexual. Receptacle straight. Perianth straight; tepals becoming revolute at anthesis. Stamens 4; filament and connective short. Hypogynous glands 4, small, free, ±oblong. Ovary sessile or shortly stipitate, 1-locular; ovules 2, sometimes abortive; style slender; pollen presenter ellipsoidal, clavate or cucullate. Fruit ±ovoid, sometimes tapered distally, splitting tardily into 2 valves. Seeds 2, flattened with a terminal wing. *n* = 14, H.P.Ramsay, *Austral. J. Bot.* 11: 5 (1963).

A widespread, endemic genus of 6 species; 2 are confined to south-western W.A., the remainder to eastern N.S.W. and Qld.

A.S.George, *Intr. Proteaceae W. Australia* 108–109 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 549–551 (1989).

**1** Leaves linear to linear-lanceolate, entire; fruit pale grey to whitish — **1. X. angustifolium**

**1:** Leaves broader than long or lanceolate, entire or variously toothed; fruit various shades of brown or ferruginous, sometimes weathering to grey but not whitish

**2** Lamina ±glaucous beneath; tepals 5–7 mm long; fruit broadest just below the middle, acuminate and recurved distally — **3. X. scottianum**

**2:** Lamina not glaucous beneath; tepals more than 7 mm long; fruit broadest near the middle, not acuminate and recurved distally

**3** Conflorescence dark ferruginous-villous; tepals 10–13 mm long, dark ferruginous-tomentose or villous; fruit dark ferruginous-velvety — **4. X. pyriforme**

**3:** Conflorescence and tepals pale brown-woolly or pale brown-, grey-brown- or ferruginous-tomentose; tepals 7–10 mm long; fruit ferruginous or pale brown-velvety, sometimes weathering grey

**4** Conflorescence and tepals pale brown-woolly; tepals c. 12 mm long; fruit pale brown-velvety, weathering grey — **2. X. occidentale**

**4:** Conflorescence and tepals pale brown, grey-brown or pale ferruginous-tomentose or pilose; tepals to 10 mm long; fruit ferruginous- or pale brown-velvety

**5:** Leaves narrowly ovate, ovate or narrowly obovate; tepals 7–8 mm long; fruit pale brown-velvety — **5. X. salicinum**

**5:** Leaves lanceolate; tepals 8–10 mm long; fruit ferruginous-velvety, weathering grey — **6. X. cunninghamianum**

## 1. Xylomelum angustifolium Kippist & Meisn. ex Meisn *in* A.L.P.P. de Candolle, *Prodr*. 14: 423 (1856)

T: Swan River Colony [W.A.], *J.Drummond 5, suppl. 7*; *n.v.*

Tall shrub or small tree to 7 m, often mallee-like. Leaves with petiole 4–12 mm long; lamina linear to linear-lanceolate, aristate, 8.5–13 cm long; margin entire (juvenile leaves 2- or 3-toothed apically); apex often uncinate. Conflorescence 5–8 cm long, pale brown-pubescent. Tepals 7 mm long, creamy white, pale brown-pubescent. Ovary pale brown-pilose; pollen presenter clavate, often pubescent. Fruit ±ovoid, 5.5–8.5 cm long, pale grey or whitish, pubescent or velvety. Seeds 4.5–7 cm long, mottled brown and cream. *Sandplain Woody Pear*. Fig. 174A–D.

Common on the sand plains from Murchison River to near Corrigin, W.A. Flowers Dec.–Feb. Map 452.

W.A.: 20 km W of Eneabba on Brand Hwy, *R.J.Cranfield 1211* (MEL); Marchagee Track, 27 km E of Brand Hwy, *D.B.Foreman 473* (MEL); Koombekine, alongside Avon, *B.H.Smith 641* (MEL).

Plants regenerate after fire from a woody underground stock. Most carpels of specimens examined had abortive ovules.

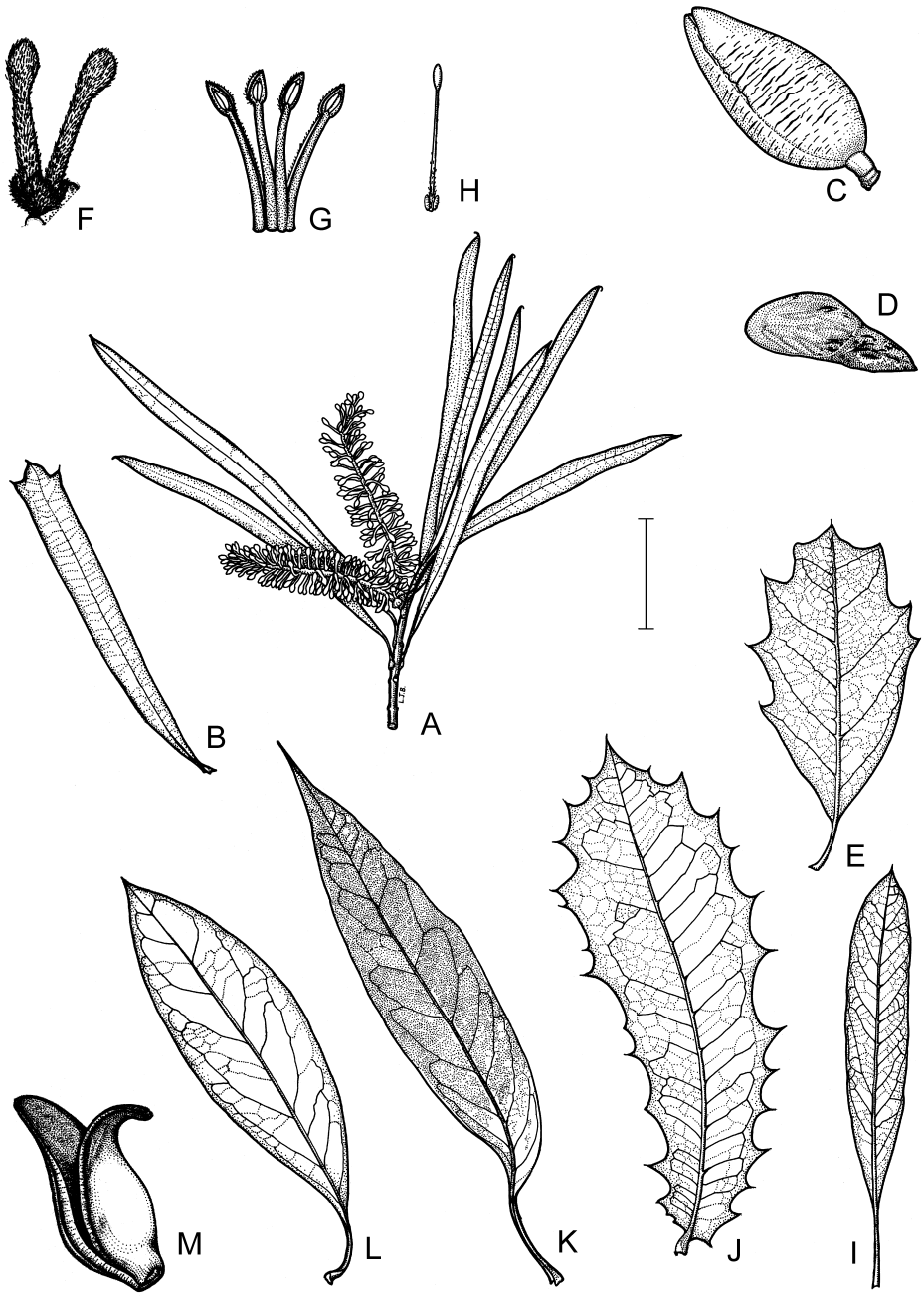



**Figure 174**. *Xylomelum*. **A–D**, *X. angustifolium*. **A**, flowering branchlet; **B**, coppice leaf; **C**, fruit; **D**, seed (**A–D**, B.Smith 641, MEL). **E–H**, *X. occidentale*. **E**, leaf (D.Foreman 847, MEL); **F**, flower pair; **G**, flower spread open (gynoecium removed); **H**, gynoecium (**F–H**, Augusta, W.A., W.Blackall s.n., PERTH). **I**, *X. cunninghamianum*, leaf (D.Foreman 873, MEL). **J–K**, *X. pyriforme*. **J**, coppice leaf; **K**, adult leaf (**J–K**, Lane Cove, N.S.W., J.Jones, MEL). **L–M**, *X. scottianum*. **L**, leaf; **M**, fruit (**L–M**, Stuarts R., Qld, S.Johnson s.n., MEL). Scale bar: **A–E**, **I–M** = 3 cm; **F–H** = 1 cm. Drawn by L.Button.

**2. Xylomelum occidentale** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 31 (1830)

T: Geographe Bay [W.A.], 1827, *C.Fraser*; *n.v.*

Tree to 8 m tall. Bark rough, flaky, often blackened by fire. Leaves with petiole 1–2 cm long; lamina ±elliptic, to 12.5 cm long, 4.5 cm wide; margin entire to variously lobed; lobes pungent. Conflorescence (main axis) of terminal clusters, to 22 cm long; lateral spikes 10–12 cm long, densely pale brown-woolly; involucral bracts oblong to broadly ovate; floral bracts 1–1.5 mm long. Tepals c. 12 mm long, cream, pale brown-woolly. Ovary pale brown-woolly; pollen presenter clavate, c. 2.5 mm long. Fruit 7–9.5 cm long, ±ovoid, pale brown-velvety, weathering to grey. Seeds 6.5–7 cm long, brown. *Western Woody Pear*. Figs 142, 174E–H.

Common in the sandy woodlands between Perth and Albany, W.A. Flowers Dec.–Feb. Map 453.

W.A.: Augusta, Dec. 1930, *W.E.Blackall* (PERTH); 12 km SE of Bunbury, on road to Boyanup, *D.B.Foreman 847* (MEL); 19 km SW of Nannup, *G.J.Keighery 1530* (PERTH); Picton Rd, Picton Junction, 7 km N of Bunbury, *G.J.Keighery 5853* (PERTH).

**3. Xylomelum scottianum** (F.Muell.) F.Muell., *Fragm.* 5: 174 (1866)

*Helicia scottiana* F.Muell., *Fragm.* 4: 107 (1864). T: Rockingham Bay, Qld, 8 Feb. 1874, *J.Dallachy*; holo: MEL.

[*Xylomelum salicinum auct. non* (Meisn.) A.Cunn. ex Benth.: G.Bentham, *Fl. Austral.* 5: 408 (1870) *p.p.*, as to J.Dallachy collection]

Shrub or small tree to 10 m tall. Leaves with petiole 1–3.5 cm long; lamina elliptic to lanceolate, 7–20 cm long, 1.5–4 cm wide, apiculate, ±glaucous beneath, sometimes slightly curved; margin entire. Conflorescence 5–13 cm long, densely pale brown-tomentose. Tepals 5–7 mm long, cream, pale brown-tomentose. Ovary densely pale brown-tomentose; pollen presenter ellipsoidal or style terminating in a small, mushroom-shaped hood. Fruit 6.5–8.5 cm long, ±ovoid; apex recurved, glabrous. Seeds 6.8–7.5 cm long, pale to mid-brown. *Peg-Tree*. Fig. 174L–M.

Widespread in the drier areas of Cape York Peninsula and Thursday Is., Qld; particularly common in sandy soils in open forests, at altitudes to 440 m. Flowers Oct.–May. Map 454.

Qld: Browns Ck, Pascoe R., *L.Brass 19633* (BRI); Thursday Is., *J.Clarkson 3798* (BRI); between Emerald Ck and Davis Ck, *B.P.M.Hyland 7943* (BRI); 23.5 km ENE of Weipa Mission, *R.Specht & R.Salt W185* (BRI).

Coppice leaves are sometimes found on plants which have recently been burnt. These leaves are often prickly-toothed, ±oblong and have a short petiole. Carpels with an ellipsoidal pollen presenter invariably show no signs of fruit development. An infusion of the bark and leaves was drunk by Aborigines to relieve internal pains.

**4. Xylomelum pyriforme** (Gaertn.) Knight, *Cult. Prot.* 105 (1809)

*Banksia pyriformis* Gaertn., *Fruct. Sem. Pl.* 220: t. 47, fig. 1 (1788); *Hakea pyriformis* (Gaertn.) Cav., *Icon.* 25: t. 536 (1800); *Conchium pyriforme* (Gaertn.) Willd., *Enum. Pl.* 141 (1809). T: New Holland [Australia], 1770, *J.Banks & D.Solander s.n.*; holo: BM.

Illustration: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 549 (1989).

Tall shrub or small tree to 4–5 m. Leaves with petiole 1.2–4 cm long; lamina narrowly elliptic, elliptic or ovate, acuminate, 10–20 cm long, to 5 cm wide, coriaceous, glabrous; margin entire, or sinuate and prickly-toothed on juvenile plants. Conflorescence 5–8 cm long, dark ferruginous-villous; involucral bracts persistent, ±orbicular, c. 4 mm long, 4 mm wide; floral bracts ovate, to c. 5 mm long and wide, often persisting, ferruginous-villous. Tepals 10–13 mm long, creamy white, ferruginous-tomentose to -villous. Ovary ferruginous-tomentose; pollen presenter cucullate or ±clavate. Fruit 6–9 cm long, ellipsoidal, dark ferruginous-velvety. Seeds to 7 cm long, mid-brown. *Woody Pear*, *Wooden Pear* or *Native Pear*. Figs 141, 174J–K.

Widespread from the Illawarra district to the north coast of N.S.W.; grows in sandy soil in sclerophyll forests on the coast and nearby ranges. Flowers Sept.–Nov. Map 455.

N.S.W.: Botany Bay, 1770, *J.Banks & D.Solander* (MEL); Lane Cove Natl Park, 28 Dec. 1963, *M.Gray* (BRI); Port Jackson, June or July 1823, *F.W.Sieber 23* (MEL); Lawson, Blue Mtns, *J.E.Tenison-Woods* (MEL).

Young leaves are reddish in colour and contain cyanogenic compounds. Carpels with clavate pollen presenters appear to be infertile. Seeds said to be edible.

### 5. Xylomelum salicinum (Meisn.) Benth., *Fl. Austral.* 5: 408 (1870)

*Xylomelum pyriforme* var. *salicinum* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 423 (1856). T: on the Brisbane River, about 88 miles [140 km] NW from the penal settlement on that stream [Qld], 25 June 1829, *A.Cunningham 36*; holo: K, MEL, photo seen.

Tree to 14 m tall. Leaves with petiole 1–3.3 cm long; lamina ovate, narrowly ovate, elliptic or obovate, apiculate, 10–18 cm long, 2–4.8 cm wide; margin entire, slightly sinuate or dentate (tooth number variable). Conflorescence 4.5–7.5 cm long, pale brown- or grey-brown-tomentose; involucral bracts broadly ovate. Tepals 7–8 mm long, white, pale brown- or grey-brown-tomentose. Ovary pale brown- or grey-brown-puberulous; pollen presenter clavate. Fruit to 9 cm long, 3.5–4 cm wide, ellipsoidal, pale brown-velvety. Seeds to 7.5 cm long, brown.

Occurs in coastal regions of south-eastern Qld, in dry sclerophyll scrub or woodland in sandy soil. Flowers Dec.–July. Map 456.

Qld: Elliot R., near Bundaberg, *D.A.Coy & L.S.Smith 560* (BRI); Glass House Mtns, *J.Shirley* (BRI); Fraser Is., *C.T.White 2524* (BRI); Tin Can Bay, *C.T.White 12280* (BRI).

### 6. Xylomelum cunninghamianum Foreman, *Muelleria* 6: 299 (1987)

T: 4–5 km NW of Wallangra, on road to Coolatai, N.S.W., 18 Aug. 1985, *D.B.Foreman 873*; holo: MEL; iso: BRI, CANB, NSW.

[*Xylomelum salicinum auct. non* (Meisn.) A.Cunn. ex Benth.: G.Bentham, *Fl. Austral.* 5: 408 (1870) *p.p.*, as to Leichhardt and Lau collections; F.J.H. von Mueller, *S. Sci. Record, n.s.* 2: unpaged preprint (1886)]

Illustration: D.B.Foreman, *op. cit.* 300, fig. 1.

Tree to 12 m tall. Leaves with petiole 1–2 cm long; lamina lanceolate, apiculate, 5–12.5 cm long, 1.2–2.3 cm wide; margin entire, slightly sinuate, or prominently toothed apically. Conflorescence to c. 46 cm long, pale ferruginous-tomentose; involucral bracts ±broadly oblong to broadly ovate. Tepals 8–10 mm long, yellow, ferruginous-pubescent or pilose. Ovary ferruginous-tomentose; pollen presenter ellipsoidal. Fruit 6–9 cm long, 3–4.5 cm wide, ±ovoid, shortly ferruginous-velvety, weathering to grey. Seeds 5–7 cm long, 1.5–2 cm wide, pale brown. Fig. 174 I.

Scattered throughout inland regions of south-eastern Qld and north-eastern N.S.W.; grows in dry sclerophyll forest in sandy soil at altitudes of 350–630 m. Flowers Feb.–May. Map 457.

Qld: Isla Gorge, 24 May 1977, *N.Byrnes & M.Olsen* (BRI); Blackdown Tableland, 22 Feb. 1982, *S.Pearson* (BRI). N.S.W.: 4.9 km E of Yetman, *R.G.Coveny 11651 & P.G.Wilson* (NSW); 4–5 km NW of Wallangra on road to Coolatai, *D.B.Foreman 880* (MEL).

This is '*X. sp.*' of S.W.L.Jacobs & J.Pickard, *Pl. New South Wales*, 182 (1981) and '*Xylomelum* sp. 1' of T.D.Stanley & E.M.Ross, *Fl. SE Queensland* 2: 17 (1986). The latter authors cited this as containing a cyanogenic glycoside, but with no recorded cases of poisoning.

## Subtrib. 3. TRIUNIINAE

*Proteaceae* subtrib. *Triuniinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 173 (1975).

Type: *Triunia* L.A.S.Johnson & B.G.Briggs

Peduncles and floral bracts absent. Flowers zygomorphic, with 3 tepals fused and 1 free. Ovules 2, laterally inserted, hemitropous. Fruit indehiscent, fleshy. Seed 1, thick, wingless.

A subtribe of 1 genus, endemic in the rainforests of eastern Australia.

## 33. TRIUNIA

*D.B.Foreman*

*Triunia* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 175 (1975); from the Latin *tri-* (three) and *unus* (one), in reference to the coherence of three tepals at a level higher than the fourth.

*Helicia* sect. *Macadamiopsis* Sleumer, *Blumea* 8: 8 (1955). T: *H. youngiana* C.Moore & F.Muell. ex F.Muell. = *T. youngiana* (C.Moore & F.Muell. ex F.Muell.) L.A.S.Johnson & B.G.Briggs

Shrubs and trees. Leaves opposite, or in whorls of 3 or 4, simple; margins entire or variously toothed. Conflorescence raceme-like, terminal, simple, solitary, ferruginous-pubescent; involucral bracts conspicuous, ±persistent; floral bracts absent. Flowers zygomorphic, cream to white, pleasantly perfumed. Receptacle straight. Perianth sparsely ferruginous-pubescent on tube, densely on limb; abaxial tepal free; other 3 fused for c. half their length. Hypogynous glands 2 (–4), adaxial, free, oblong. Stamens usually 4. Ovary sessile, 1-locular, densely ferruginous-pubescent; ovules 2; style curved, sparsely ferruginous-pubescent at base, glabrous towards tip; pollen presenter ±rhomboidal. Fruit drupaceous, indehiscent, semi-succulent. $n$ = 14, L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 169 (1975).

A genus of 4 species endemic in rainforests of eastern Australia, often at high altitudes, from near Dorrigo, N.S.W., to just south of Cooktown, north-eastern Qld.

Distinguished from *Helicia* by the asymmetrical floral structure, whorled leaves and distinctive fruit anatomy.

C.T.White, Ligneous plants collected for the Arnold Arboretum in north Queensland by S.F.Kajewski in 1929, *Contr. Arnold Arbor.* 4: 23–24 (1933), as *Macadamia p.p.*; H.Sleumer, *Helicia* sect. *Macadamiopsis p.p. in* Studies in Old World Proteaceae, *Blumea* 8: 14–15 (1955); S.L.Everist, *Poison. Pl. Australia* 593–594 (1981); D.B.Foreman, A new species of *Helicia*, new combinations and lectotypification in *Triunia* (Proteaceae) from Australia, *Muelleria* 6: 193–196 (1986); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 543–545 (1989).

**1** Adaxial surface of involucral bracts glabrous, or with a ±median band of appressed, ferruginous hairs; abaxial surface glabrous or glabrescent; fruit blue, purplish or reddish, to 25 mm diam.

**2** Adaxial surface of involucral bracts glabrous; fruits blue to reddish, c. 15 mm diam.; leaves sometimes sub-bullate, usually with a few apical teeth **1. T. youngiana**

**2:** Adaxial surface of involucral bracts with a ±median band of appressed, ferruginous hairs; fruits reddish or purplish, 15–25 mm diam.; leaves usually not sub-bullate; margins entire or variously toothed

**3** Involucral bracts narrowly ovate; abaxial surface glabrescent; leaves coriaceous, oblong-elliptic, 8–18 cm long, 2.5–6.5 cm wide; fruit reddish, to 25 mm diam. **2. T. robusta**

**3:** Involucral bracts ovate; abaxial surface glabrous; leaves coriaceous to very coriaceous, elliptic to narrowly elliptic, 5–15 cm long, 2–7 cm wide; fruit purplish, to 20 mm diam. **3. T. montana**

**1:** Adaxial surface of involucral bracts uniformly velvety, with appressed, ferruginous hairs; abaxial surface glabrous; fruit bright red, to 35 mm diam. **4. T. erythrocarpa**

## 1. Triunia youngiana (C.Moore & F.Muell. ex F.Muell.) L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 175 (1975)

*Helicia youngiana* C.Moore & F.Muell. ex F.Muell., *Fragm.* 4: 84 (1864); *Macadamia youngiana* (C.Moore & F.Muell. ex F.Muell.) F.Muell. *in* G.Bentham, *Fl. Austral.* 5: 406 (1870); *H. youngiana* var. *typica* C.T.White, *Contr. Arnold Arbor.* 4: 23 (1933), *nom. inval.* T: Duck Creek, Richmond River, N.S.W., *C.Moore s.n.*; holo: MEL.

Shrub to c. 3 m, straggling. Branchlets covered with appressed to semi-erect, ferruginous hairs, glabrescent. Leaves with petiole 4–8 mm long; lamina narrowly obovate, obovate or elliptic, 4–14 cm long, 1.2–4 cm wide, usually with 2 or 3 pairs of irregularly spaced apical teeth, coriaceous, sometimes sub-bullate, ferruginous-pubescent when young, glabrescent (some persistence ventrally). Conflorescence 4.5–7.5 cm long; involucral bracts ovate; adaxial surface glabrous; abaxial surface glabrescent. Pedicels 3–5 mm long. Tepals 1.5–2.5 mm long. Hypogynous glands usually 2. Fruit ±globose, c. 1.5 cm diam., blue to reddish, glabrescent. *n* = 14, L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 169 (1975). *Spice Bush, Red Nut.* Fig. 175 I.

Occurs from south-eastern Qld to near Dorrigo in north-eastern N.S.W.; grows in rainforest to an altitude of 1000 m. Flowers Sept.–Jan. Map 458.

Qld: Lamington Natl Park, *L.Durrington 1392* (BRI); Springbrook, terminus of Repeater Station road, Nov. 1971, *K.Williams* (BRI). N.S.W.: Murwillumbah, Sept. 1892, *W.Bäuerlen* (MEL); Byrangery Ck, 17.5 km N of Lismore, *E.F.Constable 4872* (BRI); Victoria Park, Dalwood, 6.4 km SSW of Alstonville, *R.G.Coveny 4590* (BRI).

The seeds of this tree are poisonous.

## 2. Triunia robusta (C.T.White) Foreman, *Muelleria* 6: 196 (1986)

*Helicia youngiana* var. *robusta* C.T.White, *Contr. Arnold Arbor.* 4: 23 (1933). T: Eumundi, Qld, Nov. 1892, *J.H.Simmonds s.n.*; lecto: BRI; isolecto: BRI, *fide* D.B.Foreman, *loc. cit.*

Shrub or small tree. Branchlets ferruginous-pubescent, soon glabrescent. Leaves with stout petiole 5–8 mm long; lamina oblong-elliptic, 8–18 cm long, 2.5–6.5 cm wide, coriaceous, usually not sub-bullate, glabrous at maturity (some hairs may persist ventrally); margins entire or with several coarse, irregularly-spaced apical teeth. Conflorescence 8–10 cm long; involucral bracts narrowly ovate; adaxial surface with a ±median band of appressed, ferruginous hairs; abaxial surface glabrescent. Pedicels 6–8 mm long. Tepals 16–20 mm long. Hypogynous glands 2 (–4). Fruit subglobose, c. 25 mm long, c. 23 mm diam., reddish, with short, sparse, ferruginous hairs, glabrescent. Fig. 175A.

Previously known only from the Eumundi and Maroochie (Yandina) areas of south-eastern Qld. The species has recently been discovered near Woombye. Map 459.

Qld: Maroochie [Yandina], Nov. 1879, *F.M.Bailey* (MEL); Eumundi, *J.H.Simmonds 432* (BRI); Woombye, *P.I.Forster 6145, A.R.Bean & M.C.Tucker* (BRI, CANB, CBG, K, MEL, NE, NSW).

The seeds are poisonous. In a letter to Baron von Mueller, dated 5 November 1879, F.M.Bailey writes: 'The man who brought me the specimen and who also showed me the plant growing is the one who say [*sic*] only about a half a nut nearly killed him in fact he was so ill after eating it that he had to get off his horse and lie down for sometime before he could go home'. This species was thought to be extinct until its rediscovery in 1989 in a small reserve near Woombye, Qld.

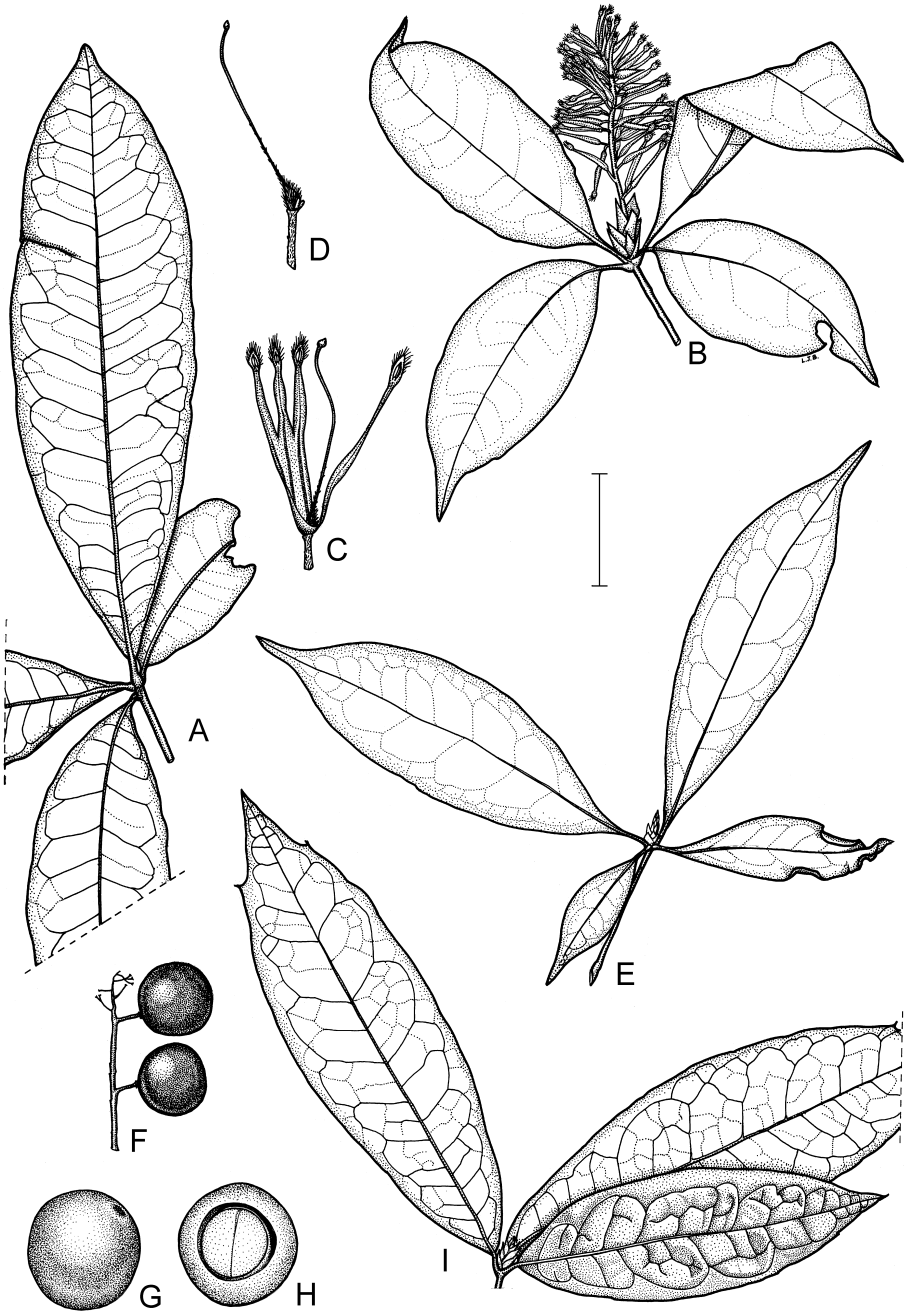



**Figure 175**. *Triunia*. **A**, *T. robusta*, branchlet (Eumundi, Qld, J.Simmonds, BRI.) **B–D**, *T. montana*. **B**, flowering branchlet; **C**, flower spread open; **D**, gynoecium (**B–D**, Mt Lewis, Qld, G.Sankowsky, QRS). **E–H**, *T. erythrocarpa*. **E**, branchlet (V.Moriarty 1961, QRS); **F**, fruits (B.Gray 2992, QRS); **G**, fruit; **H**, L.S. through fruit (**G–H**, S.Dansie 20104, QRS). **I**, *T. youngiana*, branchlet (C.Moore & W.Hill 69, MEL). Scale bar: **A**, **B**, **E–I** = 3 cm; **C**, **D** = 1 cm. Drawn by L.Button.

### 3. **Triunia montana** (C.T.White) Foreman, *Muelleria* 6: 195 (1986)

*Helicia youngiana* var. *montana* C.T.White, *Contr. Arnold Arbor.* 4: 24 (1933). T: Bellenden Ker, Palm Camp, Meston's Bellenden Ker Expedition, Qld, 1889, *F.M.Bailey s.n.*; lecto: BRI, *fide* D.B.Foreman, *loc. cit.*

Shrub or small tree 2–6 m tall. Branchlets terete, dark ferruginous-pubescent, glabrescent. Leaves with petiole 8–20 mm long; lamina elliptic to narrowly elliptic, 5–15 cm long, 2–7 cm wide, ±glossy above, duller beneath, coriaceous to very coriaceous, usually not sub-bullate, ferruginous-pubescent when young, completely glabrous at maturity; margins entire. Conflorescence 6–8 cm long; involucral bracts ovate; adaxial surface with a ±median band of appressed, ferruginous hairs; abaxial surface glabrous. Pedicels 5–6 mm long. Tepals c. 15 mm long. Hypogynous glands 2. Fruit subglobose, 15–20 mm diam., purplish, glabrescent. Seeds to c. 15 mm diam. Figs 143, 175B–D.

Known from the Bellenden Ker Range, Mt Lewis and the vicinity of Black Mountain and Mt Spurgeon in north-eastern Qld; grows in montane rainforest at altitudes of 720–1570 m. Map 460.

Qld: Mt Bellenden Ker, centre peak, near summit, *L.J.Webb & J.G.Tracey 10790* (BRI); Mt Bellenden Ker, *B.P.M.Hyland 6671* (QRS); Tree Reserve l230, Boonjee Logging Area, *B.Gray 1245* (QRS); Mt Bartle Frere, Jan. 1891, *S.Johnson* (MEL).

### 4. **Triunia erythrocarpa** Foreman, *Muelleria* 6: 302 (1987)

T: State Forest Reserve 310, Swipers Logging Area, Qld, 8 Oct. 1973, *B.P.M.Hyland 6919*; holo: QRS; iso: BRI, NSW, QRS.

[*Helicia youngiana* var. *robusta auct. non* C.T.White: C.T.White, *Contr. Arnold Arbor.* 4: 23 (1933) *p.p. quoad Kajewski 1219*]

Illustration: D.B.Foreman, *op. cit.* 303, fig. 3.

Shrub or tree to 20 m tall. Branchlets terete, ferruginous-pubescent when young, soon glabrescent. Leaves with petiole 5–8 mm long; lamina obovate to narrowly elliptic or elliptic, 6.5–10 cm long, 2–7 cm wide, ferruginous-pubescent, becoming ±glabrous, with some hairs persisting on midrib and undersurface; margins mostly entire (juvenile leaves toothed). Conflorescence to c. 7.5 cm long; involucral bracts ovate; adaxial surface ferruginous-velvety; abaxial surface glabrous. Pedicels 4–6 mm long. Tepals 12–20 mm long. Hypogynous glands 2. Fruit globose, 18–35 mm diam., bright red, glabrescent. Seeds globose, c. 20 mm diam. Fig. 175E–H.

Occurs in north-eastern Qld where it is common in the Ravenshoe–Millaa Millaa–Palmerston area, and is also known from the vicinity of Mt Spurgeon and the McDowall Range; most northerly record near Mt Amos. Grows in rainforest at altitudes of 380–1000 m. Flowers Sept.–Oct. Map 461.

Qld: State Forest Reserve 310, Windin Logging Area, *B.P.M.Hyland 7195* (QRS); E of Malanda, Atherton Tableland, *S.F.Kajewski 1219* (BRI); c. 14.5 km from Ravenshoe, on Ravenshoe–Millaa Millaa road, *K.Williams 205* (BRI).

The seeds are suspected of being poisonous.

## Trib. 5. MACADAMIEAE

*Proteaceae* trib. *Macadamieae* Venkata Rao, *Proc. Indian Acad. Sci.* 48B: 23 (1968).

Type: *Macadamia* F.Muell.

Juvenile leaves simple or divided. Peduncles and floral bracts present or absent. Pollen presenter well-developed. Ovules 2, ±pendulous, hemitropous to orthotropous. Fruit follicular or indehiscent. $n = 14$.

A tribe of 6 subtribes and 17 genera, extending from southern Africa and Madagascar through southern and eastern Asia, Malesia, Australia, New Caledonia, temperate and

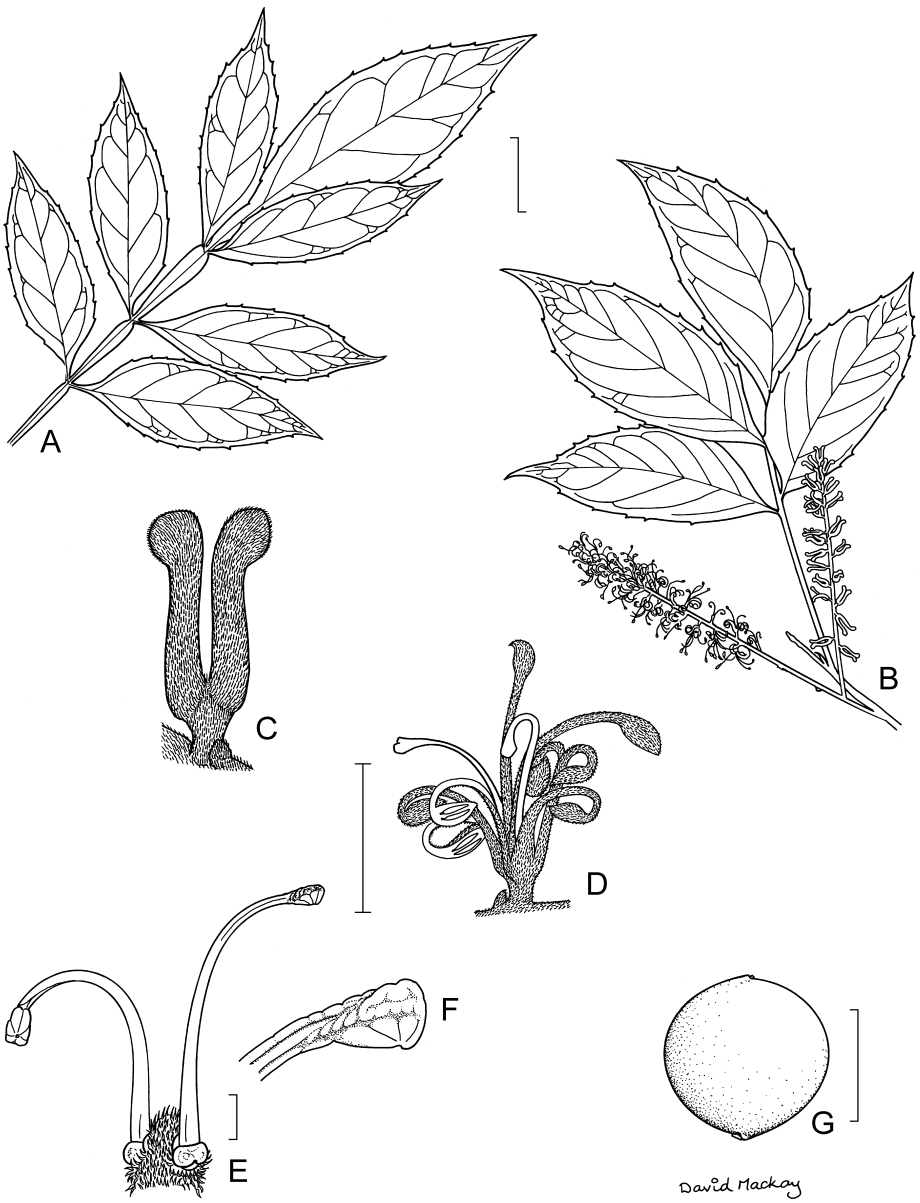



**Figure 176**. *Gevuina bleasdalei*. **A**, intermediate leaf (J.King 8, BRI); **B**, shoot with conflorescence; **C**, flower bud pair; **D**, flower pair; **E**, pair of gynoecia with hypogynous glands; **F**, pollen presenter (**B–F**, V.Moriarty 807, BRI); **G**, fruit (Atherton Tableland, Qld, E.Volck, BRI). Scale bars: **A**, **B** = 2 cm; **C**, **D** = 5 mm; **E**, **F** = 1 mm; **G** = 1 cm. Drawn by D.Mackay.

Andean South America to tropical/subtropical America. In Australia, 5 subtribes containing 7 genera, of which 5 genera are endemic.

## Subtrib. 1. GEVUININAE

*Proteaceae* subtrib. *Gevuininae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 173 (1975).

Type: *Gevuina* Molina

Juvenile leaves ±divided. Peduncles present. Floral bracts usually present. Flowers zygomorphic, with orientation anteroposterior. Hypogynous glands unequal, with posterior one sometimes absent. Pollen presenter oblique on a curved style. Fruit indehiscent. Seed 1, thick, wingless.

A subtribe of 4 genera, extending from Malesia through Australia to Melanesia, New Caledonia and temperate and tropical South America. Only 1 genus in Australia.

## 34. GEVUINA

*P.H.Weston*

*Gevuina* Molina, *Sag. Stor. Nat. Chili* 184, 353 (1781); from *gevuin*, the Chilean common name of the type species.

Type: *G. avellana* Molina

Trees. Leaves alternate; seedling leaves simple, dentate; intermediate leaves pinnatisect to imparipinnate to bipinnate; adult leaves simple to bipinnate; margins dentate. Conflorescence lateral or terminal, unbranched or branched; flower pairs bracteate, pedunculate. Flowers bisexual, ebracteate, sessile. Tepals free, not coherent; posterior tepal erect or recurved; lateral; anterior tepals revolute. Staminal filaments adnate to tepals; anthers free, ovate, apiculate. Hypogynous glands connate, anterior, fleshy, truncate. Fruit globose, sometimes umbonate; outer mesocarp thin, not succulent. Seed 1, wingless, fleshy. $x$ = 13, L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 169 (1975).

A genus of 3 species in Chile, Argentina, New Guinea and Australia; 1 species endemic in Australia.

H.Sleumer, Studies in Old World Proteaceae, *Blumea* 8: 2–95 (1955); A.C.Smith & J.Haas, Studies of Pacific island plants. XXIX. *Bleasdalea* and related genera of Proteaceae, *Amer. J. Bot.* 62: 133–147 (1975); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 546–548 (1989).

### **Gevuina bleasdalei** (F.Muell.) Sleumer, *Blumea* 8: 6 (1955)

*Grevillea bleasdalei* F.Muell., *Fragm.* 5: 90 (1865); *Adenostephanus bleasdalei* (F.Muell.) Benth., *Fl. Austral.* 5: 417 (1870); *Roupala bleasdalei* (F.Muell.) F.Muell., *Syst. Census Austral. Pl.* 68 (1883); *Kermadecia bleasdalei* (F.Muell.) Benth. & Hook.f. ex F.M.Bailey, *Syn. Queensland Fl.* 434 (1883); *Euplassa bleasdalei* (F.Muell.) Diels, *Bot. Jahrb. Syst.* 54: 200 (1916); *Bleasdalea bleasdalei* (F.Muell.) A.C.Sm. & J.E.Haas, *Amer. J. Bot.* 62: 142 (1975); *Turrillia bleasdalei* (F.Muell.) A.C.Sm., *Fl. Vit. Nova* 3: 754 (1985). T: Mt McAllister, Qld, *J.Dallachy s.n.*; holo: MEL.

Illustrations: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 520, 547 (1989), as *Turrillia bleasdalei*.

Tree 5–24 m tall. Branchlets densely ferruginous-tomentose. Leaves mostly imparipinnate, 10–65 cm long, with 2–19 leaflets, moderately to densely covered with appressed, lustrous, ferruginous to crimson hairs when immature, glabrescent; rachis prominently winged in intermediate and some adult leaves; leaflets mostly elliptic to ovate, acuminate, petiolulate, 3–18 cm long, 1.1–5.5 cm wide. Conflorescence terminal, axillary or ramiflorous, erect to

spreading, with 0–6 lateral branches; rachis 3–10 cm long; flower pair bracts 0.5–1.5 mm long; peduncle 1–2.5 mm long. Tepals 7.5–12 mm long, cream, densely appressed-ferruginous-pubescent on outside. Gynoecium 6.5–10 mm long, green, glabrous. Fruit 1.5–1.9 cm long, 1.3–1.6 cm wide, blue-black. Figs 144, 176.

Occurs in rainforest on granite and basalt, on near-coastal ranges, at 600–1200 m altitude, from Mt Lewis to Eungella Range, Qld. Flowers Aug.–Nov. and Mar.–May; fruits Jan.–Mar. Map 462.

Qld: Mt Lewis road, 8.6 km from Rex Hwy, *P.H.Weston 806* (K, NSW); Tinaroo Range Rd, *L.J.Webb 11408 & J.G.Tracey* (BRI, QRS); Tazali, *G.Sankowsky 1267 & N.Sankowsky* (K, NSW); Mt Spec, *P.Claussen 1* (BRI); 13 km N of Eungella township on Dalrymple Rd, *W.J.McDonald 4466, D.G.Fell & J.P.Stanton* (NSW).

The flowers are not scented.

*Gevuina bleasdalei* closely resembles *G. papuana* (Diels) Sleumer, from northern New Guinea, differing chiefly in its more lustrous, less dense, paler, appressed indumentum. Smith & Haas (*op. cit.*) included these two species in the genus *Bleasdalea* with three others from Vanuatu and Fiji. The latter group has distinctive, laterally compressed, inequilaterally obovoid fruits, a character that Smith & Haas predicted would also be found in *G. bleasdalei* and *G. papuana*, the fruits of which were then unknown. Fruits of *G. bleasdalei* have been collected (e.g. *Sankowsky 1267*, cited above) and closely resemble those of *G. avellana*. It seems wisest to retain *G. bleasdalei* and *G. papuana* in *Gevuina*, at least until further research clarifies the relationships of these taxa.

A.C.Smith (1975) argued that the generic name *Bleasdalea* is nomenclaturally invalid and published the name *Turrillia* to replace it. The latter is typified by the Fijian species *T. vitiensis* (Turrill) A.C.Sm. I consider that *Turrillia* should be circumscribed to exclude *G. bleasdalei* and *G. papuana*.

## Subtrib. 2. HICKSBEACHIINAE

*Proteaceae* subtrib. *Hicksbeachiinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc*. 70: 173 (1975).

Type: *Hicksbeachia* F.Muell.

Juvenile leaves ±divided. Peduncles present. Floral bracts usually present. Flowers actinomorphic. Stamen filaments adnate to tepals for most of their length. Hypogynous glands 4 or ±fused into a ring. Pollen presenter radially symmetrical. Fruit indehiscent. Seed 1, thick, wingless.

A subtribe of 6 genera, extending from Madagascar through Malesia to Australia and New Caledonia. In Australia, 3 genera, all endemic.

## 35. HICKSBEACHIA

*P.H.Weston*

*Hicksbeachia* F.Muell., *S. Sci. Rec*. 3: 33 (1883); named after Sir Michael Hicks-Beach (1837–1916), British Secretary of State for the Colonies (1878–1880).

Type: *H. pinnatifolia* F.Muell.

Small rainforest trees to 15 m tall, with one or more usually unbranched stems arising from ground level. Intermediate and adult leaves alternate, pinnate to basally pinnate, with a winged rachis, but becoming deeply pinnatifid towards tip, serrate; venation of lobes and pinnae semicraspedodromus. Conflorescence axillary, cauliflorous, pendulous, unbranched; flowers paired with pairs pedunculate, bracteate. Flowers actinomorphic, bisexual, sessile to pedicillate, ebracteate; floral orientation anteroposterior. Tepals not coherent, revolute.

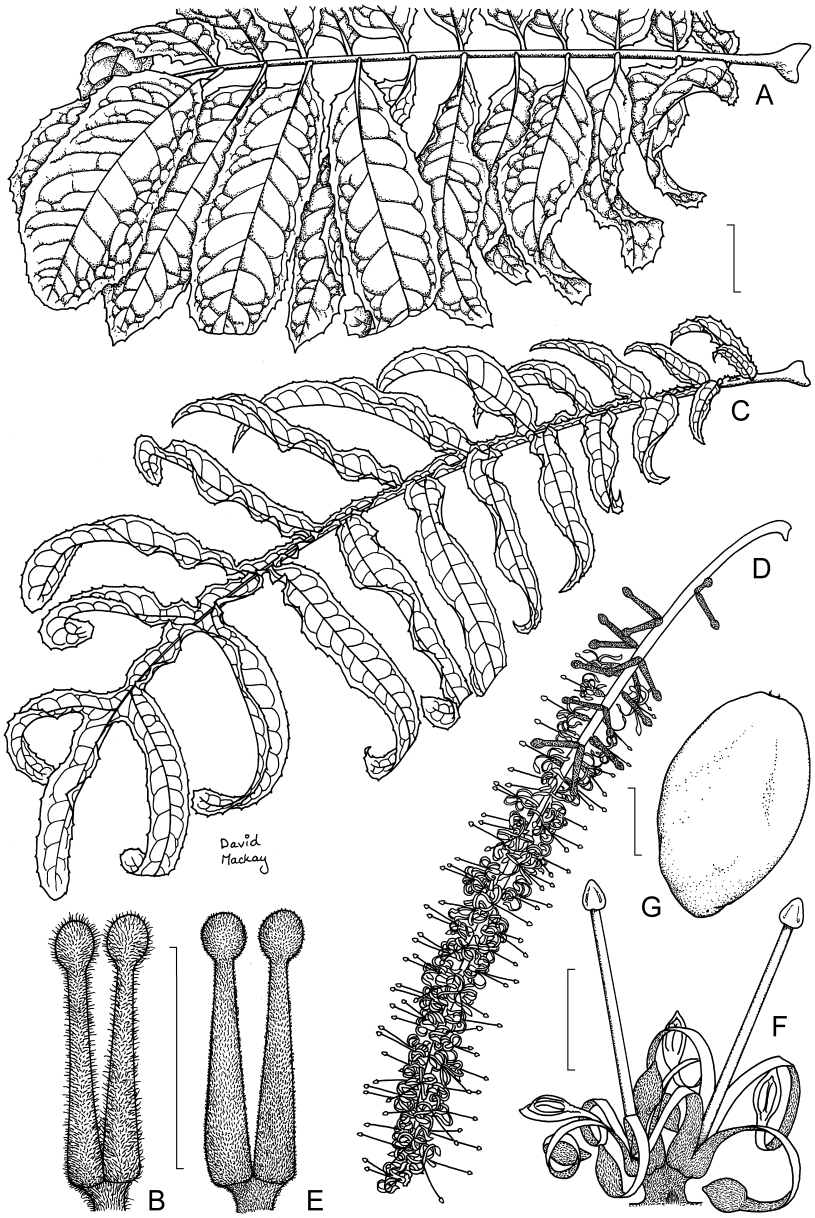



**Figure 177**. *Hicksbeachia*. **A–B**, *H. pilosa*. **A**, leaf (B.Hyland 6767, QRS); **B**, flower bud pair (E.DuRietz 4360, BRI). **C–G**, *H. pinnatifolia*. **C**, leaf (R.Thorne 21523, W.Jones & J.Tracey, NSW); **D**, conflorescence; **E**, flower bud pair; **F**, flower pair; **G**, fruit (**D–G**, drawn from living material at the Royal Botanic Gardens, Sydney, N.S.W., Apr. 1986). Scale bars: **A**, **C** = 4 cm; **B**, **E**, **G** = 1 cm; **D** = 2 cm; **F** = 5 mm. Drawn by D.Mackay.

Staminal filaments almost completely adnate to tepals; anthers free, oblong, apiculate. Hypogynous glands 4, free, fleshy, truncate. Ovary sessile; style filiform, terminated by an ovoid pollen presenter; stigma terminal. Fruit ellipsoidal to ovoid, indehiscent; outer pericarp succulent; inner pericarp bony. Seed 1, wingless, fleshy. *n* = 13 (both species), L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 169 (1975).

A genus of 2 species, endemic in eastern Australia.

The embryo is an edible 'nut'. The flowers of both species are pungently fragrant, particularly around dusk. Descriptions of this odour variously liken it to the smell of honey, sour milk, cat's urine, or mice.

F.M.Bailey, *Hicksbeachia* F.v.M., *Queensland Fl.* 1333–1334 (1901); J.H.Maiden, *Hicksbeachia pinnatifolia* F.v.M., The Monkey Nut (Family Proteaceae), *Forest Fl. New South Wales* 6: 235–239 (1917); B.Strohschen, Contributions to the biology of useful plants 5. Anatomical studies of fruit development and fruit classification of the Monkey Nut (*Hicksbeachia pinnatifolia* F.Muell.), *Angew. Bot.* 60: 249–256 (1986); P.H.Weston, A revision of *Hicksbeachia* (Proteaceae), *Telopea* 3: 231–239 (1988); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 420–422 (1989).

Conflorescence and young shoots pubescent; leaves coriaceous; leaf rachis prominently winged throughout **1. H. pinnatifolia**

Conflorescence and young shoots pilose; leaves chartaceous; leaf rachis prominently winged only towards tip **2. H. pilosa**

## 1. Hicksbeachia pinnatifolia F.Muell., *S. Sci. Rec.* 3: 33 (1883)

T: near the Tweed, N.S.W., *C.Fawcett s.n.*; not found.

Illustrations: J.H.Maiden, *Forest Fl. New South Wales* 6: t. 222 (1917); E.R.Rotheram *et al., Fl. & Pl. New South Wales & Southern Queensland* 106, figs 330, 331 (1975); P.H.Weston, *op. cit.* 233, fig. 1e–g.

Conflorescence and young shoots ferruginous-pubescent. Adult leaves 34–90 cm long, with 7–35 lobes and pinnae; rachis prominently winged throughout; lobes 2–15; pinnae 4–24; lobes and pinnae flat to concave, coriaceous, often with sinuate margins, usually not bullate; largest pinnae 14–40 cm long, 2.5–7 cm wide; secondary and tertiary veins prominently raised on both surfaces. Conflorescence axis 14–50 cm long; flower pair bracts 0.3–1 mm long; peduncle 0.3–3 mm long. Pedicels 0–1.5 mm long. Tepals 15–20 mm long, maroon outside, cream to maroon inside. Gynoecium 14–19 mm long; ovary densely hairy. Fruit 30–50 mm long, 20–28 mm wide, red. *Monkey Nut, Red Bopple Nut, Red Nut, Beef Nut, Red Apple Nut.* *Figs* 146, 177C–G.

Occurs from Tamborine Mountain, south-eastern Qld to the Bellinger Valley, north-eastern N.S.W., grows in and on the margins of subtropical rainforest. Flowers sporadically throughout the year, but mostly during Aug.–Oct. Map 463.

Qld: upper Currumbin Ck, *C.T.White 6409* (BRI). N.S.W.: 17.6 km NNE of Lismore, 0.8 km past Rocky Ck turn-off, *R.G.Coveny 4440 & A.N.Rodd* (BRI, NSW, QRS); falls on Duroby Ck, on Bilambil–North Tumblegum road, *N.S.Lander 324* (BRI, NSW); Kannaicle Creek road, 4.6 km from Missabotti, *P.H.Weston 1077, K.D.Hill & L.A.S.Johnson* (BRI, CBG, MEL, NSW, QRS).

After land-clearing, *H. pinnatifolia* often regenerates prolifically by suckering from the base.

## 2. Hicksbeachia pilosa P.H.Weston, *Telopea* 3: 236 (1988)

T: Bobbin Bobbin Falls, Cook District, Qld, 17°22'S, 145°46'E, 23 Aug. 1986, *P.H.Weston 959, G.Sankowsky & P.Hind*; holo: NSW; iso: BRI, QRS.

Illustration: P.Radke *et al.* (eds), *N. Queensland Native Pl.* 70 (1988), as *Hicksbeachia* sp. (photograph upside-down); P.H.Weston, *op. cit.* 233, fig. 1a–d.

Conflorescence and young shoots ferruginous-pilose. Adult leaves mostly 54–90 cm long, with 7–32 lobes and pinnae; rachis prominently winged only towards tip; lobes 0–4; pinnae 3–32; lobes and pinnae convex, chartaceous, with recurved, but scarcely sinuate margins, usually prominently bullate between secondary and tertiary veins; largest pinnae 11–34 cm

long, 2.5–8.5 cm wide; secondary and tertiary veins prominently raised on undersurface, usually only slightly raised on upper surface. Conflorescence axis 15–56 cm long; flower pair bracts 0.3–1 mm long; peduncle 0.3–3 mm long; pedicels 0–1.5 mm long. Tepals 19–23 mm long, pale mauve to dark purple. Gynoecium 18–22 mm long; ovary densely hairy. Fruit 40–47 mm long, 26–30 mm wide, red. Figs 145, 177A–B.

Occurs in rainforest from the Big Tableland to the Cardwell Range, north-eastern Qld. Flowers June–Nov. Map 464.

Qld: Cedar Bay, Dec. 1969, *H.Dick* (BRI); State Forest Reserve 143, Little Mossman Logging Area, *B.Gray 1458* (QRS); Atherton, cultivated from seed collected from Windin Logging Area, *B.P.M.Hyland, 6767* (NSW, QRS), Harveys Ck, 29 Aug. 1949, *H.Flecker* (BRI); Tully Falls, Aug. 1949, *A.Fielding* (NSW).

*Hicksbeachia pilosa* is geographically variable in a number of characters such as leaf size, conflorescence size and flower colour.

## 36. ATHERTONIA

*P.H.Weston*

*Athertonia* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 176 (1975); named after the Atherton Tableland (which in turn is named after John Atherton (1837–1913), a pioneer pastoralist in the district), where it occurs naturally.

Type: *A. diversifolia* (C.T.White) L.A.S.Johnson & B.G.Briggs

Hairs simple. Leaves alternate, simple, petiolate; seedling leaves not lobed, serrate; intermediate leaves deeply pinnatifid, serrate; adult leaves not lobed, serrate to entire. Conflorescence terminal, axillary, or ramiflorous, unbranched; flower pairs bracteate, pedunculate. Flowers actinomorphic, bisexual, bracteate, pedicellate. Tepals not coherent, revolute. Staminal filaments adnate to tepals; anthers free, oblong, apiculate. Hypogynous glands 4, free, fleshy, truncate. Ovary sessile; style filiform, terminated by ellipsoidal pollen presenter; stigma terminal. Fruit lenticular, indehiscent; outer mesocarp succulent, with radiating vascular strands; inner mesocarp bony, reticulate-foveate. Seed 1, wingless, fleshy.

A genus of 1 species, endemic in north-eastern Queensland.

H.Sleumer, Studies in Old World Proteaceae, *Blumea* 8: 2–95 (1955); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 76–77 (1989); A.C.Rozefelds, The subtribe Hicksbeachiinae (Proteaceae) in the Australian Tertiary, *Mem. Queensland Mus.* 32: 195–202 (1992).

**Athertonia diversifolia** (C.T.White) L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 176 (1975)

*Helicia diversifolia* C.T.White, *Queensland Dept. Agric. Div. Pl. Industr. Bull.* 20: 18 (1918); *Hicksbeachia diversifolia* (C.T.White) Sleumer, *Blumea* 8: 6 (1955). T: Atherton district, Qld, *H.W.Mocatta*; holo: BRI 011496, 011497.

Illustrations: J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 76, 84 (1989).

Trees to 8–30 m tall. Branchlets densely ferruginous-tomentose. Intermediate leaves spathulate to elliptic or cuneate in outline, 7–80 cm long, 4.5–35 cm wide, with 2–13 lobes; lobes to 18 cm long. Adult leaves with petiole 10–30 mm long; lamina elliptic to obovate or spathulate, 10–37 cm long, 3.5–13 cm wide, moderately covered with appressed, ferruginous hairs when immature, upper surface glabrescent; tip rounded, obtuse, acute or acuminate. Conflorescence pendulous, 15–34 cm long; flower pair bracts and floral bracts similar, 0.5–1 mm long; peduncle 1.5–4 mm long. Pedicels 1.5–3 mm long. Tepals 19–23 mm long, cream to pale green, moderately to densely appressed-ferruginous-pubescent. Gynoecium 19–22 mm long, glabrous. Fruit 3.6–4.1 cm long, 3.3–3.8 cm wide, 1.9–2.6 cm thick, deep blue or pink with bluish patches. Figs 147, 178.

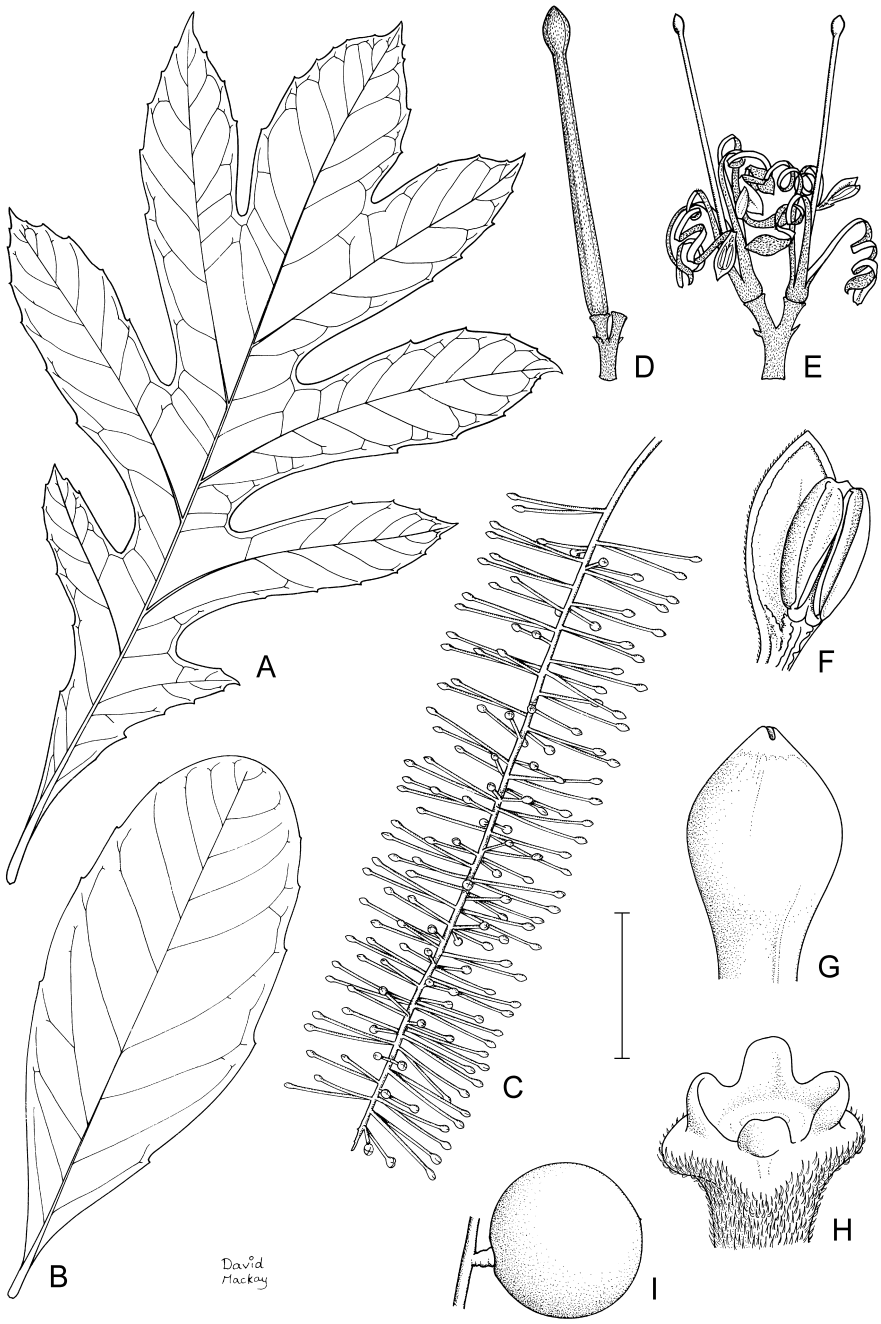



**Figure 178**. *Athertonia diversifolia*. **A**, intermediate leaf; **B**, adult leaf (**A–B**, S.Blake 15225, BRI); **C**, conflorescence; **D**, flower bud (**C–D**, G.Stocker 1433, BRI); **E**, flower pair; **F**, anther; **G**, pollen presenter; **H**, hypogynous glands (**E–H**, A.Altana, BRI); **I**, fruit (B.Gray 1615, QRS). Scale bar: **A**, **B** = 6 cm; **C**, **I** = 4 cm; **D**, **E** = 1 cm; **F** = 2 mm; **G**, **H** = 1 mm. Drawn by D.Mackay.

Occurs on coastal ranges from Cape Tribulation to Mt Bartle Frere, north-eastern Qld; grows in rainforest, mostly from 700 to 1150 m altitude but descending to as low as 400 m at Alexandra Ck. Flowers Mar.–June; fruits Aug.–Nov. Map 465.

Qld: Blackburn Ck (Boorgamba), *G.Sankowsky 424* (QRS); State Forest Reserve 143, North Mary Logging Area, *B.P.M.Hyland 12932* (NSW, QRS); Gadgarra Reserve, *S.F.Kajewski 1169* (BRI); Boonjee Logging Area, *P.H.Weston 880* (NSW); Portion 92, Malanda, *G.C.Stocker 1433* (BRI, QRS).

Flowers are reported to be strongly and sweetly scented.

Fossilised 'endocarps' that are almost indistinguishable from the bony inner mesocarp of *A. diversifolia* have been collected from mid-Tertiary deposits at Glencoe in central-eastern Qld (A.C.Rozefelds, *op. cit.*).

## 37. CATALEPIDIA

*P.H.Weston*

*Catalepidia* P.H.Weston, *Fl. Australia* 16: 499 (1995); from the Greek *kata* (low) and *lepis, lepidos* (a scale), in reference to the series of cataphylls at the base of each shoot, including the plumule.

Type: *C. heyana* (F.M.Bailey) P.H.Weston

Trees. Hairs absent. Hypocotyl obsolete. Shoots with a basal series of cataphylls. Leaves alternate, simple, entire, petiolate; venation brochidodromous, with intramarginal loops forming an undulating, intramarginal vein. Conflorescence ramiflorous, unbranched; flower pairs bracteate, pedunculate. Flowers actinomorphic, bisexual, bracteate, pedicellate. Tepals not coherent, revolute. Staminal filaments adnate to tepals; anthers free, oblong-ovate, apiculate. Hypogynous glands 4, free, fleshy, truncate. Ovary sessile; ovules 2, orthotropous, pendulous; style filiform, terminated by ovoid pollen presenter; stigma terminal. Fruit ±globose, with ventral axis longer than dorsal axis, indehiscent; outer mesocarp succulent, lacking radiating vascular or fibrous strands; inner mesocarp bony, smooth. Seed 1, wingless, fleshy.

A genus of 1 species, endemic in Australia.

H.Sleumer, Studies in Old World Proteaceae, *Blumea* 8: 2–95 (1955).

### **Catalepidia heyana** (F.M.Bailey) P.H.Weston, *Fl. Australia* 16: 499 (1995)

*Helicia heyana* F.M.Bailey, *Queensland Fl.* 4: 1329 (1901); *Macadamia heyana* (F.M.Bailey) Sleumer, *Blumea* 8: 5 (1955). T: Palm Camp, Bellenden Ker, Qld, 1889, *F.M.Bailey s.n.*; holo: BRI 011499.

Glabrous trees 3–18 m tall. Leaves with petiole 6–15 mm long; lamina oblanceolate to spathulate or oblong, 8–33 cm long, 1.5–6.5 cm wide; tip usually acuminate, occasionally acute or obtuse; primary to quaternary veins clearly raised on both surfaces. Conflorescence pendulous, 6–21 cm long; flower pair bracts triangular, 1.1–1.5 mm long; peduncle 2.5–5.5 mm long. Floral bracts triangular, 0.5–1 mm long, inserted 0–1.5 mm above pedicel base. Pedicels 2–3 mm long. Tepals 22.5–29.5 mm long, dusky pink to red outside, cream inside, revolute through 1.5–2.5 turns. Gynoecium 22–28.5 mm long, cream. Fruit pinkish red; inner mesocarp 2.3–3.1 cm diam., 1.2–1.8 mm thick. Figs 148, 179.

Occurs in rainforest on granite, from 600 to 1300 m altitude, on escarpment ranges between the Mt Windsor Tableland and Mt Bartle Frere, Qld. Flowers June–Oct., chiefly Sept.; fruits Jan. Map 466.

Qld: Mt Windsor Tableland, *Cairns City Council 5* (QRS); Mt Lewis road, 24.4 km from Rex Hwy, *P.H.Weston 793 et al.* (BRI, CBG, NSW); Mt Bellenden Ker, c. 7/8 mile [1.4 km] SE of centre peak, *L.S.Smith 14688* (BRI); Timber Reserve 1230, Boonjee Logging Area, *B.Gray 1002* (NSW, QRS); Mt Bartle Frere, slopes of NE peak, *R.L.Jago 601* (QRS).

The flowers are not scented.

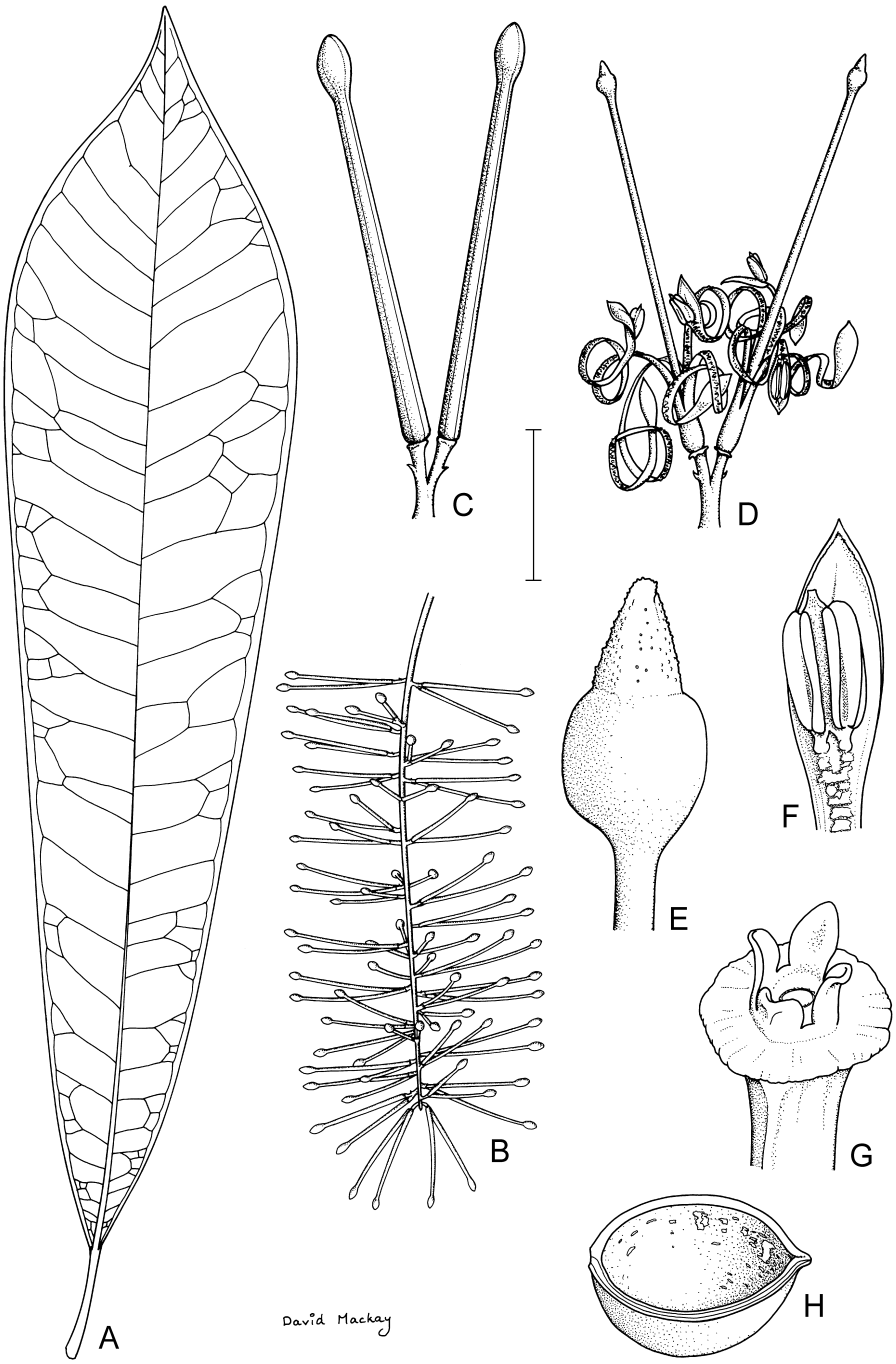



**Figure 179**. *Catalepidia heyana*. **A**, leaf; **B**, conflorescence; **C**, flower bud pair (**A–C**, B.Wallace 83132, NSW); **D**, flower pair; **E**, pollen presenter; **F**, anther; **G**, hypogynous glands (**D–G**, D.Foreman 95, NSW); **H**, half inner mesocarp (P.Weston 937, NSW). Scale bar: **A**, **H** = 2 cm; **B** = 4 cm; **C**, **D** = 1 cm; **E**, **G** = 1 mm; **F** = 2 mm. Drawn by D.Mackay.

## Subtrib. 3. FLOYDIINAE

*Proteaceae* subtrib. *Floydiinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 174 (1975).

Type: *Floydia* L.A.S.Johnson & B.G.Briggs

Juvenile leaves simple. Peduncles present. Floral bracts absent. Flowers actinomorphic. Stamen filaments adnate to tepals for most of their length. Hypogynous glands free. Pollen presenter clavate. Fruit indehiscent. Seed 1, thick, wingless.

A subtribe of a single genus endemic in the rainforests of north-eastern Qld.

## 38. FLOYDIA

*D.B.Foreman*

*Floydia* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 176 (1975); named after A.G.Floyd, formerly of the New South Wales National Parks and Wildlife Service, Coffs Harbour.

Type: *F. praealta* (F.Muell.) L.A.S.Johnson & B.G.Briggs

Trees; most parts glabrous or nearly so. Bark rough and brown. Leaves alternate, simple; margins undulate. Conflorescence raceme-like, axillary or ramiflorous, simple, solitary, densely flowered; subtending bract minute, acute; floral bracts absent. Flower pairs pedunculate. Flowers actinomorphic, bisexual, pedicellate, often caducous; receptacle straight, slender. Tepals revolute at anthesis, caducous. Stamens 4, inserted at base of limb on a short, broad filament. Hypogynous glands 4, free. Ovary sessile, unilocular; ovules 2; style geniculate just below the clavate pollen presenter. Fruit globose, indehiscent; exocarp corky. Seed 1 & ±globose, or sometimes 2 & ±hemispherical; testa neither thickened nor persistent. $n = 14$, L.A.S.Johnson & B.G.Briggs, *op. cit.* 169.

A monospecific genus endemic in coastal areas of south-eastern Qld and north-eastern N.S.W.

Distinguished from related genera by the simple juvenile leaves and large globular fruit, by the absence of floral bracts and by the paired flowers borne on a short stalk.

H.Sleumer, Studies in Old World Proteaceae. 2. A survey of the genus *Macadamia*, *Blumea* 8: 3–5 (1955); W.D.Francis, *Austral. Rain-forest Trees* 4th edn, 94–96 (1982); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 186–187 (1989).

**Floydia praealta** (F.Muell.) L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 176 (1975)

*Helicia praealta* F.Muell., *Fragm.* 3: 37 (1862); *Macadamia praealta* (F.Muell.) F.M.Bailey, *Queensland Fl.* 4: 1330 (1901). T: Clarence River, N.S.W., *H.Beckler s.n.*; lecto: K *n.v.*; isolecto: MEL, *fide* H.Sleumer, *Blumea* 8: 5 (1955).

Tree 20–30 m tall. Branchlets terete, sparsely ferruginous-pilose. Leaves with petiole 8–10 mm long; lamina linear or very narrowly elliptic to narrowly obovate, 7–30 cm long, 2–4.5 cm wide, obtuse to acute, glabrous; lateral veins 10–28 pairs, straight, then distinctly interarching near margin; venation densely reticulate, obvious on both surfaces. Conflorescence 7–20 cm long, ferruginous-tomentose; peduncle 2–4 mm long; pedicels c. 1 mm long. Tepals 12–17 mm long, cream, sparsely ferruginous-pilose; limb 3–4 mm long, 1.5–2 mm wide. Anthers c. 2 mm long. Ovary minutely ferruginous-pubescent; pollen presenter 1.5–2.5 mm long, 0.5–0.7 mm wide. Fruit 3–4.5 cm diam., brown; pericarp c. 5 mm thick. *Ball Nut, Possum Nut*. Figs 149, 180.

Occurs in coastal scrub from near Gympie, south-eastern Qld, south to near Dorrigo, north-eastern N.S.W. Flowers Jan.–Feb.; fruits c. June. Map 467.

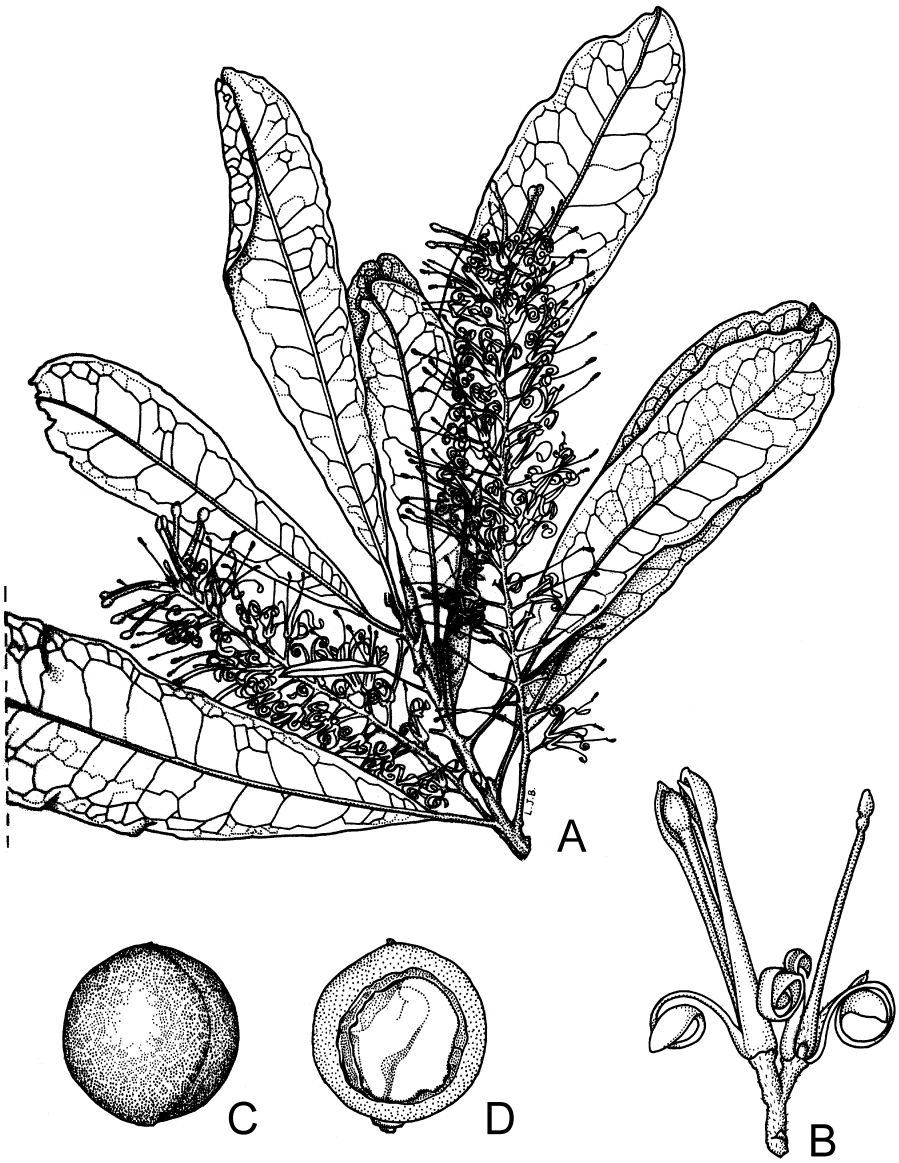



**Figure 180**. *Floydia praealta*. **A**, flowering branchlet; **B**, flower pair; **C**, fruit; **D**, L.S. through fruit (**A–D**, Royal Botanic Gardens, Melbourne, Vic., D.Foreman, MEL). Scale bar: **A**, **C**, **D** = 4 cm; **B** = 1 cm. Drawn by L.Button.

Qld: Imbil, *W.A.W. de Beauzeville* (NSW 106405); Springbrook, *D.Hocking* AQ191408 (BRI); upper Tallebudgera, *W.J.F.McDonald 2816 & W.G.Whiteman* (BRI). N.S.W.: Wilsons Creek Reserve, Boat Harbour, *A.G.Floyd 239* (NSW); Clarence R., *C.Moore* (MEL 1538131).

The seeds are said to be edible, and to have been eaten by Aborigines. This claim needs to be treated with some caution as other members of the family are known to contain toxic compounds. The timber has been used for cabinet work and interior fittings.

## Subtrib. 4. MACADAMIINAE

*Proteaceae* subtrib. *Macadamiinae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 174 (1975).

Type: *Macadamia* F.Muell.

Juvenile leaves simple. Peduncles and floral bracts absent. Flowers slightly zygomorphic. Stamen filaments free from tepals for most of their length. Hypogynous glands ±completely fused into a ring. Pollen presenter present. Fruit indehiscent or tardily and incompletely dehiscent. Seed 1, thick, wingless.

A subtribe of 3 genera, 1 endemic in southern Africa, 1 endemic in tropical and subtropical America, and the third found in eastern Australia and Sulawesi, Indonesia.

## 39. MACADAMIA

*C.L.Gross*

*Macadamia* F.Muell., *Trans. & Proc. Philos. Inst. Vic.* 2: 72 (1857); named after John Macadam, a secretary of the Philosophical Institute of Victoria.

Type: *M. ternifolia* F.Muell.

Trees to 40 m tall, sometimes multistemmed, ±buttressed. Leaves simple; adult leaves mostly verticillate, ±petiolate; margins entire or spinose. Conflorescence simple or in whorls on stalks; pseudo-racemes axillary and/or terminal. Flowers ±slightly zygomorphic, bisexual, each pair subtended by a ±caducous bract; pedicels free. Tepals 4, strap-like, dilated distally, coherent to free, becoming circinately reflexed, cream, cream-brown or pink. Filaments 4, partially adnate to tepals. Anthers 4, with connective slightly exceeding anthers. Hypogynous gland cylindrical, glabrous. Ovary glabrous to sericeous, sessile to shortly stipitate; ovules 2, orthotropous; style terete to slightly quadrate; stigma ovoid, clavate. Fruit a globular follicle, with an apical horn, tardily dehiscent along a ±distinct, longitudinal suture. Seeds globular to broadly ovoid; testa brown, smooth or wrinkled; embryo with cotyledons, cream, globose, sweet, bland or bitter.

A genus of 8 species; 7 species endemic in eastern Australia and 1, *M. hildebrandii* Steenis endemic in Sulawesi, Indonesia.

The fruits of *Macadamia integrifolia* and *M. tetraphylla* are edible and form the basis of the macadamia industry in Australia and overseas. Some species have been an important food source for aboriginal peoples in Australia and Sulawesi. It appears that the Aborigines in the Bellenden-Ker area of tropical Qld consumed the extremely bitter fruit of *M. whelanii*, probably after prolonged leaching. *Macadamia grandis* also occurs on the ranges of Mt Bellenden-Ker, but it is not known whether the fruit is edible or was consumed by the Aborigines. The Aborigines of the Mt Bauple region called the fruit of macadamia *Jindilli*. Further south, in northern N.S.W., the local aboriginal name for macadamia was *Kindal Kindal*. Macadamia was first domesticated in Hawai'i from *M. integrifolia* seeds imported from Australia by William Purvis in 1882. See also Introduction p. 38.

H.Sleumer, *Macadamia*, *Fl. Males.* ser. I, 5: 194–198 (1955); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 453–459 (1989).

**1** Adult leaves in whorls of 3 or 4 (–5); if 4 (–5), lamina margin always spinose; if 3, lamina margins spinose or entire; conflorescence simple

**2** Lamina margins spinose; leaves sessile to subsessile; petiole rarely to 4 mm long; rachis densely pubescent — **1. M. tetraphylla**

**2:** Lamina margins entire or spinose; leaves distinctly petiolate; petiole 6–18 mm long; rachis pubescent to glabrescent

**3** Lamina apices obtuse — **2. M. integrifolia**

**3:** Lamina apices acute to acuminate

**4** Lamina margins entire — **4. M. jansenii**

**4:** Lamina margins spinose

**5** Lamina lanceolate to oblanceolate; tip long and tapering, at an angle of less than 45°; petiole 4–10 mm long; branchlets smooth, brown to burgundy, with small, white, regular lenticels; flowers pink — **3. M. ternifolia**

**5:** Lamina obovate to broadly ovate; tip broad, at an angle of more than 60°; petiole 6–18 mm long; branchlets rough, pale brown, with irregular, cream lenticels; flowers cream — **2. M. integrifolia**

**1:** Adult leaves in whorls of 4 or more; lamina margins entire; conflorescence branched

**6** Midrib prominent below, not above; pedicel longer than tepals; style to 2 mm long — **5. M. whelanii**

**6:** Midrib prominent above and below; pedicel shorter than tepals; style more than 2.5 mm long

**7** Leaves chartaceous; tepals less than or equal to 4 mm; style less than 6.5 mm; ovary glabrous — **6. M. grandis**

**7:** Leaves coriaceous; tepals greater than or equal to 8.5 mm; style greater than or equal to 10 mm; ovary sericeous — **7. M. claudiensis**

## 1. Macadamia tetraphylla L.A.S.Johnson, *Proc. Linn. Soc. New South Wales* 79: 15 (1954)

T: Lismore, N.S.W., Nov. 1909, *T.G.Hewitt s.n.*; holo: NSW.

Tree 3–18 m tall, often branched near base. Adult leaves in whorls of (3–) 4 (–5); petiole 0–4 mm long; lamina oblong to oblanceolate, 7–30 cm long, 1.4–6 cm wide, semi-glossy above, paler below, rigidly coriaceous, sparsely pilose, glabrescent; bases truncate, attenuate to abruptly attenuate; margin weakly undulate, antrorsely spinose; apices acute or subacute, sometimes mucronate; midrib prominent above and below. Conflorescence simple; rachis 5.5–38 cm long; bracts ovate, 0.2–1.4 mm long. Tepals 5.5–15 mm long, 0.35–0.6 mm wide, cream or pink, free or coherent. Filaments 4–10 mm long, adnate to tepals for 3–8 mm. Anthers 0.8–2.5 mm long. Ovary shortly stipitate, 0.2–1.2 mm long, 0.4–1 mm wide; style 7–12 mm long, 0.2–0.5 mm diam. Fruit globose, 2.4–5 cm long, 1.5–5 cm wide; pericarp 2–9 mm thick. Seeds 2.6–3 cm long, 1.6–2.4 cm wide; testa wrinkled to smooth, 2–6 mm thick. Figs 151, 181A–C.

Rare in rainforest from northern N.S.W. to south-eastern Qld. Map 468.

Qld: near Beenleigh, *L.S.Smith 5183* (BRI). N.S.W.: Lennox Head, Ballina, *R.Dick 642* (NSW); 1 mile [1.6 km] E of Nimbin, Nimbin to Turntable Falls, *H.Salasoo 4553* (NSW); Victoria Park, 4 miles [6.5 km] SSW of Alstonville, *S.Clark, J.Pickard & R.G.Coveny 1264* (NSW); Numinbah Gate, *G.P.Guymer 1812 & L.W.Jessup* (BRI).

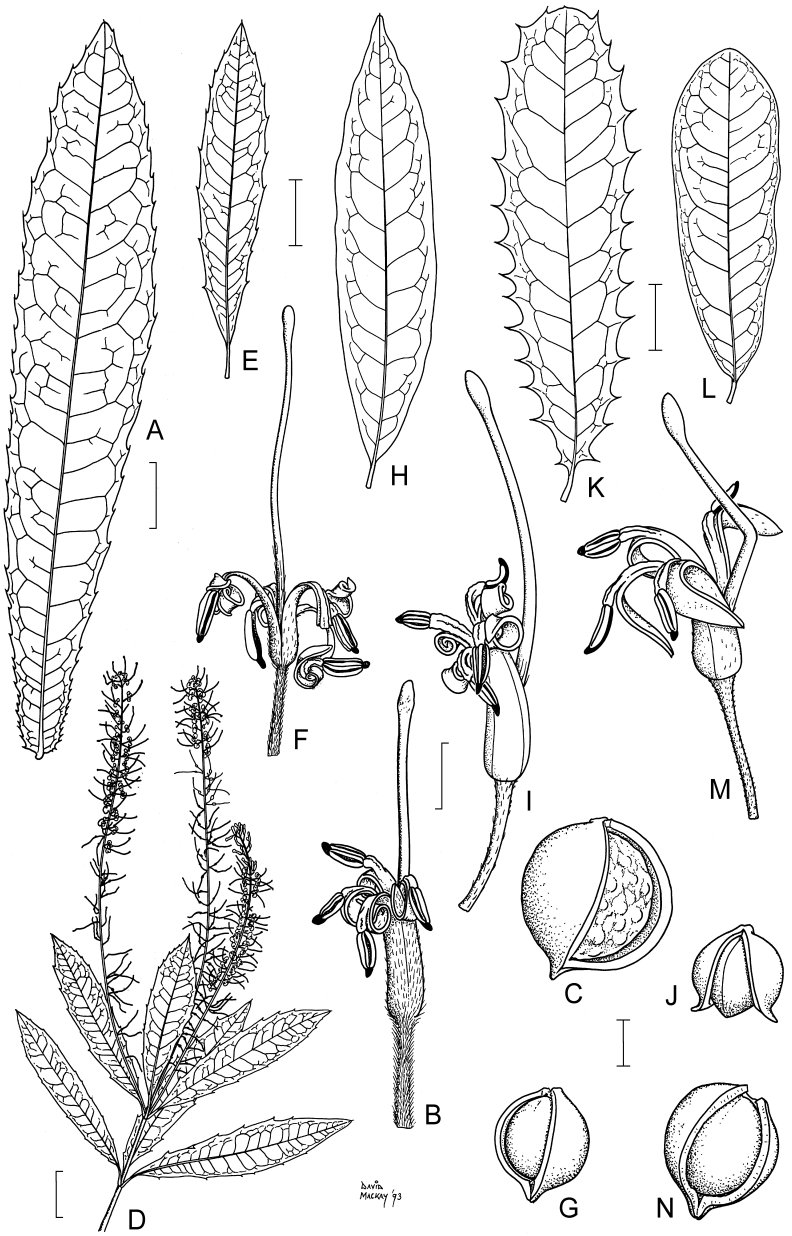



**Figure 181**. *Macadamia*. **A–C**, *M. tetraphylla*. **A**, leaf (C.White 3258, BRI); **B**, flower (cult. RBG Sydney, N.S.W., NSW 257846); **C**, fruit (Numinbah Valley, Qld, J.Beaumont, NSW). **D–G**, *M. ternifolia*. **D**, flowering branchlet; **E**, leaf (**D–E**, Maroochy R., Qld, J.Birbeck, BRI); **F**, flower (Pine R., Moreton Bay, [Qld], Hill & F.Mueller, NSW); **G**, fruit (Kin Kin, Qld, C.White, NSW). **H–J**, *M. jansenii*. **H**, leaf; **I**, flower; **J**, fruit (**H–J**, Bulburin State Forest, Qld, R.Jansen, NSW). **K–N**, *M. integrifolia*. **K–L**, leaves (**K**, Mt Bauple, Qld, S.Kajewski, BRI; **L**, C.White 6166, BRI); **M**, flower (cult. RBG Sydney, N.S.W., C.Gross, NSW); **N**, fruit (J.Olsen 321, NSW). Scale bars: **A**, **D**, **E**, **H**, **K**, **L** = 2 cm; **B**, **F**, **I**, **M** = 2 mm; **C**, **G**, **J**, **N** = 1 cm. Drawn by D.Mackay.

**2. Macadamia integrifolia** Maiden & Betche, *Proc. Linn. Soc. New South Wales* 21: 624 (1897)

*Macadamia ternifolia* var. *integrifolia* (Maiden & Betche) Maiden & Betche, *Proc. Linn. Soc. New South Wales* 24: 150 (1899). T: Camden Haven, N.S.W., c. 1850–1860, *C.Moore? s.n.*; holo: NSW.

Illustrations: E.R.Rotherham *et al.*, *Fl. & Pl. New South Wales & Southern Queensland* 105, fig. 328 (1975); K.Williams, *Native Pl. Queensland* 2nd edn, 2: 187 (1988).

Tree 6–18 m tall. Adult leaves in whorls of 3; petiole 6–18 mm long; lamina ovate to obovate, 6.5–14 cm long, 2–6.5 cm wide, glossy above, paler below, stiffly coriaceous, glabrescent; base very shortly attenuate; margin weakly undulate, entire to spinose; apices acute to obtuse, with a rounded tip or occasionally retuse, ±mucronate; midrib prominent below, flattened above. Conflorescence simple; rachis 8.5–25 cm long; bract ovate, concave, 0.5–5 mm long. Tepals 5–10 mm long, cream. Filaments 4.5–7 mm long, adnate to tepals for 3–5.5 mm. Anthers 0.7–2.2 mm long. Ovary 0.5–2 mm long; style 7.5–11 mm long. Fruit globose, 3–4 cm long, 2–4.5 cm wide; pericarp 2.2–6 mm thick. Seeds 25–31 mm long, 24–30 mm wide; testa 6–10 mm thick. $n$ = 14, *fide* H.P.Ramsay, *Austral. J. Bot.* 11: 5 (1963). Fig. 181K–N.

Rare in remnant rainforest in northern N.S.W. and south-eastern Qld. Map 469.

Qld: Amamoor, *D.J.McGillivray 485* (NSW); between Mt Glorious and Samford, *B.A.Lebler & L.Durrington* (BRI, NSW); Highvale, near Samford, *K.A.Williams 83092* (BRI). N.S.W.: Wangawallan Ck, *L.S.Smith 5363A* (BRI); Lismore, *R.White* (NSW).

**3. Macadamia ternifolia** F.Muell., *Trans. & Proc. Philos. Inst. Vic.* 2: 72 (1858)

T: in forests on the Pine River, Moreton Bay [Qld], *Hill & Mueller s.n.*; holo: MEL.

*Macadamia minor* F.M.Bailey, *Queensland Agric. J.* 25: 11 (1910). T: Eumundi [Qld], *Mr Ball s.n.*; holo: BRI.

*Macadamia lowii* F.M.Bailey, *Queensland Agric. J.* 26: 127 (1911). T: Maroochie (Yandina) [Qld], *J.A.Low s.n.*; holo: MEL.

*Macadamia ternifolia* var. *typica* Domin, *Biblioth. Bot.* 89: 585 (1921), *nom. inval.*; *Helicia ternifolia* F.Muell., *Fragm.* 2: 91 (1860). T: in vallibus silvaticis ad sinum Moreton Bay [Qld], *coll. unknown*; holo: MEL.

Illustration: T.D.Stanley & E.M.Ross, *Fl. SE Queensland* 2: 18, fig. 2D (1986).

Small multi-stemmed tree to 8 m tall. Adult leaves in whorls of 3; petiole 4–10 mm long; lamina narrowly ovate, 9–12.5 cm long, 2–3.5 cm wide, dull above, paler below, rigidly coriaceous, glabrous; base attenuate; margin somewhat undulate, antrorsely spinose; apex acute, mucronate; midrib prominent below, slightly sunken above. Conflorescence simple; rachis 5–18 cm long; bract oblong, 1–5 mm long. Tepals 6–8.5 mm long, pink. Filaments 4–7 mm long, adnate to tepals for 0.5–6 mm. Anthers 1–2 mm long. Ovary 0.4–1 mm long; style 5–10 mm long. Fruit 14–22 mm long, 13–22 mm wide; pericarp c. 1.5–3.5 mm thick. Seeds globose to broadly ovoid, c. 16 mm long, c. 12 mm wide; testa c. 1 mm thick, smooth. Fig. 181D–G.

Occurs from Pine River, north to Kin Kin, east-south-east of Gympie, Qld. Map 470.

Qld: 6 km W of Woombye, *P.I.F.Forster 6205, L.H.Bird & A.R.Bean* (BRI, NSW); Conondale Ra., western edge of Natl Park 477, *A.R.Bean 2675* (BRI); Maroochy R., between Cooroy and Eumundi, *L.S.Smith 5386* (BRI); Dulong Rd, Dulong, 7 km SW of Nambour, *Sharpe 4891 & A.Moran* (BRI); Leacys Ck, near Dayboro, 15 Aug. 1956, *S.R.Stevens* (BRI).

**4. Macadamia jansenii** C.L.Gross & P.H.Weston, *Austral. Syst. Bot.* 5: 725 (1992)

T: Bulburin State Forest, near Miriam Vale, Qld, 4 July 1987, *R.C.Jansen s.n.*; holo: NSW; iso: BRI, CBG, K, MO, QRS.

Illustrations: C.L.Gross & P.H.Weston, *op. cit.* 726, fig. 2, 727, fig. 3.

Multi-stemmed tree 6–9 m tall. Adult leaves in whorls of 3; petiole 2–14 mm long; lamina oblanceolate, 10–17.5 cm long, 2.5–5 cm wide, scarcely glossy above, paler below,

somewhat chartaceous, glabrescent; base attenuate, sometimes cuneate; margin entire, somewhat undulate; apex acute to attenuate, mucronate; midrib prominent below, inconspicuous above. Conflorescence simple; rachis 10–17.5 cm long; bract oblong, c. 8 mm long. Tepals 7–9 mm long, creamy brown. Filaments c. 6.5 mm long, adnate to tepals for 3–4.5 mm. Anthers 1–1.8 mm long. Ovary c. 1.8 mm long; style 10–11 mm long. Fruit tardily dehiscent, 15–25 mm long, 20–24 mm wide; pericarp c. 2 mm thick. Seeds globose to broadly ovoid, 14–18 mm long, 11–16 mm wide; testa 0.8–1.5 mm thick. Fig. 181H–J.

Restricted to Bulburin State Forest, south-west of Miriam Vale, Qld. Map 471.

Qld: Bulburin State Forest, July 1982, *R.C.Jansen* (NSW); *loc. id.*, 4 July 1987, *R.C.Jansen* (CBG, K, MO, NSW, QRS).

### 5. **Macadamia whelanii** (F.M.Bailey) F.M.Bailey, *Queensland Fl.* 4: 1330 (1901)

*Helicia whelanii* F.M.Bailey, *Rep. Meston's Exped. Bellenden-Ker Range* 2 (1899). T: along Tringilburra Creek and thence to Whelanian Pools, Qld, 1889, *F.M.Bailey s.n.*; holo: BRI.

Illustration: N.Nicholson & H.Nicholson, *Austral. Rainforest Pl.* 3, 36 (1991).

Tree 10–30 m tall, sometimes buttressed. Adult leaves in whorls of (4–) 5; petiole 6–30 mm long; lamina ovate to elliptic, 6–21.5 cm long, 2–6.5 cm wide, glossy above and slightly glossy below, coriaceous, glabrescent; base cuneate; margin entire; apices acute to shortly acuminate; tip rounded; sparse ferruginous hairs on midrib. Conflorescence of 1 or 2 whorls on stalks 6–8.5 cm long; each whorl with 4–5 racemes; rachis 4.5–7 cm long, c. 1 mm diam.; bract ovate, concave, 0.7–1.5 mm long. Tepals free, 2–3.2 mm long, highly circinate, cream. Filaments 0.5–2 mm long, adnate to tepals for 0.2–0.8 mm. Anthers 0.5–2 mm long. Ovary 0.25–0.7 mm long; style 1.2–1.8 mm long. Fruit c. 41 mm long, c. 44 mm wide; pericarp c. 2–3 mm thick. Seeds globose to broadly ovoid, c. 31 mm long, c. 34 mm wide; testa 4–6 mm thick. Figs 150, 182G–J.

Occurs from Mt Bellenden Ker to Mossman, north-eastern Qld; grows in lowland and coastal rainforest. Map 472.

Qld: Josephine Falls Natl Park, *P.H.Weston 990, P.Hind et al.* (NSW); Little Mossman Logging Area, Rex Ra., *G. & N.Sankowsky 604* (NSW); Fishery Ck, 25 miles [c. 40 km] S of Cairns, 24 Nov. 1946, *S.E.Stephens* (NSW); State Forestry Reserve 755, *B.P.M.Hyland 1261* (QRS); Bramston Beach, *R.Jago 313* (QRS).

### 6. **Macadamia grandis** C.L.Gross & B.Hyland, *Austral. Syst. Bot.* 6: 347 (1993)

T: State Forest Reserve 755, Barong LA [Logging Area], Qld, 12 Dec. 1979, *B.Gray 1586*; holo: QRS; iso: NSW.

Illustrations: C.L.Gross & B.P.M.Hyland, *op. cit.* 348, fig. 4, 349, fig. 5.

Tree 10–40 m tall, ±buttressed. Adult leaves in whorls of (4–) 5 (–6); petiole 3–14 mm long; lamina narrowly elliptic, sometimes obovate, 8–23 cm long, 2–6 cm wide, acute, never mucronate; base cuneate or attenuate, dull above, paler below, somewhat chartaceous, glabrescent; margin entire, weakly undulate; midrib prominent above and below. Conflorescence of 1–2 whorls, on stalks 2.5–6 cm long, 2–3 mm diam.; each whorl with 4–6 racemes, 8–9 cm long, c. 1 mm diam.; bract somewhat persistent, ovate, 0.5–1.5 mm long. Tepals 3.5–4 mm long, c. 1.2 mm wide, reflexed, almost circinate, yellow-cream. Filaments 2–5.5 mm long, adnate to tepals for 0.5–2.5 mm, c. 0.25 mm wide. Anthers 0.5–1 mm long. Ovary glabrous, 0.3–0.8 mm long; style 2.5–6 mm long. Fruit 1 per raceme, globose, c. 5 cm long, c. 7 cm wide; pericarp 8–10 mm thick. Seeds depressed-globose, c. 3.5 cm long, c. 2 cm wide; testa thin, 1–2 mm thick. Fig. 182D–F.

Occurs in the Barong Logging Area on Mt Bellenden Ker and McNamees Creek area, north-eastern Qld. Map 473.

Qld: State Forestry Reserve 191, Wongabel, *G.C.Stocker 664* (QRS); China Camp, McDowall Ra., Aug. 1968, *R.Grimes* (QRS); State Forestry Reserve 755, Barong Logging Area, *S.J.Dansie 20124* (QRS); Barong Logging Area, Barong Logging Rd, 24 km from junction with Bruce Hwy, *P.H.Weston 998, P.Hind, D.Healey & G.Sankowsky* (NSW); Woopen Ck, *G.Sankowsky 601 & N.Sankowsky* (BRI, NSW).

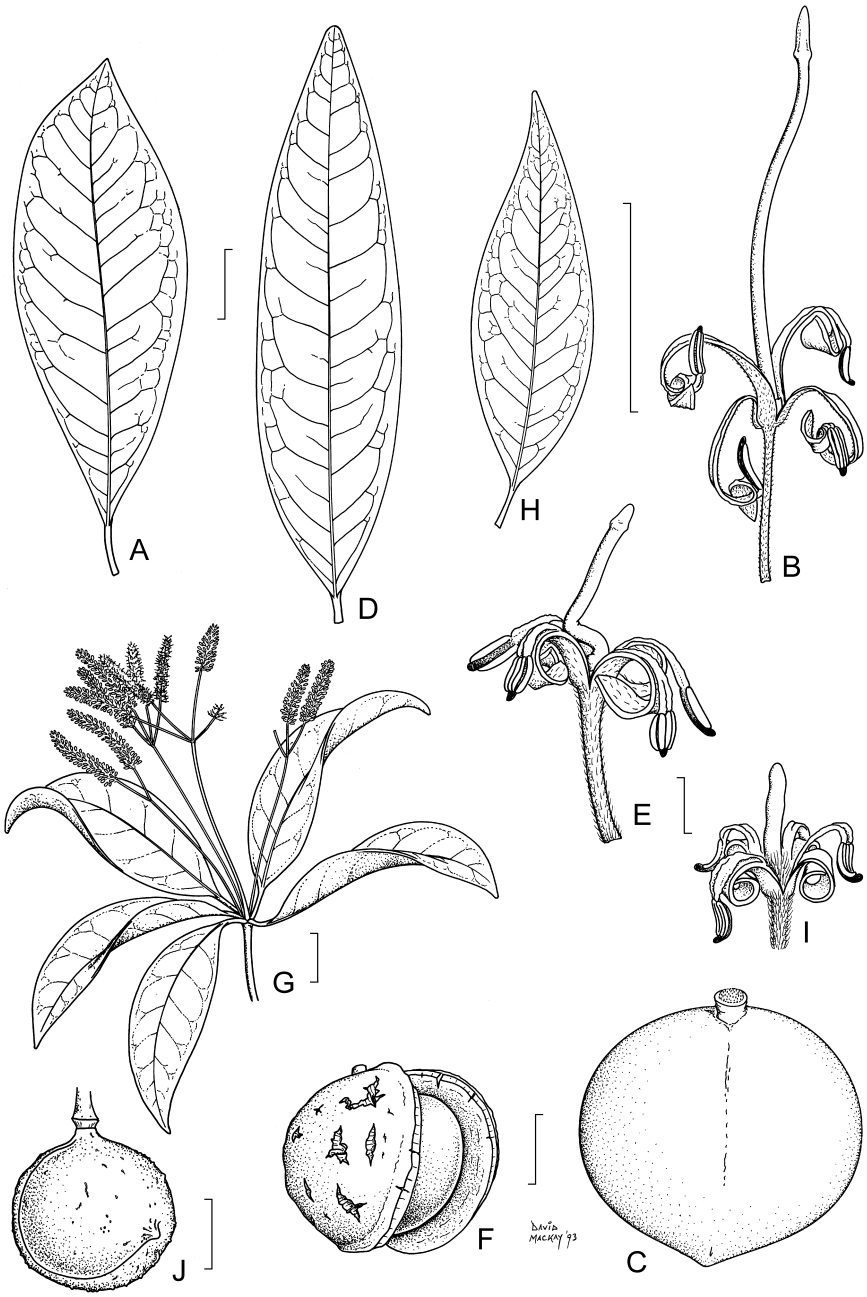



**Figure 182**. *Macadamia*. **A–C**, *M. claudiensis*. **A**, leaf; **B**, flower (**A–B**, B.Hyland 2582, NSW & QRS); **C**, fruit (from a photograph of fresh material cultivated at TFRC Aboretum, Atherton, supplemented by specimen: B.Hyland 12424, NSW). **D–F**, *M. grandis*. **D**, leaf (G.Sankowsky 601 & N.Sankowksy, NSW); **E**, flower (B.Gray 1586, NSW); **F**, fruit (B.Gray 2865, NSW). **G–J**, *M. whelanii*. **G**, flowering branchlet; **H**, leaf; **I**, flower (**G–I**, Mt Bellenden Ker, Qld, G.Podenzana, NSW); **J**, fruit (Fishery Ck, S.Stephens, NSW). Scale bars: **A**, **C**, **D**, **F**, **G**, **J** = 2 cm; **B** = 1 cm; **E**, **I** = 1 mm; **H** = 6 cm. Drawn by D.Mackay.

**7. Macadamia claudiensis** C.L.Gross & B.Hyland, *Austral. Syst. Bot.* 6: 343 (1993)

T: Claudie River, Qld, 29 June 1972, *B.P.M.Hyland 2582*; holo: QRS; iso: NSW.

Illustrations: C.L.Gross & B.P.M.Hyland, *op. cit.* 344, fig. 1, 345, fig. 5.

Tree 25–30 m tall. Adult leaves in whorls of 5 or 6; petiole 3–25 mm long; lamina ovate, sometimes obovate, 11.5–26 cm long, 4–13.5 cm wide, glossy above, dull below, coriaceous, glabrescent; base cuneate; margin entire; apex acute to acuminate; midrib prominent below and somewhat prominent above. Conflorescence of 1–2 whorls on 4–10 cm long stalks; each whorl with 4–6 racemes; rachis 8–19 cm long, 2–3 mm diam.; bract c. 1.2 mm long, triangular, concave. Tepals free, 8.5–13.5 mm long, cream. Filaments 6–11 mm long, adnate to tepals for 5–10 mm. Anthers 1–3 mm long. Ovary 1–1.7 mm long; style 10–19 mm long, somewhat quadrate. Fruit globose, 6.5–7 cm long, 6.5–8 cm wide; pericarp 8–10 mm thick, dark green to black, coriaceous. Seeds globose, c. 5 cm long, c. 6.5 cm wide; testa 1–2 mm thick, thicker near pedicel. Fig. 182A–C.

Restricted to rainforest in the Iron Range region, far north-eastern Qld. Map 474.

Qld: Claudie R., *A.W.Dockrill 550* (QRS); *loc. id.*, *B.P.M.Hyland 3102* (QRS); Tozers Gap, Garraway Ra., *B.Gray 186* (QRS); Gordon Ck, *B.P.M.Hyland 12458* (QRS); Lamond Hill, Iron Ra., Nov. 1986, *G.Sankowsky* (NSW); Iron Ra., *L.J.Brass 19124* (A, BRI).

## Subtrib. 5. LAMBERTIINAE

*Proteaceae* subtrib. *Lambertiinae* (Venkata Rao) L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 173 (1975).

*Proteaceae* trib. *Lambertieae* Venkata Rao, *Proc. Indian Acad. Sci.* 48B: 23 (1968). T: *Lambertia* Sm.

Juvenile leaves simple. Peduncles and floral bracts absent. Flowers actinomorphic or ±zygomorphic. Stamen filaments free from tepals for most of their length. Hypogynous glands free or fused into a ring or absent. Pollen presenter small, swollen. Fruit follicular. Seeds (1–) 2, narrowly winged on all sides.

A monogeneric subtribe, endemic in Australia.

## 40. LAMBERTIA

*R.J.Hnatiuk*

*Lambertia* Sm., *Trans. Linn. Soc. London* 4: 214, 223 (1798); named in honour of Aylmer Bourke Lambert, FLS, FRS, author.

Type: *L. formosa* Sm.

Shrubs or small trees, pubescent, villous or glabrescent. Bark smooth, rarely fibrous, with lenticels. Leaves in whorls of 3, rarely paired or 4 or 8; petiole short or absent. Conflorescence terminal or on short, lateral shoots and appearing axillary, sessile or subsessile, 1–7 (–19)-flowered. Bracts numerous; outer very short; inner long and reaching half-way up perianth or exceeding it, red, yellow or green. Flowers actinomorphic or zygomorphic, bisexual. Perianth tubular, but often with 4 free segments from base to 3 mm up tube, pilose, hirsute or glabrous; limb 4-lobed, with 1 stamen in each lobe, becoming tightly revolute. Stamens sessile or very shortly pedicellate, with or without an apical gland. Hypogynous glands (2–) 4, free or fused or absent, glabrous or occasionally with indumentum. Ovary densely strigose or hirsute; style exceeding open perianth, narrow, glabrous or sparsely hirsute or pilose; stigma less than 1 mm long, with apical groove or pit, or 2-lobed, distal to slightly swollen pollen presenter. Fruit a follicle, sessile or subsessile, splitting when seeds ripe, smooth or spiny especially along suture, with stylar beak and a pair of prominent horns at distal end of suture. Seeds (1) or 2, narrowly winged, flat or slightly

domed on 1 side, finely papillate, mottled black and brown. *n* = 14, *fide* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 99 (1975). *Honeysuckle* (W.A.), *Mountain Devil* (N.S.W.).

A genus of 10 species endemic in temperate Australia; 9 in the south-west, 1 in the south-east. They occur in kwongan or dry sclerophyll forest. Several species are suitable for horticulture. Flowering peaks in spring but for most species can occur at any time of year.

The fruits of all species, though small, are ornamented and attractive. Each has a primary beak, formed from the indurated base of the style, which projects obliquely from the proximal end of the suture or opening of the fruit. Two horns at the distal end of the suture are usually evident as lobes on the ovary even prior to the opening of the flower. The degree of development of these projections varies between species. The sides of the fruit may have many subsidiary spines or ridges which may even extend onto the primary beak and horns.

C.Venkata Rao, Morphology, floral anatomy and embryology of *Lambertia* Sm. with a discussion on the taxonomic position of the genus, *Proc. Indian Acad. Sci.* 48B: 11–24 (1968); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 441–446 (1989).

**1** Leaves obtuse, without a mucro; flowers yellow to orange or red

**2** Leaves linear, 1–1.5 mm wide; margins strongly revolute — **9. L. ericifolia**

**2:** Leaves not linear, more than 1.5 mm wide; margins not strongly revolute

**3** Leaves ovate or spathulate, 3–7 mm wide; margins scarcely or narrowly revolute — **10. L. inermis**

**3:** Leaves orbicular, 15–20 mm diam. — **8. L. orbifolia**

**1:** Leaves mucronate or apiculate; or if not mucronate, then flowers green

**4** Leaves spiny on margins

**5:** Perianth 10–12 mm long, not or scarcely dilated, almost erect — **2. L. ilicifolia**

**5:** Perianth 25–40 mm long, dilated in middle and facing inwards

**6** Leaves narrowly obovate or narrowly elliptic; spines few and irregularly spaced; fruit smooth or finely textured on sides — **3. L. fairallii**

**6:** Leaves broader, mostly strongly and regularly lobed; fruit spiny on sides — **1. L. echinata**

**4:** Leaves not spiny on margins or, if spiny, flowers less than 12 mm long

**7** Flowers less than 12 mm long — **2. L. ilicifolia**

**7:** Flowers more than 12 mm long

**8** Conflorescence 1-flowered

**9** Leaves linear or narrowly oblanceolate; perianth green or yellow — **7. L. rariflora**

**9:** Leaves ovate, obovate, or oblong; perianth bright red; limb yellow or yellow-green below — **6. L. uniflora**

**8:** Conflorescence 4–7-flowered (rarely more)

**10** Leaves orbicular to broadly ovate, mostly in pairs — **8. L. orbifolia**

**10:** Leaves linear, narrowly elliptic, or uncommonly ovate or auriculate, not in pairs

**11** Inner subfloral bracts less than half length of unopened perianth — **5. L. multiflora**

**11:** Inner subfloral bracts more than half length of unopened perianth

**12** Perianth pink or red; horns of fruit longer than 10 mm; sides of fruit ornamented with spines or ridges, or almost smooth

**13** Flowers pink or red; fruit with prominent horns; sides of fruit variously spiny to almost smooth [eastern Australia] — **4. L. formosa**

**13:** Flowers yellow; fruit covered with coarse, spreading spines [western Australia] **2. L. ilicifolia**

**12:** Perianth yellow; horns of fruit less than 5 mm long; sides of fruit ±smooth [western Australia] **3. L. fairallii**

## 1. Lambertia echinata R.Br., *Trans. Linn. Soc. London* 10: 189 (1810)

T: in Novae Hollandiae ôra australi, Leeuwin's Land [Lucky Bay, W.A.], 1801–1802, *R.Brown s.n.;* holo: BM.

*Lambertia echinata* var. *intricata* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 422 (1856). T: v.s. sine fl. in herb. Sonder; holo: MEL.

Shrub to 2.5 m tall; lignotubers not known. Branches erect or spreading; young branches densely villous. Leaves with petiole to 2 mm long or absent; lamina narrowly cuneate, 10–40 mm long, with dilated apex, 3–5 marginal spines, mucronate, glabrous, rarely almost unlobed; distal lobes undulate. Conflorescence 7-flowered; bracts numerous, firm; inner bracts c. two-thirds length of perianth. Flowers zygomorphic, crowded, loosely enclosed by bracts. Perianth 25–40 mm long, yellow or reddish pink, dilated, ±glabrous; adaxial suture deepest. Hypogynous glands 2–4, free or variously fused. Style slender; lower half sparsely pilose-villous. Fruit ovoid, 5–8 mm diam., with spines on entire surface. Seeds 2, circular, with narrow, annular wing. *Prickly Honeysuckle.*

Endemic between Albany and Esperance, southern W.A.; grows in gravelly or sandy-clay soils in kwongan vegetation. Flowers mainly Sept.–Jan.

*Lambertia echinata* var. *intricata* is a variant with leaves having 3 lobes and 2 or 3 spines on each lobe. Intergradation of leaf form occurs on single plants and between plants and is not given taxonomic status here. There are 2 geographically distinct subspecies.

Perianth orange-red to pink **1a.** subsp. **echinata**

Perianth yellow **1b.** subsp. **citrina**

### 1a. Lambertia echinata R.Br. subsp. echinata

Illustration: R.Erickson *et al.*, *Fl. & Pl. W. Australia* 82, fig. 229 (1979).

Shrub to 1 m tall; branches spreading. Leaves 30–40 mm long; veins on undersurface prominently raised. Perianth orange-red to pink. Fig. 183B.

Known only from the type locality in south-western W.A.; grows in exposed coastal areas. Map 475.

W.A.: Lucky Bay, E of Esperance, *E.M.Scrymgeour 898B* (PERTH).

### 1b. Lambertia echinata subsp. citrina Hnatiuk, *Fl. Austral.* 16: 500 (1995)

T: last hill overlooking Cheynes Beach, c. 4 km from town [W.A.], 16 Nov. 1982, *G.J.Keighery 5727*; holo: PERTH.

*Lambertia propinqua* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 30 (1830). T: orâ occid-merid., King George's Sound [W.A.], 1829, *W.Baxter*; syn: BM, NSW.

Illustrations: A.S.George, *Intr. Proteaceae W. Australia* 88, pl. 130 (1984), as *L. propinqua*; J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 455 (1989), as *L. propinqua.*

Shrub to 2.5 m tall; branches erect to spreading. Leaves 15–35 mm long, thick, often lacking raised veins below. Perianth yellow. Fig. 183C–G.

Occurs from Cheyne Beach on Cheyne Bay to near Albany, W.A.; in sandy, lateritic soils. Map 476.

W.A.: c. 4 km E of Cheyne Beach turn-off, *H.Demarz D6685* (PERTH).

*Lambertia propinqua*, in which the leaves are almost without lobes, appears to be no more than a juvenile growth form of *L. echinata* subsp. *citrina*.

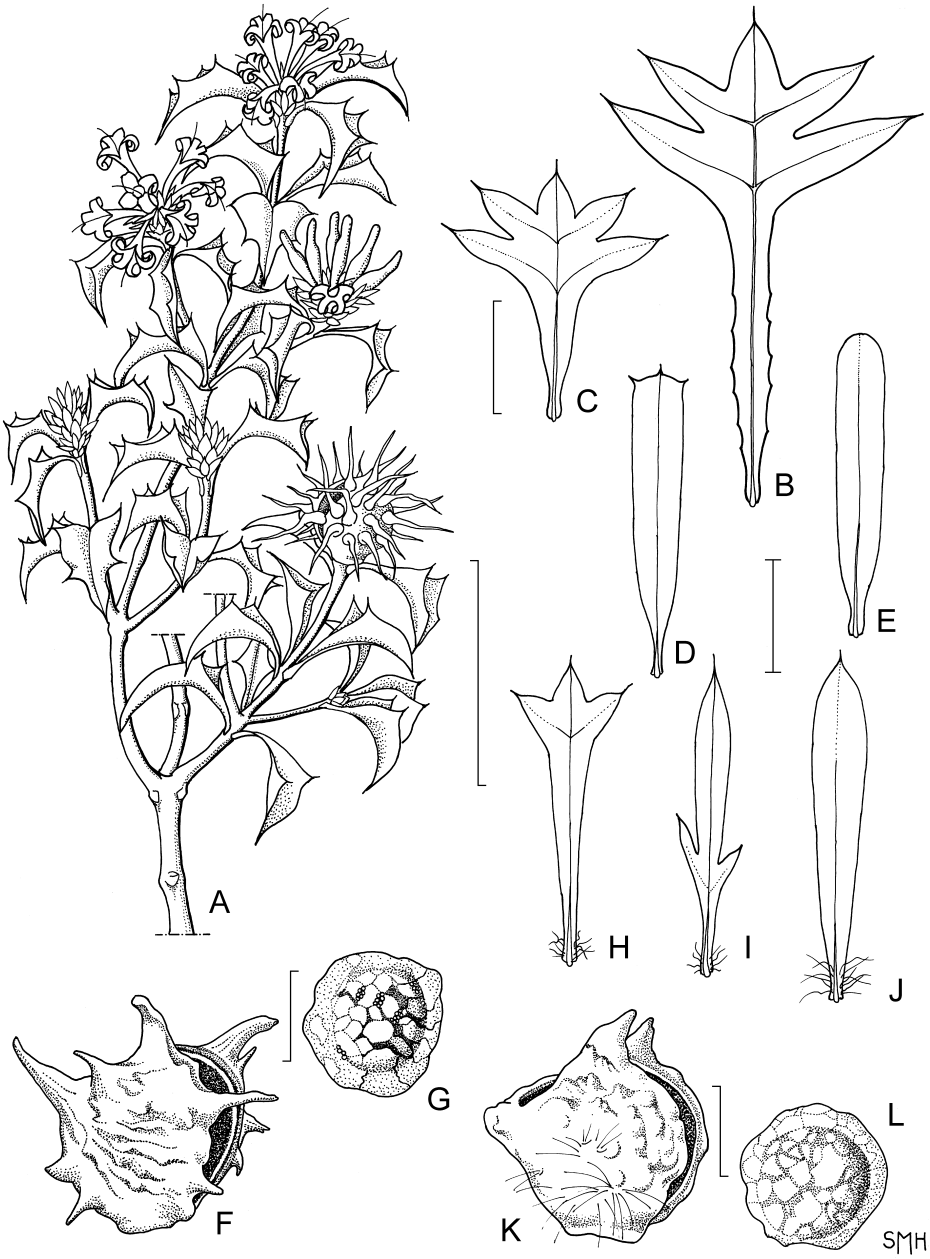



**Figure 183**. *Lambertia*. **A**, *L. ilicifolia*, branchlet with flowers, flower buds and fruit (R.Purdie 5329, CBG). **B**, *L. echinata* subsp. *echinata*, leaf (A.George 7468, PERTH). **C–G**, *L. echinata* subsp. *citrina*. **C**, leaf (H.Demarz D6685, PERTH); **D–E**, juvenile leaf variants (**D–E**, King Georges Sound, W.A., W.Baxter, BM); **F**, fruit; **G**, seed (**F–G**, H.Demarz D6685, PERTH). **H–L**, *L. fairallii*. **H–J**, leaf variants (**H–I**, Mt Trio, Stirling Ra., W.A., N.Speck, CANB; J, B.Barnsley 746, CBG); **K**, fruit; **L**, seed (**K–L**, B.Barnsley 746, CBG). Scale bars: **A** = 3 cm; **B–E**, **I**, **J** = 1 cm; **H** = 2 cm; **F**, **G**, **K**, **L** = 5 mm. Drawn by S.House.

**2. Lambertia ilicifolia** Hook., *Icon. Pl.* 6: t. 553 (1843)

T: Swan River [W.A.], *J.Drummond*; holo: K.

Illustrations: A.S.George, *Intr. Proteaceae W. Australia* 89, pl. 133 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 438 (1989).

Shrub to 2 m tall, apparently lacking lignotubers. Branches erect to spreading; young branches finely pubescent. Leaves shortly petiolate; lamina ovate or obovate, 10–25 mm long, thick, strongly mucronate, entire or with 1 or 2 prickly lobes on each margin, glabrous; veins scarcely visible. Conflorescence 7-flowered; inner bracts stiff, reaching to base of suture of perianth. Flowers actinomorphic, crowded, enclosed by bracts. Perianth 10–12 mm long, bright yellow, scarcely dilated, with sparse indumentum; adaxial suture deepest. Anthers generally not coiling with perianth lobes. Hypogynous glands absent. Style pilose in lower ½–⅔. Fruit somewhat globose, c. 10 mm diam.; beak and horns largely indistinguishable from coarse spines on sides. Seeds 2, circular, 7–8 mm diam., with narrow, irregular, annular wing. *Holly-Leaved Lambertia, Little Honeysuckle.* *Figs* 153, 183A.

Occurs primarily between Quairading and Kukerin, W.A., with an uncorroborated outlier from north-west Bencubbin region at Naraling, south-east of Northampton [1922, *J.Dillon s.n.* (PERTH)]. Grows in grey or yellow sand over lateritic gravel in kwongan vegetation. Flowers mainly Sept.–Oct. Map 477.

W.A.: 25.6 km W of Woodanilling, *K.Newbey 3433* (PERTH); SSE of Corrigin, *A.S.George 14366* (PERTH).

Two distinct leaf forms occur, one with small, ovate, entire leaves with a single, strong apical spine, and a second with 1 or 2 prominent, spiny lobes. Both types of leaf may occur on some plants, but those with only one type of leaf look very distinctive. The absence of other differences and co-occurrence of forms on single plants precludes taxonomic recognition.

*Lambertia ilicifolia* has the smallest flowers of the genus. It appears to be closely related to *L. echinata*, *L. fairallii* and *L. formosa*, since all four have flowers that face inwards, i.e. the deepest suture of the perianth is adaxial, thus giving the flowers a slight to strong asymmetry. The asymmetry is weakest in *L. ilicifolia*. The conflorescence is surrounded by stiff bracts which usually hold the flowers together, and the seeds are usually circular and have an annular wing.

**3. Lambertia fairallii** Keighery, *Bot. Jahrb. Syst.* 104: 180 (1983)

T: ridgeline, SE Ellen's Peak, [Ellen Peak], Stirling Ra., W.A., 11 May 1982, *G.J.Keighery 4845;* holo: PERTH; iso: AD, CANB, K, MEL, NSW.

Illustration: G.J.Keighery, *op. cit.* 179, fig. 2.

Shrub to 1.5 m tall, lacking lignotubers. Branches dense; young branches pilose. Leaves crowded; lamina 20–30 mm long, 2–5 mm wide, very narrowly elliptic to cuneate, revolute, apiculate, rarely with irregular, mucronate lobes, pilose basally, otherwise glabrous. Conflorescence 5–7-flowered; bracts stiff; inner bracts reaching suture of flower; bracts with hairs at apex only. Flowers zygomorphic, crowded, enclosed by bracts. Perianth 30–40 mm long, bright yellow, dilated near middle, mostly glabrous; adaxial suture deepest. Hypogynous glands fused; margin irregular. Style pilose. Fruit 6–7 mm long, with a single beak at stylar end of suture and 2 horns at opposite end; sides smooth or slightly uneven. Seeds 2, circular, c. 5 mm diam., with a narrow, annular wing. Fig. 183H–L.

Confined to the Stirling Range, W.A.; grows in shallow, peaty sand over quartzite or sandy loam in kwongan vegetation. Flowers known from Jan., May, and Sept. Map 478.

W.A.: 4 km SSW of Moir Hill, 2 km W of Ellen Peak, *S.D.Hopper 2334* (PERTH).

This species appears to be most closely related to *L. ilicifolia* (see discussion of that species).

**4. Lambertia formosa** Sm., *Trans. Linn. Soc. London* 4: 214, 223, t. 20 (1798)

T: New South Wales, *coll. unknown*; holo: LINN, photo seen.

*Protea nectarina* J.C.Wendl. *in* H.A.Schrader & J.C.Wendland, *Sert. Hannov.* 4: 5, t. xxi (1798). T: Nova Hollandia [N.S.W.], *coll. unknown*; *n.v.*

*Lambertia formosa* var. *longifolia* Andrews, *Bot. Repos.* 1, t. 69 (1799). T: Australia, grown by J.Robertson, Stockwell, Surrey, 1798; *n.v.*

*Lambertia formosa* var. *pallida* Guilf., *Austral. Pl.* 233 (1911). T: not designated.

*Lambertia barbata* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: Port Jackson [Sydney], N.S.W., Jan. 1904, *C.Walter*; lecto: NSW, photo seen, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 345 (1973); syn: NSW.

*Lambertia proxima* Gand., *Bull. Soc. Bot. France* 66: 228 (1919). T: Hornsby, N.S.W., Mar. 1897, *Baker*; lecto: NSW, photo seen, *fide* D.J.McGillivray, *Contr. New South Wales Natl. Herb.* 4: 345 (1973); Port Jackson [Sydney] district, N.S.W., 1895, *J.H.Maiden*; syn: NSW.

*Lambertia formosa* f. *tomentosa* Domin, *Biblioth. Bot.* 89: 32 (1921). T: Blue Mtns [N.S.W.], 1910, *K.Domin IV*; *n.v.*

Illustrations: *S.G.A.P.: Hort. Guide to Austral. Pl.* Set 8, No. 43 (1983); J.W.Wrigley & M.Fagg *Banksias, Waratahs & Grevilleas* 442 (1989); G.J.Harden *in* G.J.Harden (ed.), *Fl. New South Wales* 2: facing 58, pl. 5 (1991).

Shrub to 2 m tall, often lignotuberous. Branches ascending; young branches brown, villous. Leaves sessile or shortly petiolate; lamina narrowly obovate to linear or ovate to oblong, from 10 mm long and 7 mm wide to 80 mm long and 2 mm wide, strongly mucronate, glabrous above; hairs below dense, crisped, pale or red-brown; margins revolute. Conflorescence 7-flowered, usually solitary; bracts stiff, reaching to or above suture of perianth. Flowers zygomorphic, crowded, enclosed by bracts. Perianth erect, c. 45 mm long, red or pink, slightly dilated in middle, glabrous outside; sutures equally deep or the adaxial deepest. Hypogynous glands fused. Ovary hirsute; style sparsely pilose in lower half. Fruit irregularly ovoid, 8–10 mm long; beak 3–5 mm long; 2 horns at base of suture to 10 mm long; surface variously spiny to almost smooth. Seeds 2, with an irregular, annular wing. *Mountain Devil.* *Figs* 154, 184 I–L.

Occurs from the coast to the eastern rim of plateau in central-eastern and north-eastern N.S.W.; grows in mallee shrubland or as understorey to eucalypt woodlands in deep or shallow sand and swampy or rocky soils. Flowers throughout the year, but mainly Sept.–Jan. Map 479.

N.S.W.: 1 km from Dunjera Dam, Yalwal State Forest, *T.James & R.G.Coveny 52* (NSW); c. 13 km E of Sassafras on Braidwood–Nowra road, Turpentine Ra., *R.D.Hoogland 11.372* (CANB, L, NSW).

Leaf form is very variable in this species. Rapid growth can produce long, narrow leaves and slow growth short, wide ones. Hair colour on leaves is also variable and may change with time. Flower colour varies in intensity of red or pink, e.g. *L. formosa* var. *pallida* refers to a pink form. Further study of these variations may lead to the recognition of the subspecific taxa, here put in synonymy.

### 5. **Lambertia multiflora** Lindl., *Sketch Veg. Swan R.* xxxii (1839)

T: Swan River district [W.A.], *J.L.Drummond s.n.*; lecto: CGE, *fide* R.J.Hnatiuk, *Fl. Australia* 16: 500 (1995).

Shrub to 2 m tall, frequently lignotuberous. Branches erect to spreading; young branches white-puberulous, with a ridge from base of leaf to subtending node. Leaves with lamina linear or oblong to narrowly obovate, 15–80 mm long, 3–7 (–10) mm wide, acute to obtuse, mucronate, sometimes hastate at base; margin slightly revolute; midrib prominent below and reticulate venation prominent above. Conflorescence 7-, 13- or 19-flowered; inner bracts moderately firm, spreading, less than half length of perianth. Flowers zygomorphic. Perianth 25–30 mm long, reddish orange or yellow, green at tip, dilated in middle, minutely pubescent outside, sometimes glutinous; adaxial suture deepest. Hypogynous glands 4, free. Ovary densely strigose; style sparsely pubescent in lower half. Fruit irregularly ovoid, 8–10 mm long, 9 mm wide; beak at one end of suture; 2 prominent, straight or curved horns at opposite end, with ridges along edges of sutures; sides mostly smooth or slightly mammillate. Seeds 2, asymmetrically cuneate, c. 8 mm long, c. 6 mm wide, with a very narrow annular wing. *Many-flowered Honeysuckle.* Fig. 184C–H.

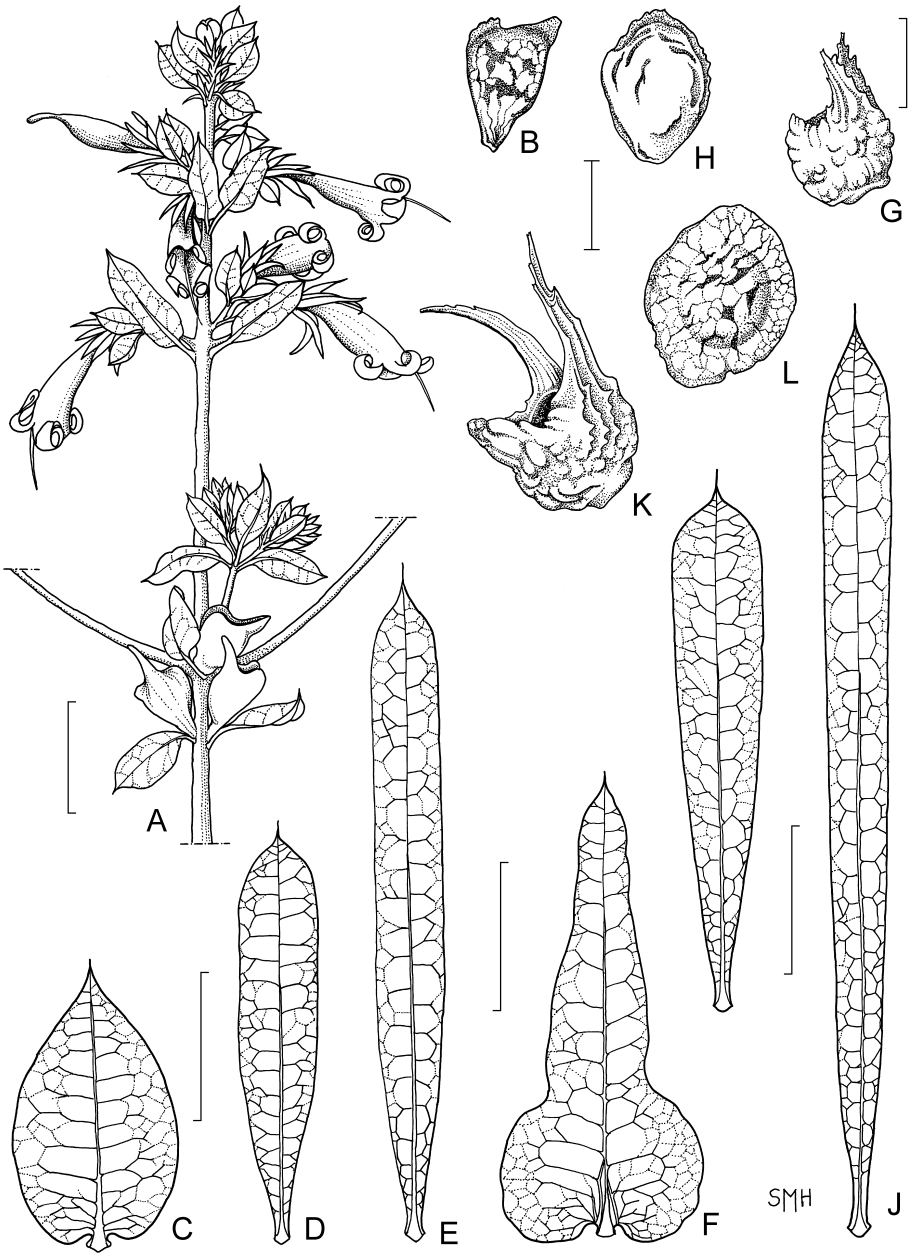



**Figure 184**. *Lambertia*. **A–B**, *L. uniflora*. **A**, branchlet with flowers and fruits; **B**, seed (**A–B**, E.Mullins 372, CBG). **C–H**, *L. multiflora*. **C**, ovate leaf (Darlington, W.A., A.Morrison, CANB); **D**, short narrowly linear leaf (N.Hoyle 180, CANB); **E**, long narrowly linear leaf (Darlington, W.A., A.Morrison, CANB); **F**, auricular leaf; **G**, fruit (**F–G**, N.Hoyle 180, CANB); **H**, seed (Darlington, W.A., A.Morrison, CANB). **I–L**, *L. formosa*. **I**, short narrowly obovate leaf (N.Burbidge 2866, CANB); **J**, long narrowly obovate leaf; **K**, fruit; **L**, seed (**J–L**, E.Canning 1165, CBG). Scale bars: **A** = 2 cm; **B**, **H**, **L** = 5 mm; **C–G**, **I–K** = 1 cm. Drawn by S.House.

Occurs from near Eneabba to Busselton, W.A.; grows in sandy, lateritic or loamy soils in kwongan or open *Banksia/Eucalyptus* woodland. Flowers mainly Aug.–Dec. There are 2 varieties.

Perianth reddish orange **5a.** var. **multiflora**

Perianth yellow **5b.** var. **darlingensis**

### 5a. Lambertia multiflora Lindl. var. multiflora

Perianth reddish orange.

Known from just south of Regans Ford to a little north of Eneabba, W.A. A common component of the sclerophyllous shrubs of the kwongan vegetation once prominent from Badgingarra to Eneabba; grows most abundantly in shallow sand over laterite. Map 480.

W.A.: 11 km N of Greenhead Rd along Eneabba South Rd, *Barnaby 880* (PERTH); 5 km S of Eneabba, *R.J.Hnatiuk 770023* (PERTH).

### 5b. Lambertia multiflora var. darlingensis Hnatiuk, *Fl. Australia* 16: 500 (1995)

T: Crystal Brook, W.A., Aug. 1971, *S.Paust s.n.*; holo: PERTH.

Illustrations: A.S.George, *Intr. Proteaceae W. Australia* 89, pl. 132 (1984); N.G.Marchant *et al.*, *Fl. Perth Reg.* 1: 349, fig. 126 (1987); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 438 (1989), all as *L. multiflora*.

Perianth yellow.

Known from Chittering Valley south to Busselton, W.A. Occurs primarily as isolated populations near base of Darling Range escarpment in deep, yellow sands or loamy, clayey or gravelly soils associated with kwongan or low open *Banksia* and *Eucalyptus* woodland. Map 481.

W.A.: 4.8 km E of Muchea on Chittering Valley Rd, *B.Maslin & R.G.Coveny 3113* (NSW, PERTH); Darlington to Greenmount, 21 Oct. 1908, *Morrison* (PERTH); Cannington, Sept. 1956, *Serventy* (PERTH).

### 6. Lambertia uniflora R.Br., *Trans. Linn. Soc. London* 10: 188 (1810)

T: in Novae Hollandiae ôra australi, Leeuwin's Land [W.A.], 1802, *R.Brown s.n.*; syn: BM, NSW.

Illustrations: A.S.George, *Intr. Proteaceae W. Australia* 86, pl. 128 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 455 (1989).

Shrub to 3 m tall, apparently lacking lignotubers. Branches erect; young branches densely pale brown-pubescent. Leaves with petiole 3–4 mm long; lamina ovate, obovate to elliptic, 10–30 mm long, 7–13 mm wide, sparsely pubescent or sometimes glabrous; margin entire; apex mucronate; midrib prominent below; venation reticulate above. Conflorescence terminal or appearing axillary, 1-flowered; inner bracts 8–30 mm long. Flowers zygomorphic. Perianth 25–40 mm long, red with prominent yellow or yellow-green limb, strongly dilated about middle, sparsely hairy; adaxial suture apparently deepest. Hypogynous glands 4, free. Ovary densely strigose; style sparsely pilose. Fruit asymmetrically cuneate, c. 8 mm long, c. 4 mm wide, beaked; sides smooth or finely fissured. Seeds 2, asymmetrically cuneate, c. 7 mm long, c. 2 mm wide, with minute wings at apex and base. Fig. 184A–B.

Known from inland areas between Albany and Cheyne Bay, and north to Stirling Range, W.A.; grows in tall shrubland and low eucalypt woodland in kwongan vegetation in sandy loam and lateritic gravel. Flowers mainly Oct.–Jan. Map 482.

W.A.: Hassell Hwy, *H.Demarz D7815* (PERTH); Stirling Ra., Mt Ross, Red Gum Pass, Oct. 1963, *A.M.Dorrien-Smith* (PERTH).

*Lambertia uniflora* appears to be most closely related to *L. multiflora* and *L. rariflora*.

### 7. **Lambertia rariflora** Meisn. *in* J.G.C.Lehmann, *Pl. Preiss*. 2: 263 (1848)

T: Swan River [W.A.], *J.Drummond 2: 312;* holo: PERTH.

Shrub or small tree to 7 m tall; lignotubers not known. Branches erect, slender; young branches with long spreading hairs. Leaves shortly petiolate; petiole 2–3 mm long; lamina linear or narrowly oblanceolate, 1.5–9 cm long, 2–5 mm wide, tapering slightly at base, sparsely hirsute, glabrescent; margins irregular and slightly revolute; apex usually shortly mucronate. Conflorescence appearing axillary, 1-flowered; inner bracts 2–4 mm long. Flowers zygomorphic. Perianth 25–35 mm long, green or yellow, dilated about middle, sparsely to densely pubescent; abaxial suture apparently deepest. Hypogynous glands 4, free. Style sparsely pilose in lower half. Fruit slender, cuneate, erect, c. 7–15 mm long, c. 3–5 mm wide; beak erect or curved inwards or outwards; sides smooth or slightly striate. Seeds apparently solitary, asymmetrically cuneate; wing apical, 1 mm long.

*Lambertia rariflora* appears to be most closely related to *L. multiflora* and *L. uniflora*. The inconspicuous green flowers of subsp. *rariflora* contrast with those of other *Lambertia* spp. which are brightly coloured yellow, red, orange or pink. It is a declared rare species in W.A. There are 2 geographically distinct subspecies.

| | |
|---|---|
| Flowers green; leaves with rounded apices with or without a mucro, rarely attenuate | **7a.** subsp. **rariflora** |
| Flowers yellow; leaves mostly attenuate and mucronate, rarely rounded | **7b.** subsp. **lutea** |

### 7a. **Lambertia rariflora** Meisn. subsp. **rariflora**

Leaves with rounded apices, with or without a mucro. Flowers with only one mature at a time within a leaf whorl and rarely others mature at the same time in nearby whorls. Perianth green. *Green Honeysuckle*.

Occurs inland from Busselton, W.A. Confined to very localised populations in lateritic or clayey soils near intermittent streams in open or closed *Eucalyptus megacarpa* and *E. calophylla*-dominated forest. Flowers Jan.–Mar. (observed on only 4 occasions). Map 483.

W.A.: 20 km SE of Busselton, *D.Halford 8/2/4* (PERTH); Jarrahwood, *McCutcheon 562* (PERTH); Whicher Ra., S of Busselton, *A.S.Weston 95.4.6* (PERTH).

### 7b. **Lambertia rariflora** subsp. **lutea** Hnatiuk, *Fl. Australia* 16: 500 (1995)

T: 30 km N of Walpole, W.A., 31 Mar. 1995, *A.S.Weston 95.4.1*.; holo: PERTH; iso: CBG.

Leaves mostly attenuate and mucronate, rarely rounded, with occasional short hairs. Flowers with only one mature at a time within a leaf whorl but others concurrently mature in adjacent leaf whorls. Perianth yellow.

Only known from two localities north of Walpole, W.A. Occurs on slopes in drier situations than subsp. *rariflora*. Flowers Mar. Map 484.

W.A.: c. 30 km N of Walpole, *A.S.Weston 93.3.6* (PERTH).

*Lambertia rariflora* subsp. *lutea* has been found in only two populations in close proximity to each other and some 200 km from the closest population of subsp. *rariflora*. It differs from subsp. *rariflora* in the colour of the flowers and in habitat. From the few specimens seen, the flowers are also more abundant than in subsp. *rariflora*.

### 8. **Lambertia orbifolia** C.A.Gardner, *J. Roy. Soc. W. Australia* 47: 55 (1964)

T: near King River, not far from King George Sound, W.A., June 1962, *A.J.Gray*; holo: PERTH.

Illustration: A.S.George, *Intr. Proteaceae W. Australia* 88, pl. 131 (1984).

Shrub to 3 m tall, apparently lacking lignotubers. Branches erect, spreading or arching; young branches brown, villous to pilose. Leaves opposite or rarely in whorls of 3, sessile or shortly petiolate; lamina orbicular, 15–20 mm diam., obtuse, slightly cordate and cupped, entire, glabrous. Conflorescence 4–6-flowered. Flowers zygomorphic. Perianth 40–50 mm

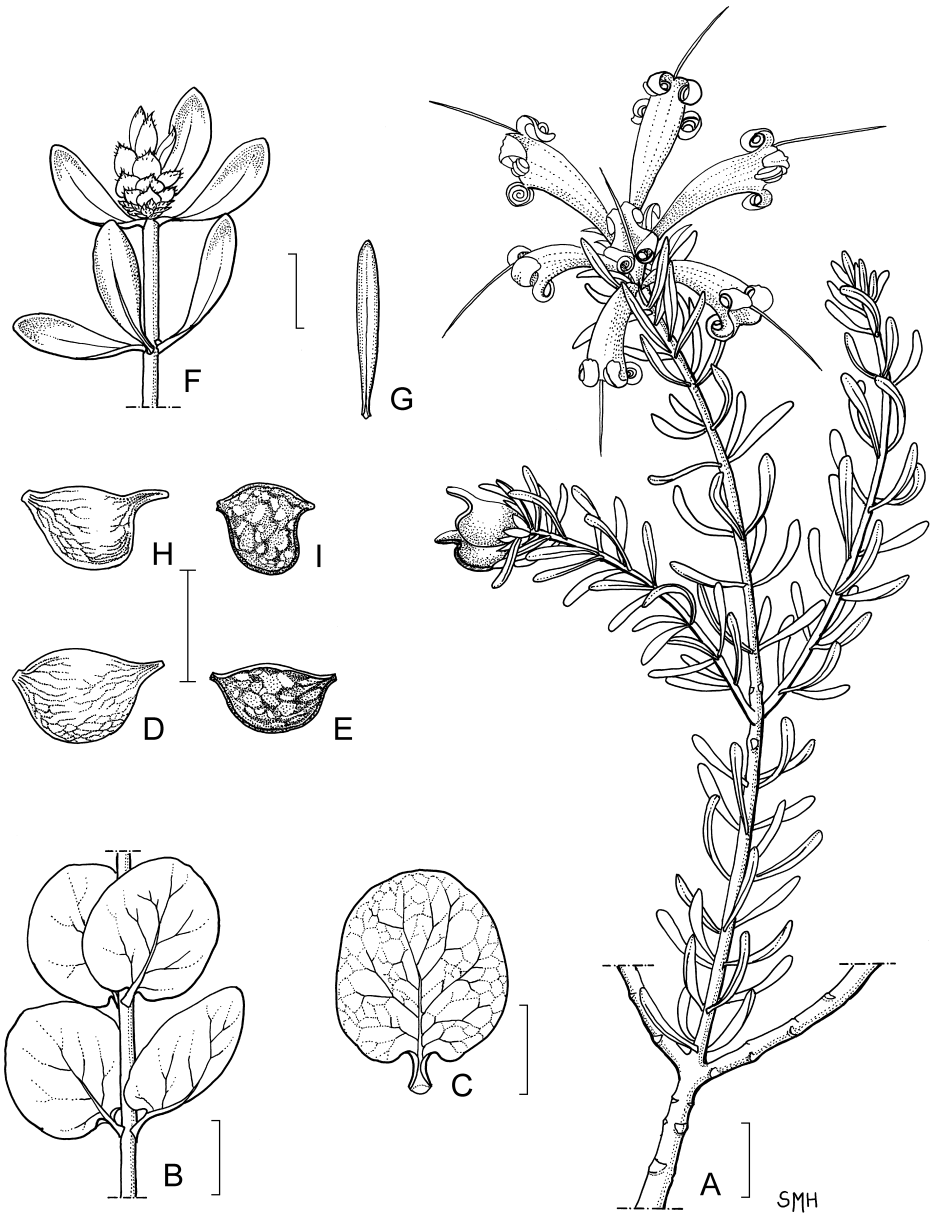



**Figure 185**. *Lambertia*. **A**, *L. ericifolia*. Branchlet with conflorescence and fruits ('Mt Helen Powell', W.A., M.Phillips, CBG). **B–E**, *L. orbifolia*. **B**, arrangement of leaves on stem; **C**, leaf; **D**, fruit; **E**, seed (**B–E**, N.Marchant 80/70, CANB). **F–I**, *L. inermis*. **F**, elliptic leaves on stem, with terminal overwintering bracts at apex (R.Purdie 5346, CBG); **G**, linear-oblong leaf (4.8 km N of Gibson, W.A., M.Phillips, CBG); **H**, fruit (R.Purdie 5346, CBG); **I**, seed (B.Barnsley 643, CBG). Scale bars = 1 cm. Drawn by S.House.

long, red, dilated about middle, brown-hirsute; abaxial suture deepest. Hypogynous glands 4, free. Ovary densely brown-pilose; style glabrous above, sparsely pilose in lower half. Fruit asymmetric, 7–10 mm diam., flattened; beak oblique; horns scarcely developed; sides smooth. Seeds 2, asymmetric, cuneate, c. 10 mm long, c. 6 mm wide, with a narrow wing from apex to base along one side. *Roundleaf Honeysuckle.* *Fig.* 185B–E.

Known only from very localised populations in south-western W.A.; grows in grey sand over laterite, in open *Eucalyptus* forest with *Banksia* and other shrubs in understorey. Flowers mainly Dec.–Jan. Map 485.

W.A.: W of Narrikup, *A.S.George 11771* (PERTH); on banks of Scott R., *R.D.Royce 67* (PERTH).

*Lambertia orbifolia* appears to be most closely related to *L. ericifolia* and *L. inermis*. These three, unlike other species, have flowers that face outward. The bracts do not constrain the flowers which spread widely so that they can readily be probed by birds such as honeyeaters which perch on the stems below the flowers. All three have asymmetric, cuneate seeds and obtuse leaves.

### 9. Lambertia ericifolia R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 30 (1830)

T: orâ occid.-merid., King George's Sound [W.A.], 1829, *W.Baxter*; holo: BM.

Illustration: B.Fuhrer & N.Marchant, *Wildfl. Stirling Range* 15 (1989).

Shrub to 5 m tall, lacking lignotubers. Branches, sparse, elongate; young branches shortly pubescent. Leaves with lamina arcuate, linear, 8–20 mm long, 1–1.5 mm wide, contracted to petiole; margin strongly revolute; apex obtuse. Conflorescence terminal or 2 or 3 together, 7-flowered; bracts numerous; outer bracts c. 3 mm long; inner bracts weak, c. 20 mm long, half length of perianth. Flowers zygomorphic, spreading, not enclosed by bracts. Perianth 30–55 mm long, red, dilated, strongly curved outwards, sparsely pilose; abaxial suture deepest. Hypogynous glands 4, free or partly connate. Style slender, glabrous. Fruit irregularly ovoid, sessile, 8–10 mm long, c. 6 mm wide; beak 4–6 mm long, with 2 low ridges adjacent to suture; sides smooth. Seeds 2, asymmetrically cuneate, c. 8 mm long, c. 4 mm wide, with a very narrow annular wing. *Native Honeysuckle, Heath-leaved Lambertia.* *Fig.* 185A.

Endemic in the vicinity of Stirling Range, W.A.; grows in gravelly soils in kwongan vegetation. Flowers mainly Aug.–Jan. Map 486.

W.A.: junction of E Pillenorup & South Bluff tracks, Stirling Ra., *B.Barnsley 719* (PERTH); c. 10 km S of South Bluff, Stirling Ra., *R.J.Hnatiuk 761386* (PERTH).

*Lambertia ericifolia* appears to be most closely related to *L. orbifolia* (see notes for that species) and *L. inermis*.

### 10. Lambertia inermis R.Br., *Trans. Linn. Soc. London* 10: 188 (1810)

T: Bay No. I [Lucky Bay, W.A.], 11 Jan. 1802, *R.Brown (Britten 3310)*; holo: BM; iso: MEL.

Shrub or small tree to 6 m tall, lacking lignotubers. Branches widely spreading; young branches minutely tomentose or silky. Leaves with petiole 2–4 mm long; lamina variable, ovate, oblong-spathulate to linear, 6–24 mm long, 3–7 mm wide, obtuse, glabrous above, densely white- or rusty brown-velvety below; margin entire, narrowly revolute. Conflorescence (6–) 7-flowered; inner bracts weak, widely spreading, yellow, brown, or purple. Flowers zygomorphic, spreading, possibly fragrant. Perianth 45–55 mm long, yellow, pale yellow-orange or orange to scarlet, often dark on limb, dilated in middle, glabrous; abaxial suture deepest. Hypogynous glands 4, free (rarely 2 fused). Style glabrous to sparsely pilose. Fruit asymetrically ovoid, 8–10 mm long, 6–8 mm wide; beak 2–5 mm long; sides smooth or minutely fissured. Seeds 2, asymmetrically cuneate, c. 8 mm long, c. 5 mm wide, with a very narrow, annular wing. *Chittick*. Fig. 185F–I.

Occurs inland from Albany/Esperance and north to Ongerup, W.A.; grows in a variety of soils, including coastal dunes, sand over limestone or laterite, and sandy loam. Associated vegetation is predominantly kwongan, mallee, and low woodland. Flowers throughout the year. There are 2 varieties.

Perianth orange **10a.** var. **inermis**

Perianth yellow **10b.** var. **drummondii**

### 10a. Lambertia inermis R.Br. var. inermis

Illustrations: R.Erickson *et al.*, *Fl. & Pl. W. Australia* 87, fig. 245 (1979); A.S.George, *Intr. Proteaceae W. Australia* 87, pl. 129 (1984); J.W.Wrigley & M.Fagg, *Banksias, Waratahs & Grevilleas* 438 (1989).

Perianth orange, ranging from moderately intense to pale. Fig. 152.

Occurs in W.A.; most prominent in south of species range. Flowers become paler towards north of range. Map 487.

W.A.: Coramup Hill, c. 30 km NE of Esperance, *P.S.Short 2328* (MEL, PERTH); 57.6 km N of Albany on highway from Borden, *M.D.Tindale 290a* (NSW, PERTH).

### 10b. Lambertia inermis var. drummondii (Fielding & Gardner) Hnatiuk, *Fl. Australia* 16: 500 (1995)

*Lambertia drummondii* Fielding & Gardner, *Sert. Pl.* part 1: t. 22 (1843). T: Swan River Colony, New Holland [W.A.], *J.Drummond 594*; holo: OXF.

Perianth pale to clear medium yellow.

Occurs north and north-east of Stirling Range, and southwards, W.A. Map 488.

W.A.: 31.7 km E of Hopetoun on track to Starvation Boat Harbour, *M.Carter 292* (PERTH); between Dumbleyung and L. Grace, *W.E.Blackall 3168* (PERTH).

*Lambertia inermis* var. *drummondii* is the more common variety north of the Stirling Range. The varieties are mixed and intergrade south of the Range.

## Excluded name

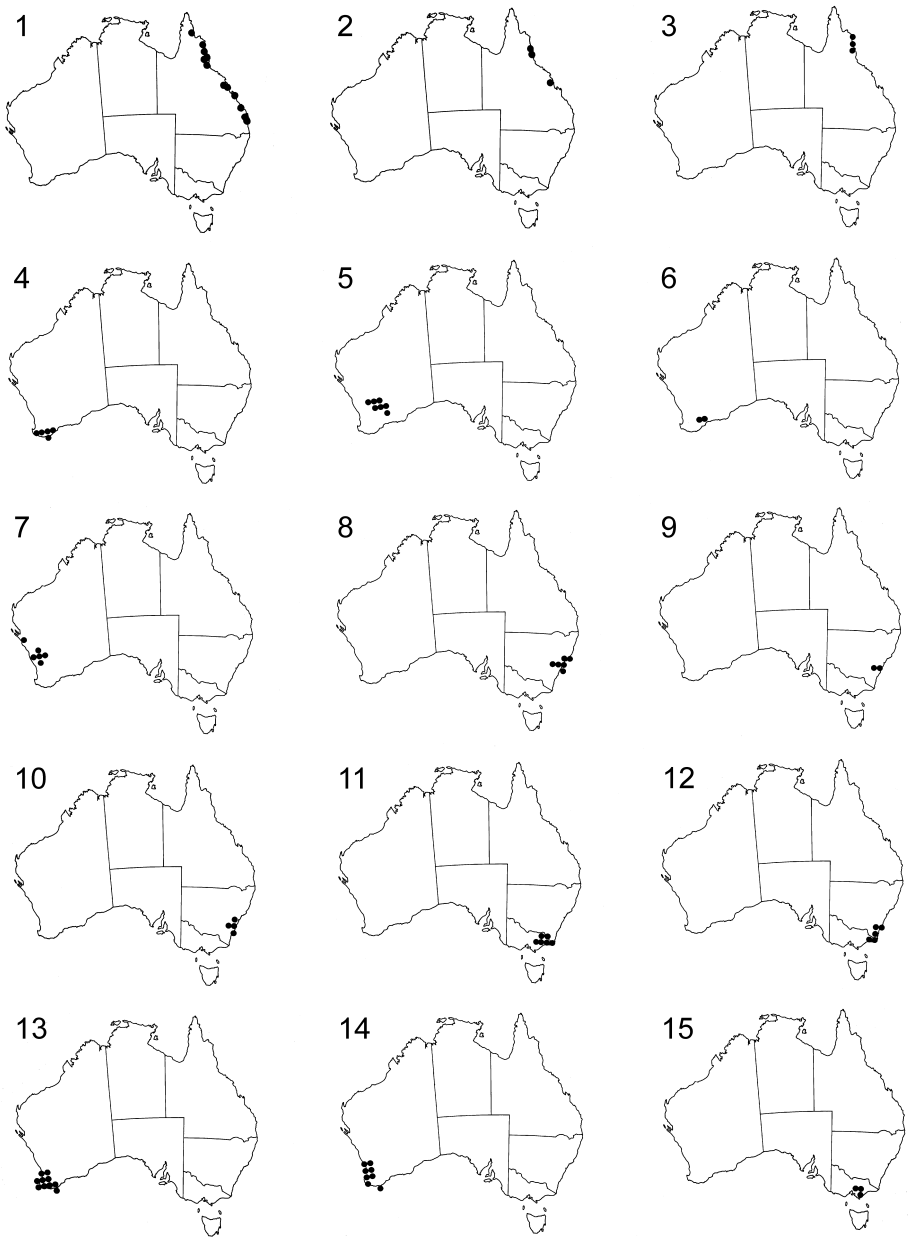
*Lambertia teretifolia* C.F.Gaertn., *Suppl. Carp.* 213, t. 217, fig. 7 (1807)

T: Port Jackson [N.S.W.], *Lambert*; *n.v.*

This is *Hakea pugioniformis* Cav., *nom. illeg.*, *fide* C.F.Meisner *in* A.L.P.P. de Candolle, *Prodr.* 14: 422 (1856) and G.Bentham, *Fl. Austral.* 5: 506 (1870).

## MAPS

Number in brackets refers to the page on which the taxon is described.




**1**. Elaeagnus triflora var. triflora (3)

**2**. Elaeagnus triflora var. brevilimbata (3)

**3**. Placospermum coriaceum (49)

**4**. Acidonia microcarpa (50)

**5**. Persoonia inconspicua (60)

**6**. Persoonia brevirhachis (60)

**7**. Persoonia rufiflora (62)

**8**. Persoonia laurina subsp. laurina (63)

**9**. Persoonia laurina subsp. intermedia (63)

**10**. Persoonia laurina subsp. leiogyna (63)

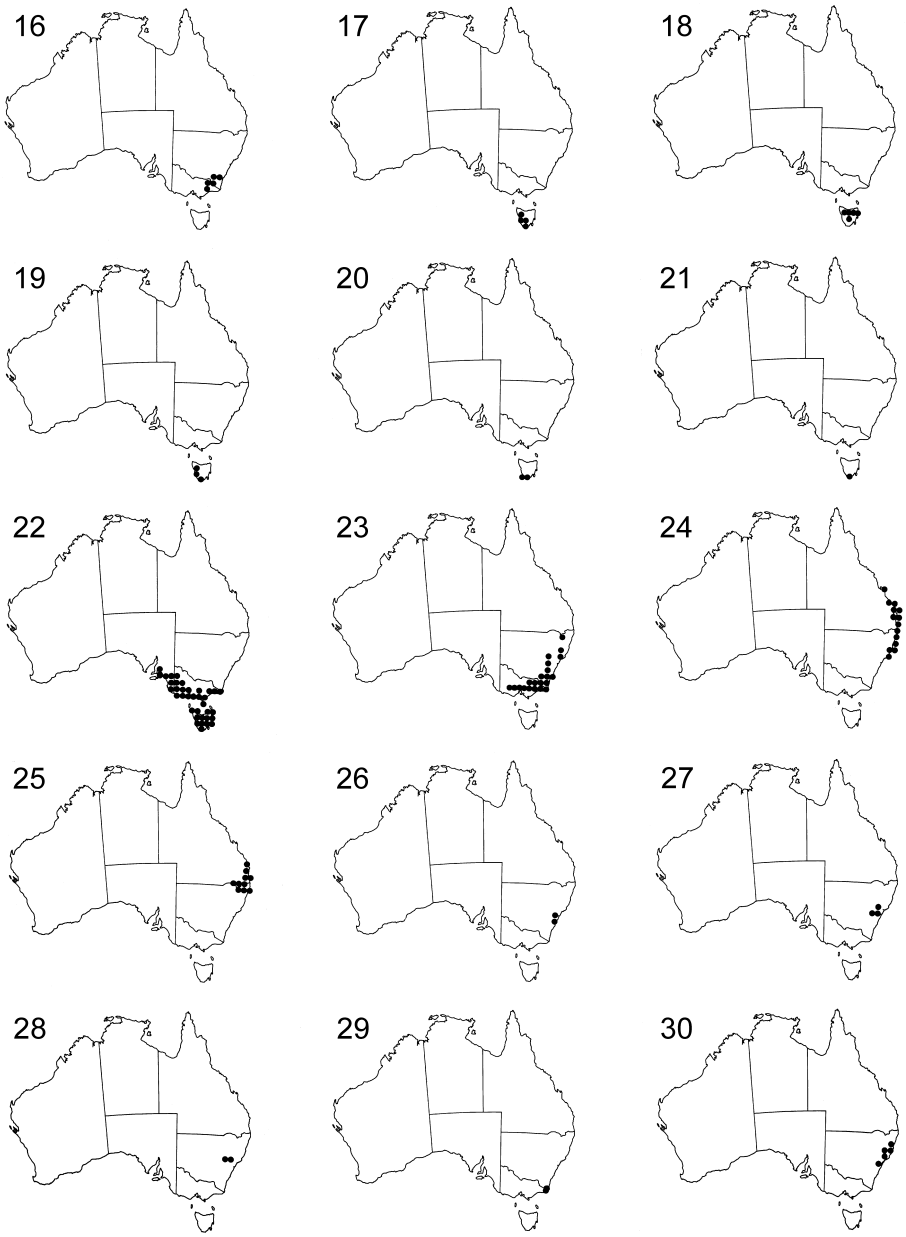
**11**. Persoonia confertiflora (64)

**12**. Persoonia silvatica (64)

**13**. Persoonia longifolia (65)

**14**. Persoonia elliptica (65)

**15**. Persoonia arborea (67)




**16**. Persoonia subvelutina (67)

**17**. Persoonia gunnii (68)

**18**. Persoonia muelleri subsp. muelleri (69)

**19**. Persoonia muelleri subsp. angustifolia (69)

**20**. Persoonia muelleri subsp. densifolia (70)

**21**. Persoonia moscalii (70)

**22**. Persoonia juniperina (71)

**23**. Persoonia chamaepeuce (72)

**24**. Persoonia virgata (72)

**25**. Persoonia tenuifolia (73)

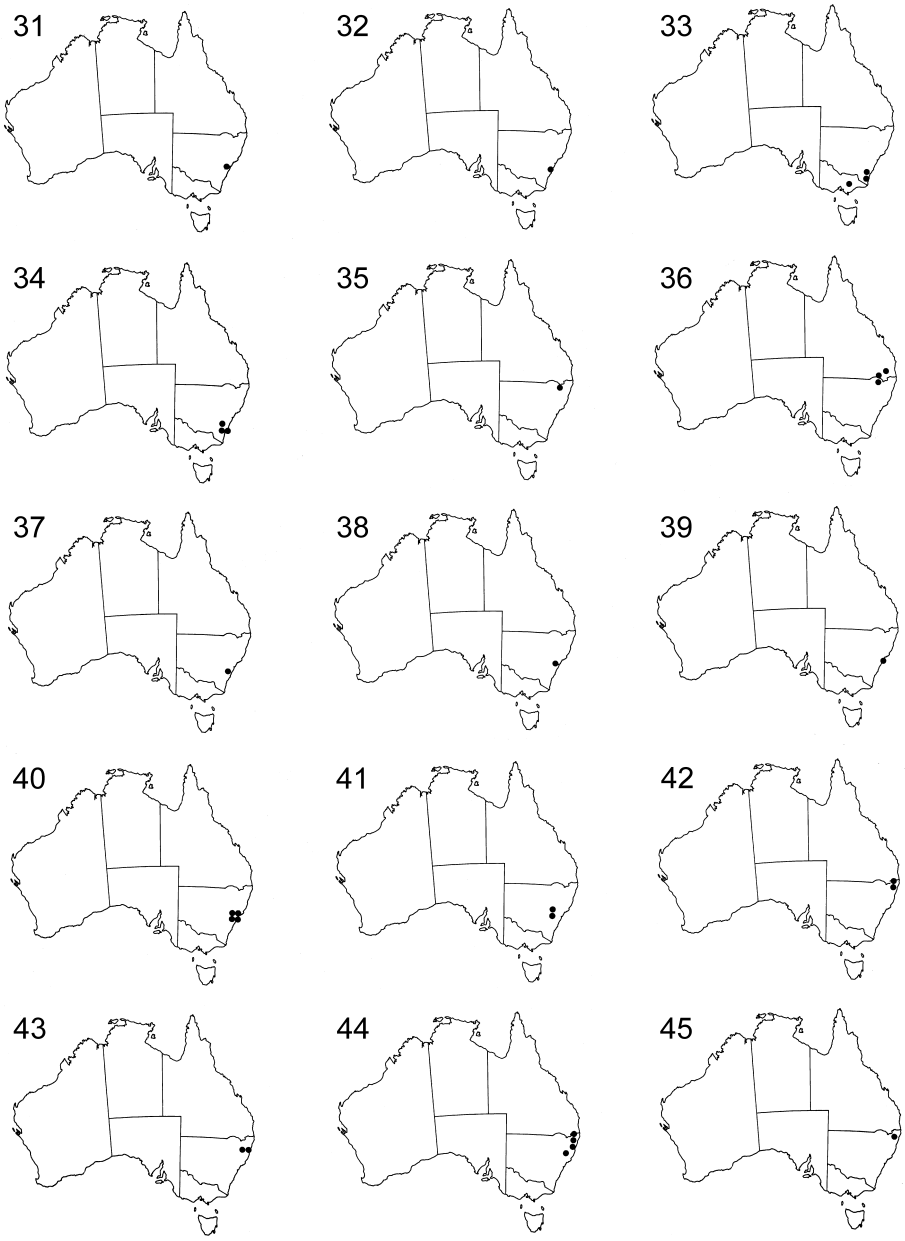
**26**. Persoonia acerosa (73)

**27**. Persoonia myrtilloides subsp. myrtilloides (74)

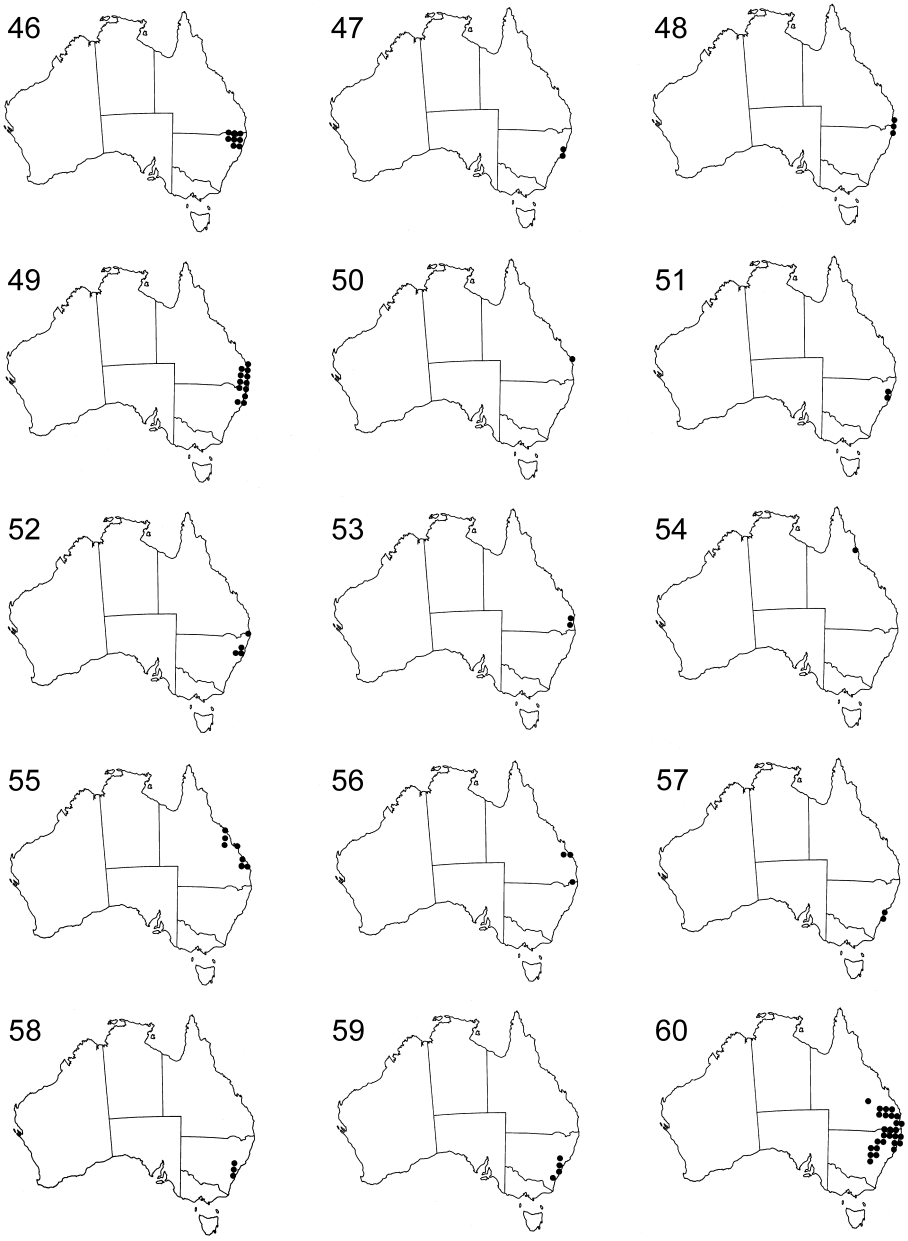
**28**. Persoonia myrtilloides subsp. cunninghamii (75)

**29**. Persoonia brevifolia (75)

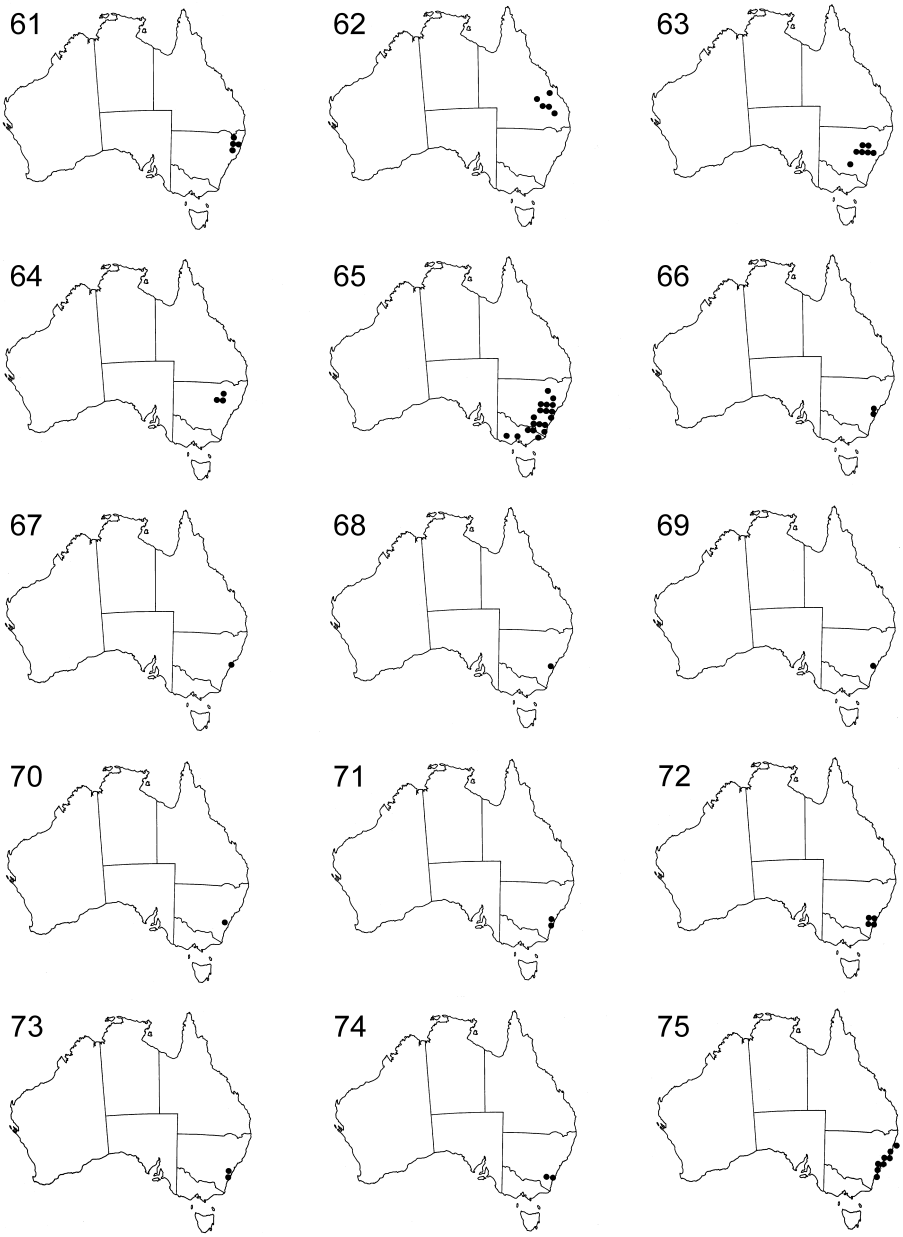
**30**. Persoonia acuminata (77)



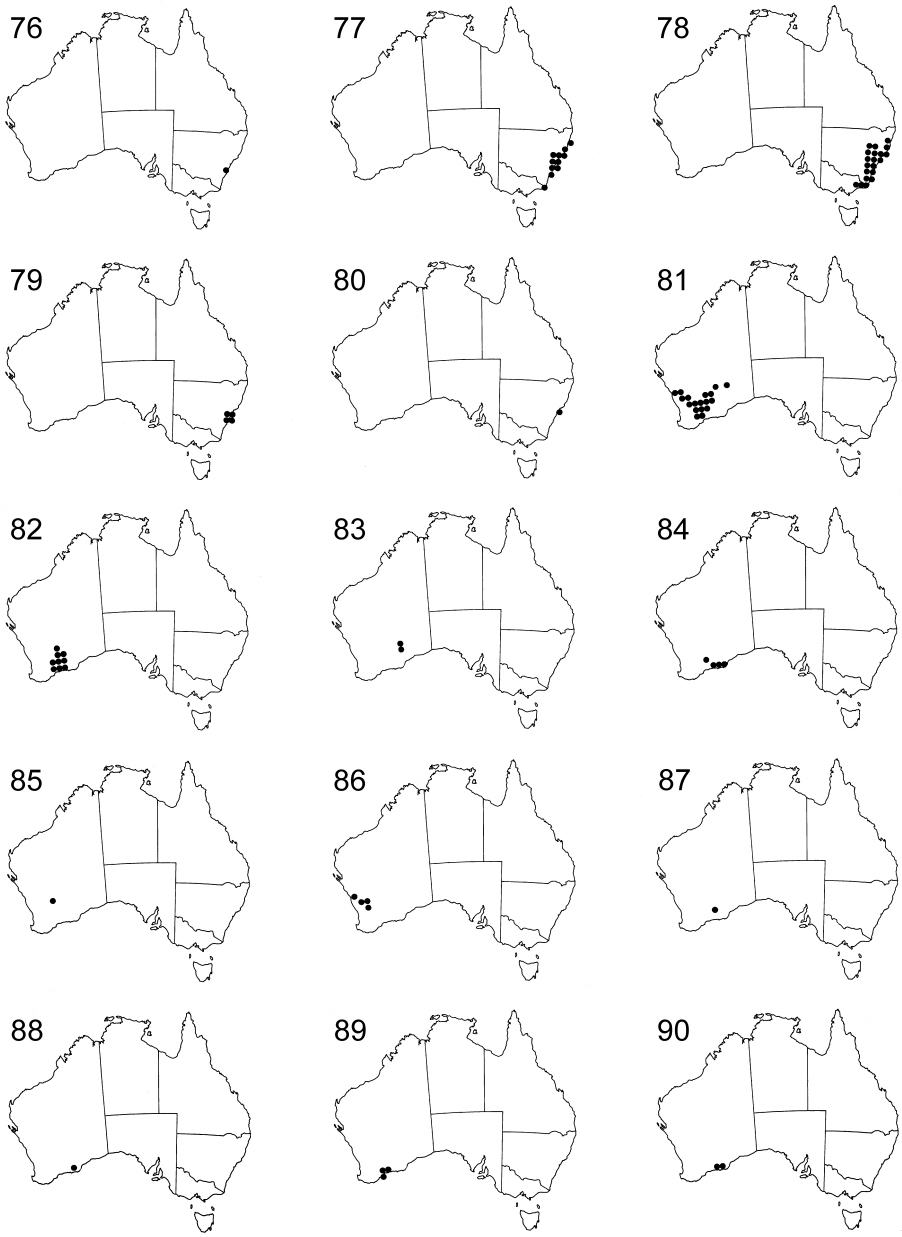

**31**. Persoonia recedens (77)
**32**. Persoonia oxycoccoides (78)
**33**. Persoonia asperula (78)
**34**. Persoonia microphylla (79)
**35**. Persoonia terminalis subsp. terminalis (79)
**36**. Persoonia terminalis subsp. recurva (80)
**37**. Persoonia bargoensis (80)
**38**. Persoonia nutans (80)
**39**. Persoonia laxa (81)
**40**. Persoonia oblongata (81)
**41**. Persoonia marginata (82)
**42**. Persoonia daphnoides (82)
**43**. Persoonia procumbens (82)
**44**. Persoonia oleoides (83)
**45**. Persoonia rufa (84)



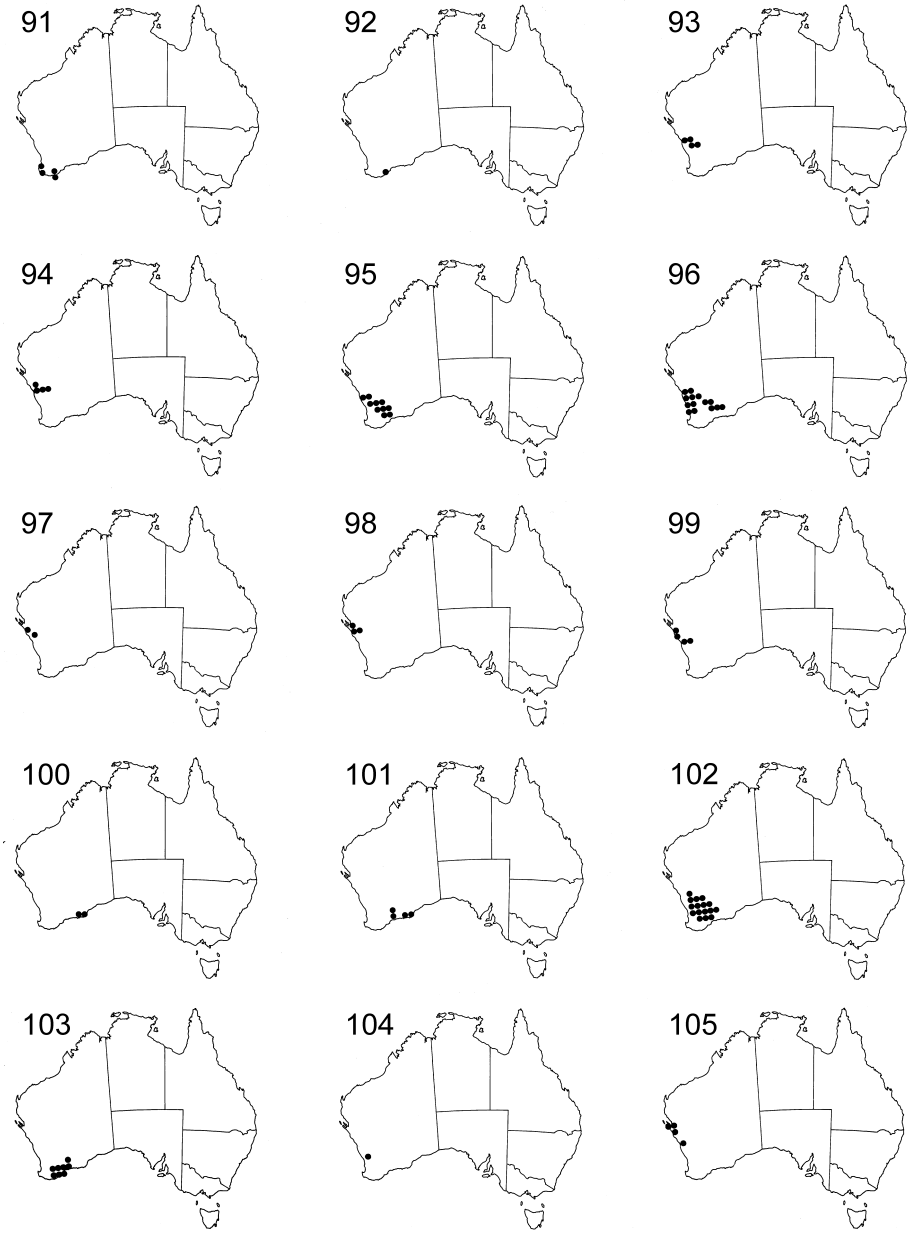

**46**. Persoonia cornifolia (84)
**47**. Persoonia katerae (85)
**48**. Persoonia adenantha (85)
**49**. Persoonia stradbrokensis (86)
**50**. Persoonia prostrata (86)
**51**. Persoonia conjuncta (86)
**52**. Persoonia media (87)
**53**. Persoonia iogyna (88)
**54**. Persoonia tropica (88)
**55**. Persoonia amaliae (89)
**56**. Persoonia volcanica (89)
**57**. Persoonia hirsuta subsp. hirsuta (90)
**58**. Persoonia hirsuta subsp. evoluta (90)
**59**. Persoonia chamaepitys (91)
**60**. Persoonia sericea (91)



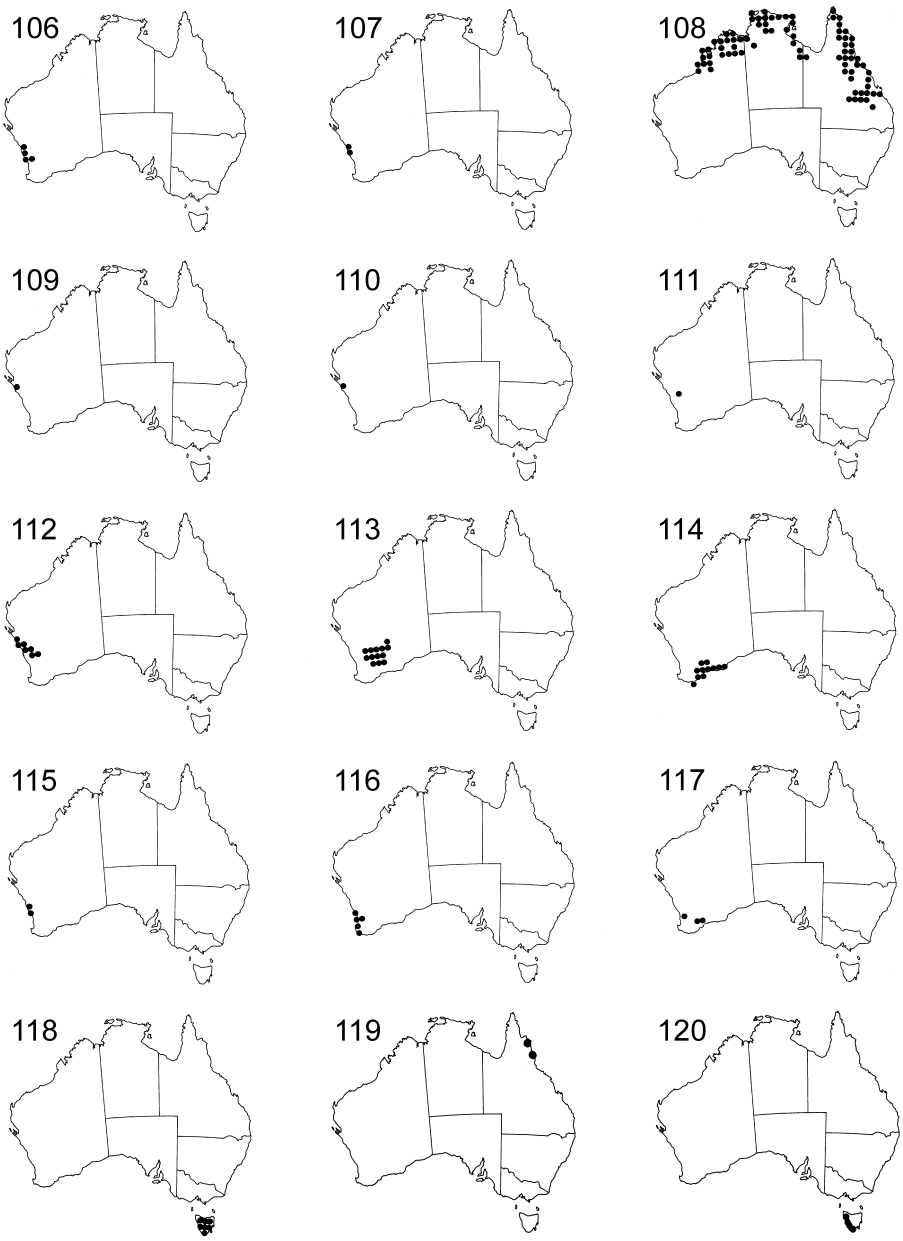

**61**. Persoonia fastigiata (93)
**62**. Persoonia subtilis (93)
**63**. Persoonia curvifolia (94)
**64**. Persoonia cuspidifera (94)
**65**. Persoonia rigida (95)
**66**. Persoonia mollis subsp. mollis (96)
**67**. Persoonia mollis subsp. maxima (97)
**68**. Persoonia mollis subsp. nectens (97)
**69**. Persoonia mollis subsp. ledifolia (97)
**70**. Persoonia mollis subsp. revoluta (98)
**71**. Persoonia mollis subsp. leptophylla (98)
**72**. Persoonia mollis subsp. livens (98)
**73**. Persoonia mollis subsp. caleyi (99)
**74**. Persoonia mollis subsp. budawangensis (99)
**75**. Persoonia lanceolata (99)



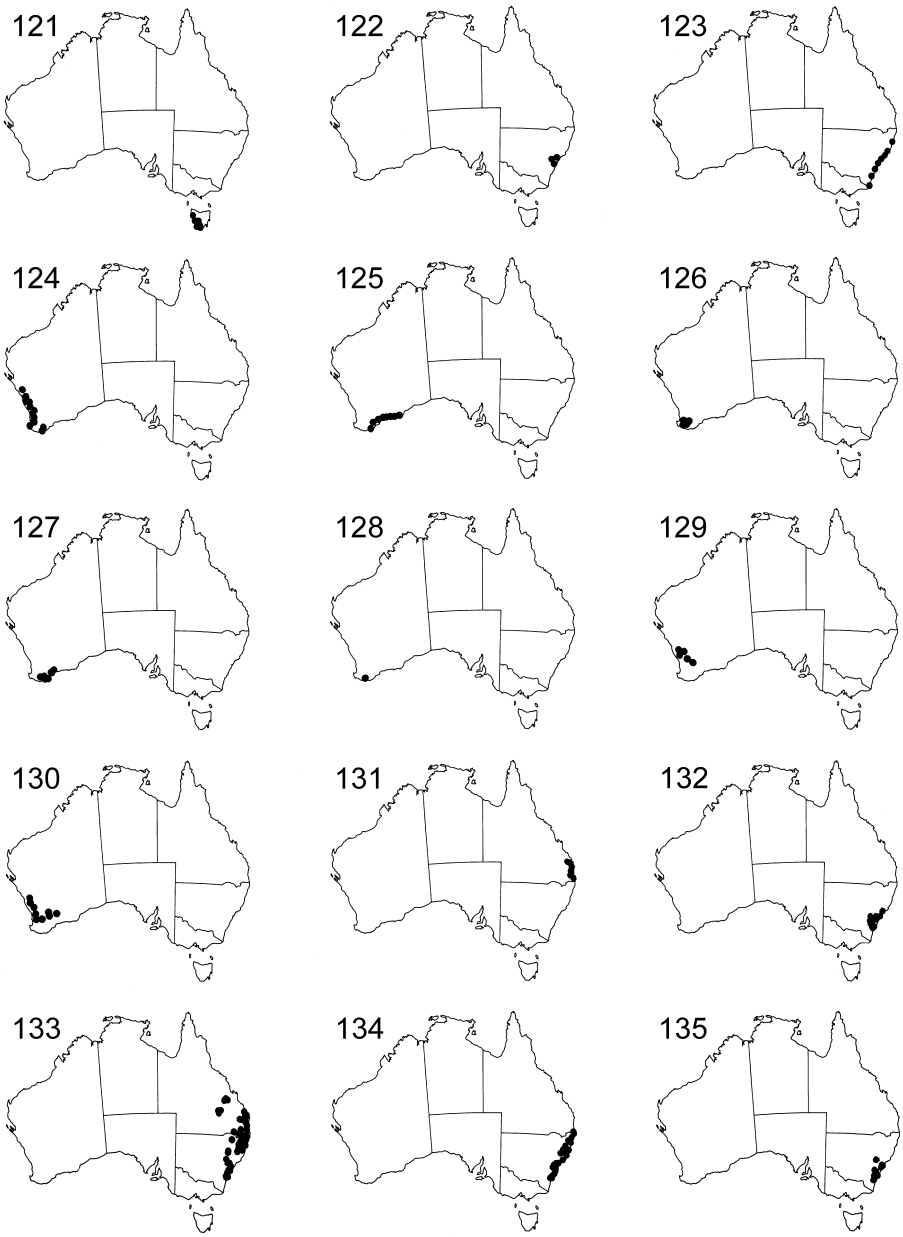

**76**. Persoonia glaucescens (100)
**77**. Persoonia levis (100)
**78**. Persoonia linearis (101)
**79**. Persoonia pinifolia (102)
**80**. Persoonia isophylla (103)
**81**. Persoonia coriacea (103)
**82**. Persoonia helix (105)
**83**. Persoonia pertinax (105)
**84**. Persoonia cymbifolia (105)
**85**. Persoonia leucopogon (106)
**86**. Persoonia pungens (106)
**87**. Persoonia baeckeoides (107)
**88**. Persoonia cordifolia (107)
**89**. Persoonia dillwynioides (107)
**90**. Persoonia flexifolia (108)




**91**. Persoonia graminea (108)
**92**. Persoonia micranthera (110)
**93**. Persoonia chapmaniana (110)
**94**. Persoonia pentasticha (111)
**95**. Persoonia trinervis (111)
**96**. Persoonia angustiflora (112)
**97**. Persoonia papillosa (113)
**98**. Persoonia bowgada (113)
**99**. Persoonia hexagona (115)
**100**. Persoonia spathulata (115)
**101**. Persoonia scabra (115)
**102**. Persoonia quinquenervis (116)
**103**. Persoonia striata (117)
**104**. Persoonia sulcata (117)
**105**. Persoonia acicularis (117)

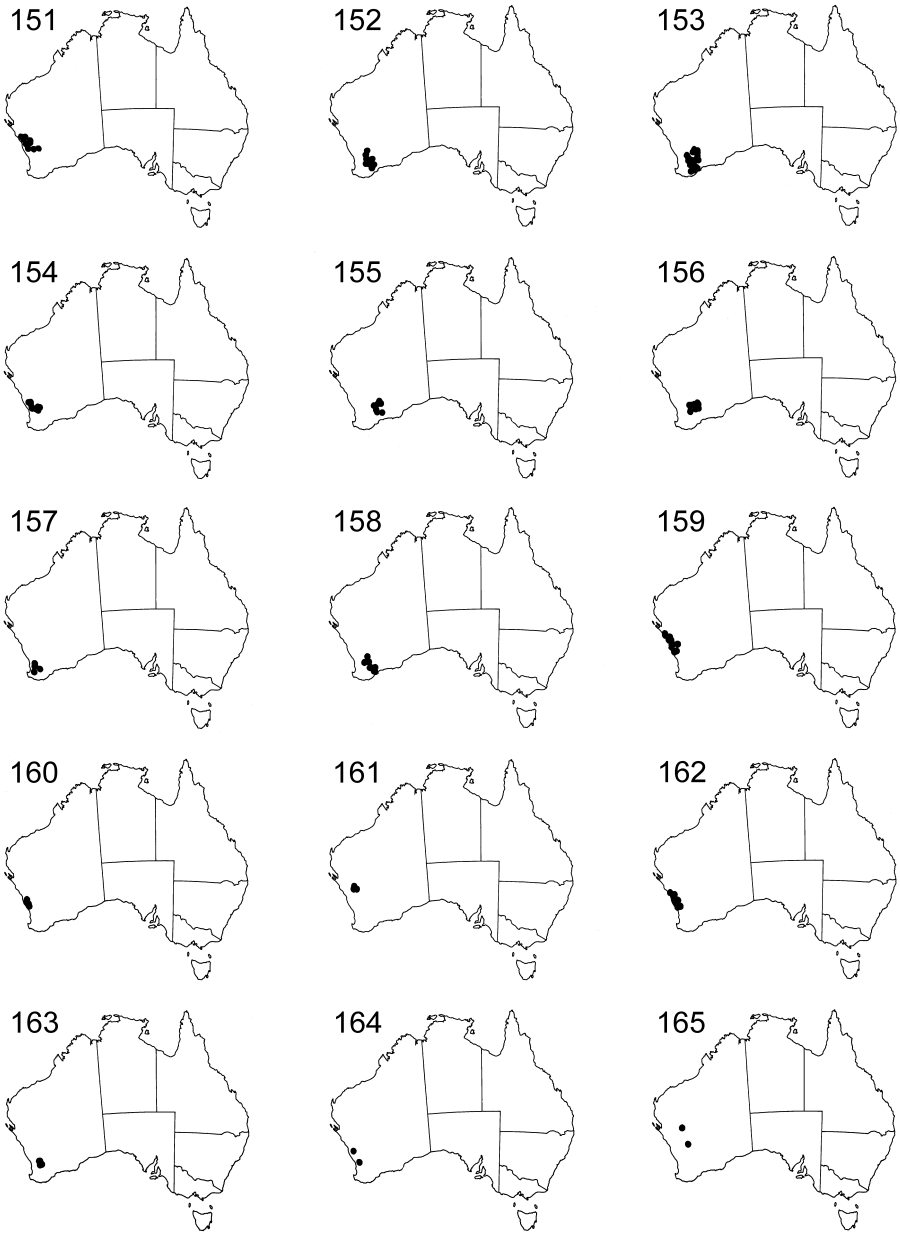



**106**. Persoonia rudis (118)
**107**. Persoonia filiformis (118)
**108**. Persoonia falcata (119)
**109**. Persoonia biglandulosa (119)
**110**. Persoonia brachystylis (121)
**111**. Persoonia kararae (121)
**112**. Persoonia stricta (121)
**113**. Persoonia saundersiana (122)
**114**. Persoonia teretifolia (122)
**115**. Persoonia comata (123)
**116**. Persoonia saccata (124)
**117**. Persoonia hakeiformis (124)
**118**. Bellendena montana (125)
**119**. Eidothea zoexylocarya (128)
**120**. Agastachys odorata (131)




**121**. Cenarrhenes nitida (133)
**122**. Symphionema montanum (135)
**123**. Symphionema paludosum (135)
**124**. Stirlingia latifolia (136)
**125**. Stirlingia anethifolia (138)
**126**. Stirlingia seselifolia (138)
**127**. Stirlingia tenuifolia (139)
**128**. Stirlingia divaricatissima (139)
**129**. Stirlingia abrotanoides (139)
**130**. Stirlingia simplex (140)
**131**. Petrophile shirleyae (154)
**132**. Petrophile pedunculata (155)
**133**. Petrophile canescens (155)
**134**. Petrophile pulchella (157)
**135**. Petrophile sessilis (157)


**136**. Petrophile multisecta (157)
**137**. Petrophile conifera (158)
**138**. Petrophile drummondii (158)
**139**. Petrophile rigida (158)
**140**. Petrophile circinata (159)
**141**. Petrophile crispata (159)
**142**. Petrophile seminuda (160)
**143**. Petrophile fastigiata (160)
**144**. Petrophile helicophylla (162)
**145**. Petrophile teretifolia (162)
**146**. Petrophile stricta (162)
**147**. Petrophile longifolia (163)
**148**. Petrophile acicularis (163)
**149**. Petrophile media (164)
**150**. Petrophile brevifolia (164)




**151**. Petrophile megalostegia (164)

**152**. Petrophile aspera (165)

**153**. Petrophile ericifolia subsp. ericifolia (165)

**154**. Petrophile ericifolia subsp. subpubescens (167)

**155**. Petrophile arcuata (167)

**156**. Petrophile merrallii (170)

**157**. Petrophile imbricata (170)

**158**. Petrophile cyathiforma (170)

**159**. Petrophile scabriuscula (173)

**160**. Petrophile recurva (173)

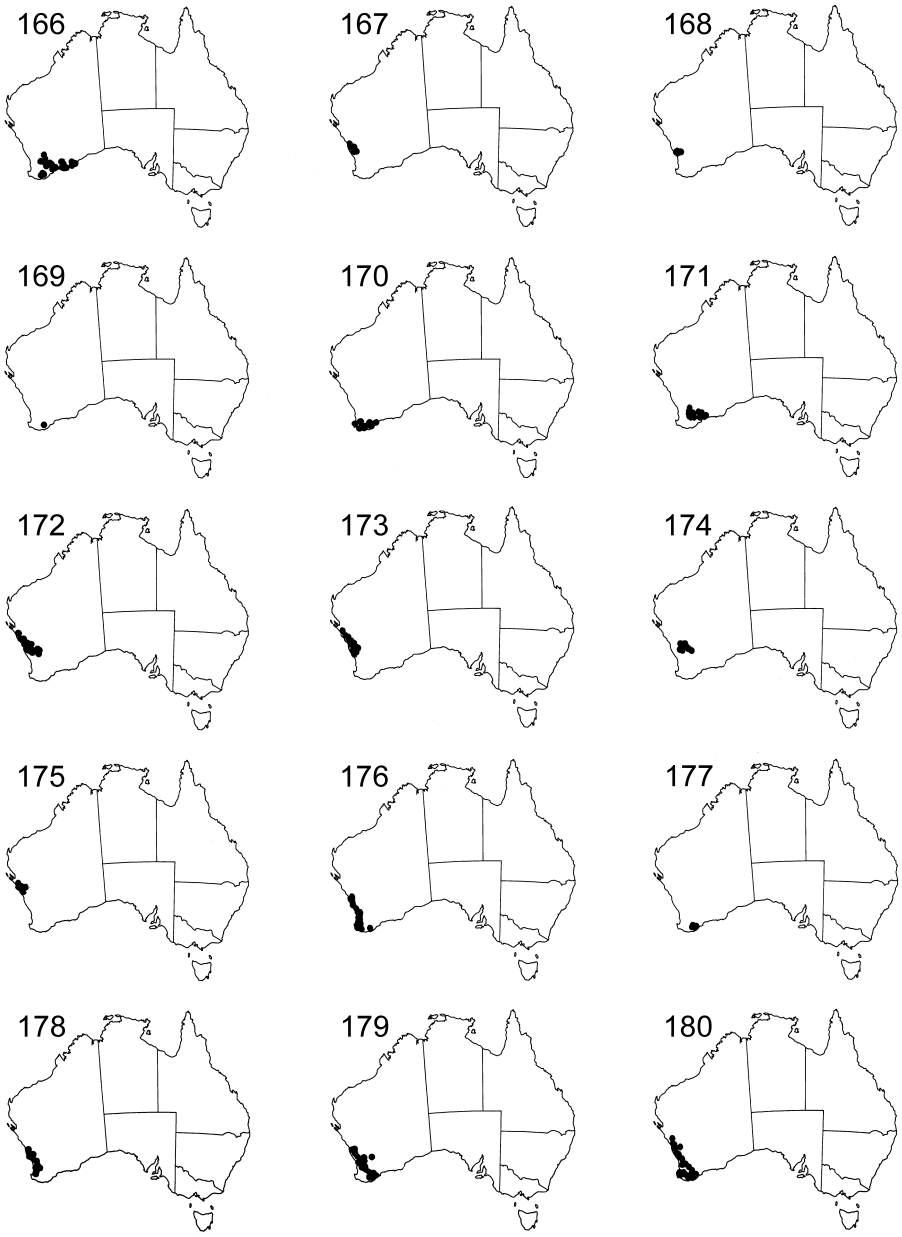
**161**. Petrophile wonganensis (173)

**162**. Petrophile chrysantha (177)

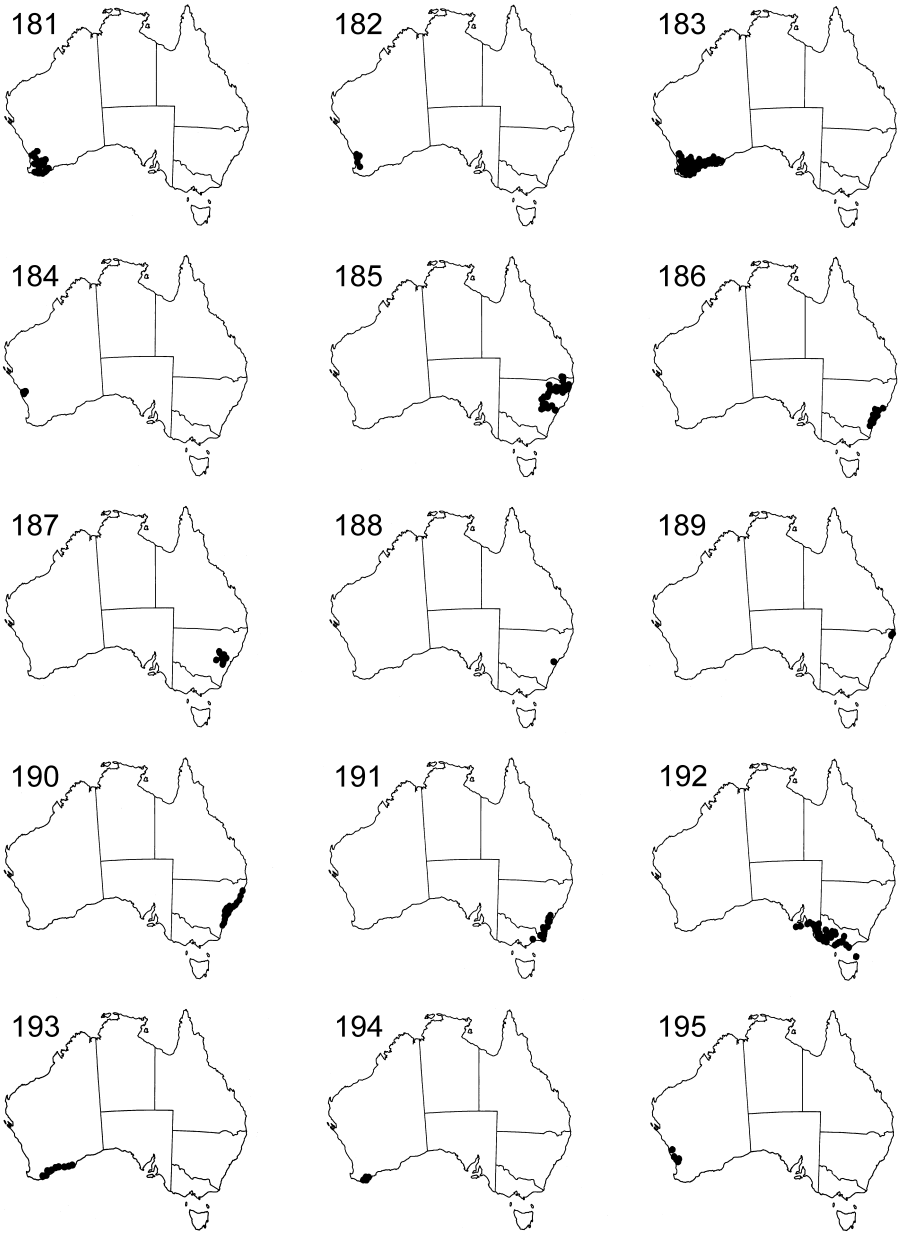
**163**. Petrophile misturata (177)

**164**. Petrophile trifurcata (177)

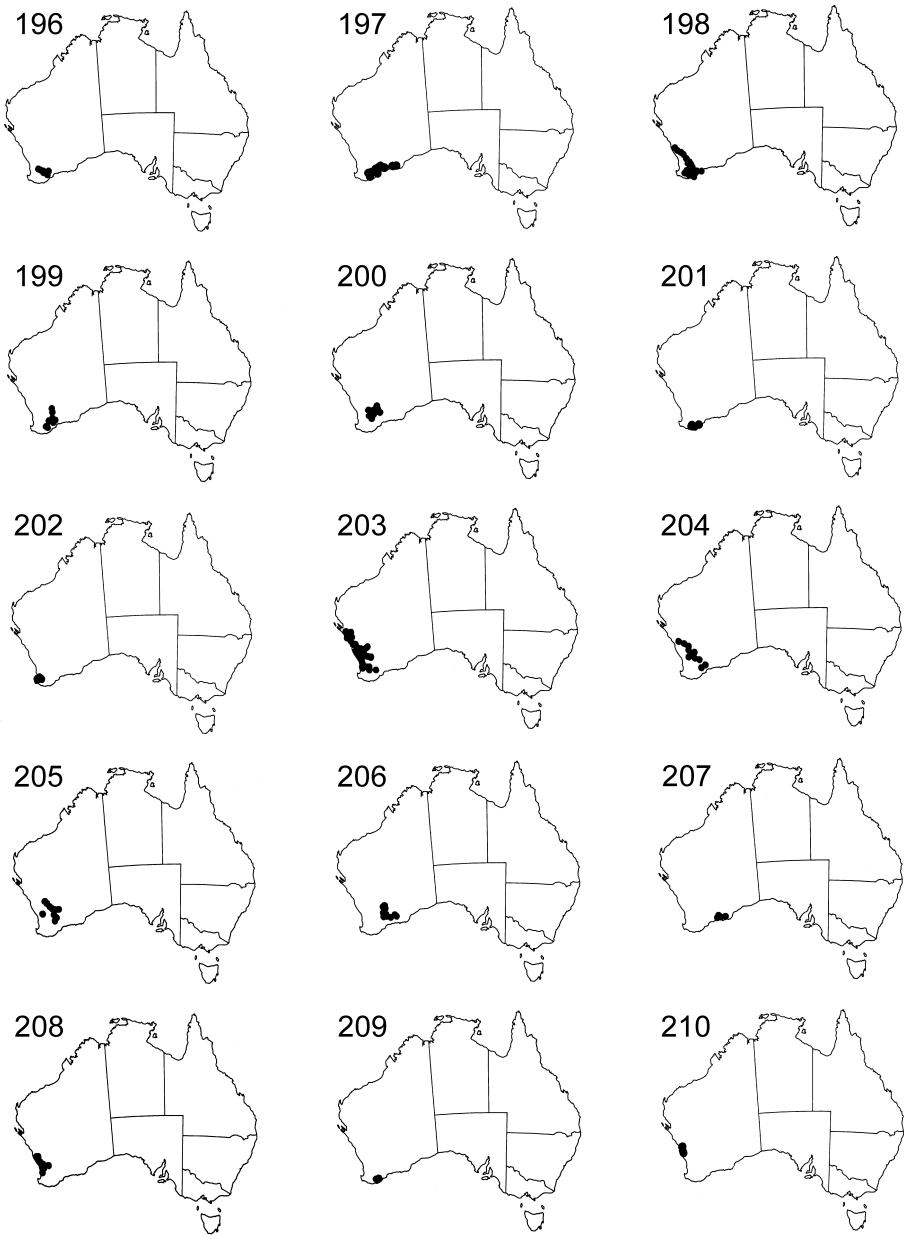
**165**. Petrophile pauciflora (180)




**166**. Petrophile phylicoides (180)
**167**. Petrophile biternata (180)
**168**. Petrophile plumosa (181)
**169**. Petrophile carduacea (181)
**170**. Petrophile diversifolia (181)
**171**. Petrophile glauca (183)
**172**. Petrophile shuttleworthiana (183)
**173**. Petrophile macrostachya (183)
**174**. Petrophile incurvata (185)
**175**. Petrophile semifurcata (185)
**176**. Petrophile linearis (185)
**177**. Petrophile anceps (187)
**178**. Petrophile striata (187)
**179**. Petrophile divaricata (188)
**180**. Petrophile serruriae (188)




**181**. Petrophile heterophylla (190) **182**. Petrophile biloba (190) **183**. Petrophile squamata (191)
**184**. Petrophile aculeata (193) **185**. Isopogon petiolaris (197) **186**. Isopogon anethifolius (198)
**187**. Isopogon dawsonii (198) **188**. Isopogon fletcheri (199) **189**. Isopogon mnoraifolius (199)
**190**. Isopogon anemonifolius (201) **191**. Isopogon prostratus (201) **192**. Isopogon ceratophyllus (202)
**193**. Isopogon trilobus (202) **194**. Isopogon longifolius (203) **195**. Isopogon sp. A (204)




**196**. Isopogon villosus (204)

**197**. Isopogon heterophyllus (205)

**198**. Isopogon teretifolius subsp. teretifolius (207)

**199**. Isopogon teretifolius subsp. petrophiloides (207)

**200**. Isopogon gardneri (207)

**201**. Isopogon formosus subsp. formosus (208)

**202**. Isopogon formosus subsp. dasylepis (208)

**203**. Isopogon divergens (209)

**204**. Isopogon scabriusculus subsp. scabriusculus (210)

**205**. Isopogon scabriusculus subsp. stenophyllus (210)

**206**. Isopogon scabriusculus subsp. pubifloris (210)

**207**. Isopogon alcicornis (210)

**208**. Isopogon asper (212)

**209**. Isopogon baxteri (212)

**210**. Isopogon inconspicuus (213)


**211**. Isopogon adenanthoides (213)
**212**. Isopogon tridens (214)
**213**. Isopogon linearis (214)
**214**. Isopogon polycephalus (215)
**215**. Isopogon attenuatus (215)
**216**. Isopogon uncinatus (217)
**217**. Isopogon sphaerocephalus (217)
**218**. Isopogon cuneatus (218)
**219**. Isopogon latifolius (218)
**220**. Isopogon dubius (219)
**221**. Isopogon crithmifolius (219)
**222**. Isopogon axillaris (221)
**223**. Isopogon buxifolius var. buxifolius (221)
**224**. Isopogon buxifolius var. spathulatus (222)
**225**. Isopogon buxifolius var. obovatus (222)


**226**. Isopogon buxifolius var. linearis (222)

**227**. Conospermum flexuosum subsp. flexuosum (228)

**228**. Conospermum flexuosum subsp. laevigatum (230)

**229**. Conospermum paniculatum (230)

**230**. Conospermum quadripetalum (230)

**231**. Conospermum teretifolium (232)

**232**. Conospermum capitatum subsp. capitatum (234)

**233**. Conospermum capitatum subsp. glabratum (234)

**234**. Conospermum capitatum subsp. velutinum (234)

**235**. Conospermum petiolare (234)

**236**. Conospermum elongatum (235)

**237**. Conospermum leianthum subsp. leianthum (236)

**238**. Conospermum leianthum subsp. orientale (236)

**239**. Conospermum toddii (236)

**240**. Conospermum eatoniae (237)


**241**. Conospermum ephedroides (237)

**242**. Conospermum polycephalum (237)

**243**. Conospermum glumaceum (239)

**244**. Conospermum caeruleum subsp. caeruleum (240)

**245**. Conospermum caeruleum subsp. oblanceolatum (240)

**246**. Conospermum caeruleum subsp. contortum (240)

**247**. Conospermum caeruleum subsp. marginatum (240)

**248**. Conospermum caeruleum subsp. debile (242)

**249**. Conospermum caeruleum subsp. spathulatum (242)

**250**. Conospermum huegelii (242)

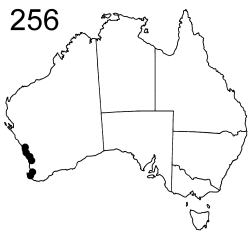
**251**. Conospermum densiflorum subsp. densiflorum (243)

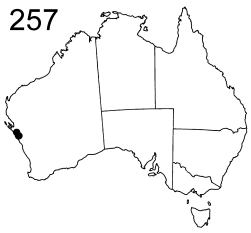
**252**. Conospermum densiflorum subsp. unicephalatum (243)

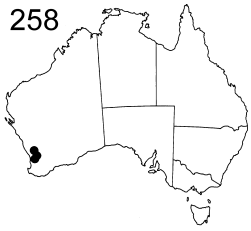
**253**. Conospermum brownii (243)

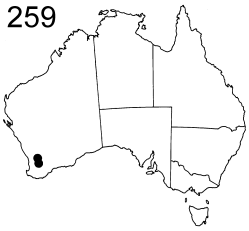
**254**. Conospermum scaposum (245)

**255**. Conospermum tenuifolium (245)

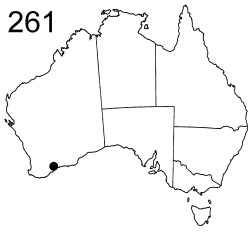


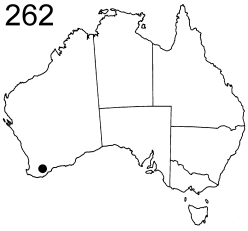



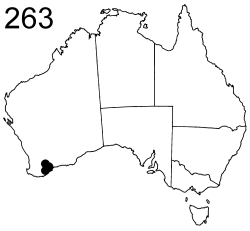



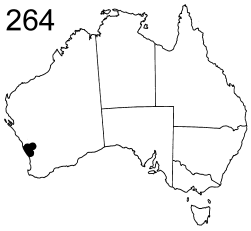



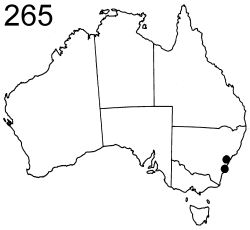


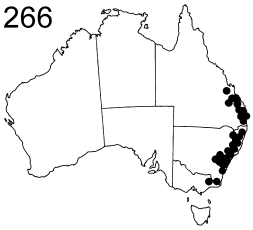


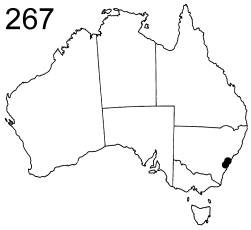



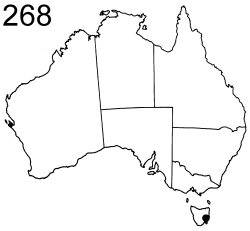



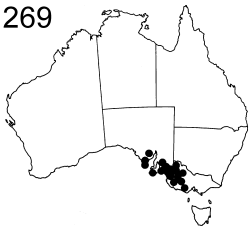



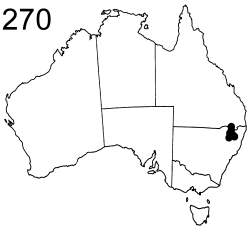




**256**. Conospermum acerosum subsp. acerosum (247)

**257**. Conospermum acerosum subsp. hirsutum (247)

**258**. Conospermum amoenum subsp. amoenum (248)

**259**. Conospermum amoenum subsp. cuneatum (248)

**260**. Conospermum croniniae (248)

**261**. Conospermum coerulescens subsp. coerulescens (249)

**262**. Conospermum coerulescens subsp. dorrienii (249)

**263**. Conospermum coerulescens subsp. adpressum (250)

**264**. Conospermum nervosum (250)

**265**. Conospermum ericifolium (252)

**266**. Conospermum taxifolium (252)

**267**. Conospermum ellipticum (254)

**268**. Conospermum hookeri (254)

**269**. Conospermum patens (255)

**270**. Conospermum burgessiorum (255)


**271**. Conospermum sphacelatum (255)

**272**. Conospermum longifolium subsp. longifolium (256)

**273**. Conospermum longifolium subsp. mediale (256)

**274**. Conospermum longifolium subsp. angustifolium (257)

**275**. Conospermum mitchellii (257)

**276**. Conospermum filifolium subsp. filifolium (258)

**277**. Conospermum filifolium subsp. australe (258)

**278**. Conospermum sigmoideum (260)

**279**. Conospermum distichum (260)

**280**. Conospermum multispicatum (260)

**281**. Conospermum floribundum (262)

**282**. Conospermum spectabile (262)

**283**. Conospermum bracteosum (262)

**284**. Conospermum microflorum (263)

**285**. Conospermum stoechadis subsp. stoechadis (264)


**286**. Conospermum stoechadis subsp. sclerophyllum (264)

**287**. Conospermum canaliculatum subsp. canaliculatum (264)

**288**. Conospermum canaliculatum subsp. apiculatum (265)

**289**. Conospermum triplinervium (265)

**290**. Conospermum cinereum (265)

**291**. Conospermum undulatum (266)

**292**. Conospermum wycherleyi subsp. wycherleyi (266)

**293**. Conospermum wycherleyi subsp. glabrum (267)

**294**. Conospermum boreale subsp. boreale (267)

**295**. Conospermum boreale subsp. ascendens (267)

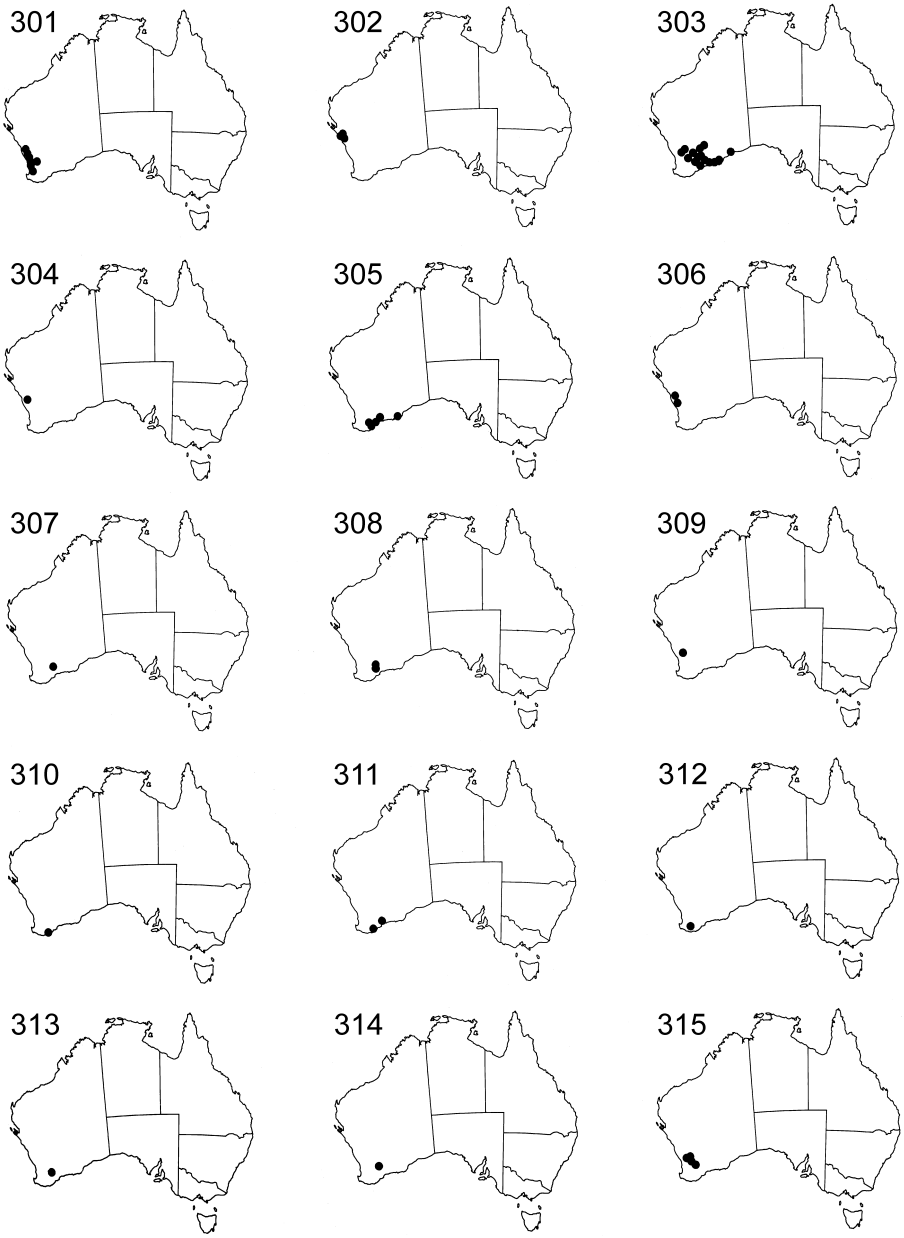
**296**. Conospermum incurvum (268)

**297**. Conospermum brachyphyllum (268)

**298**. Conospermum unilaterale (270)

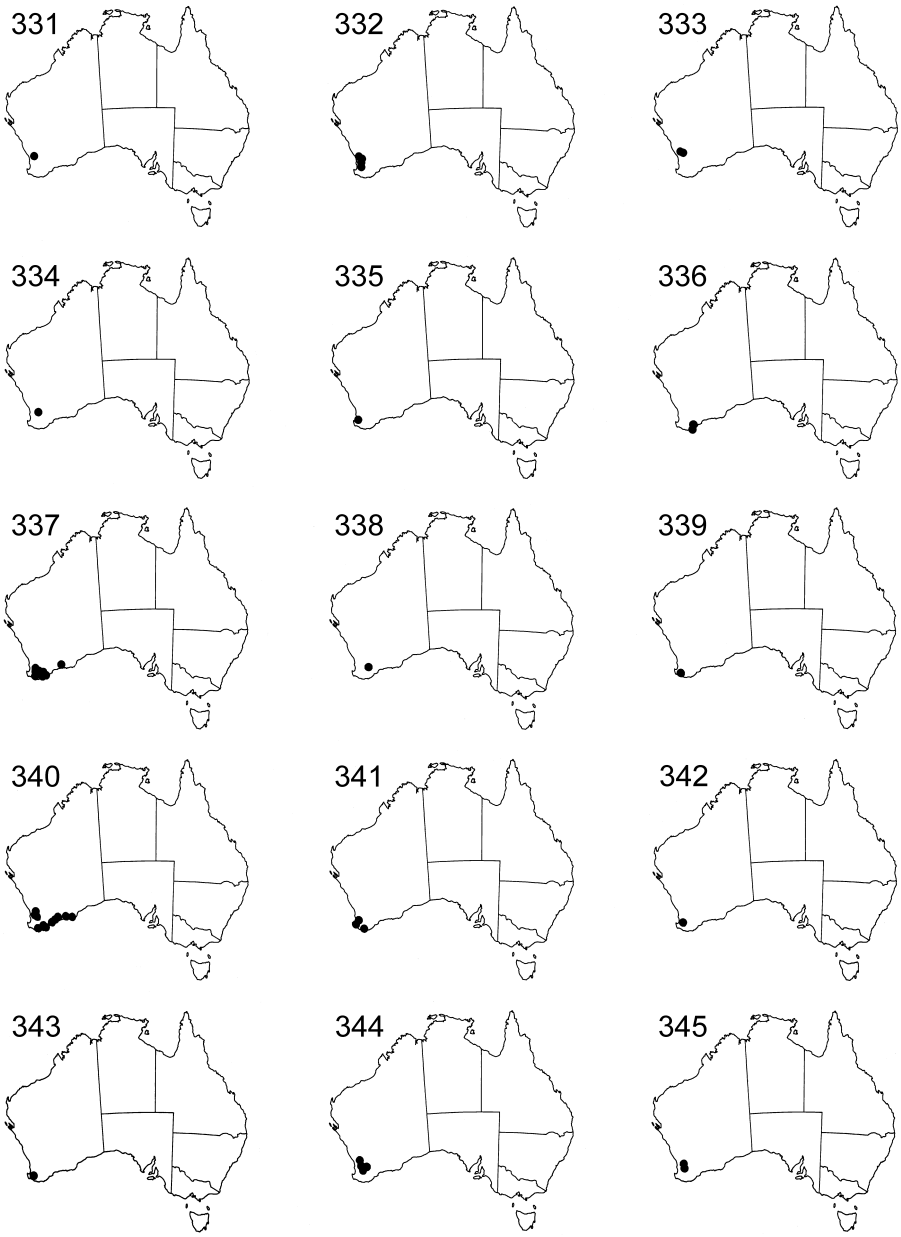
**299**. Conospermum galeatum (270)

**300**. Conospermum crassinervium (270)

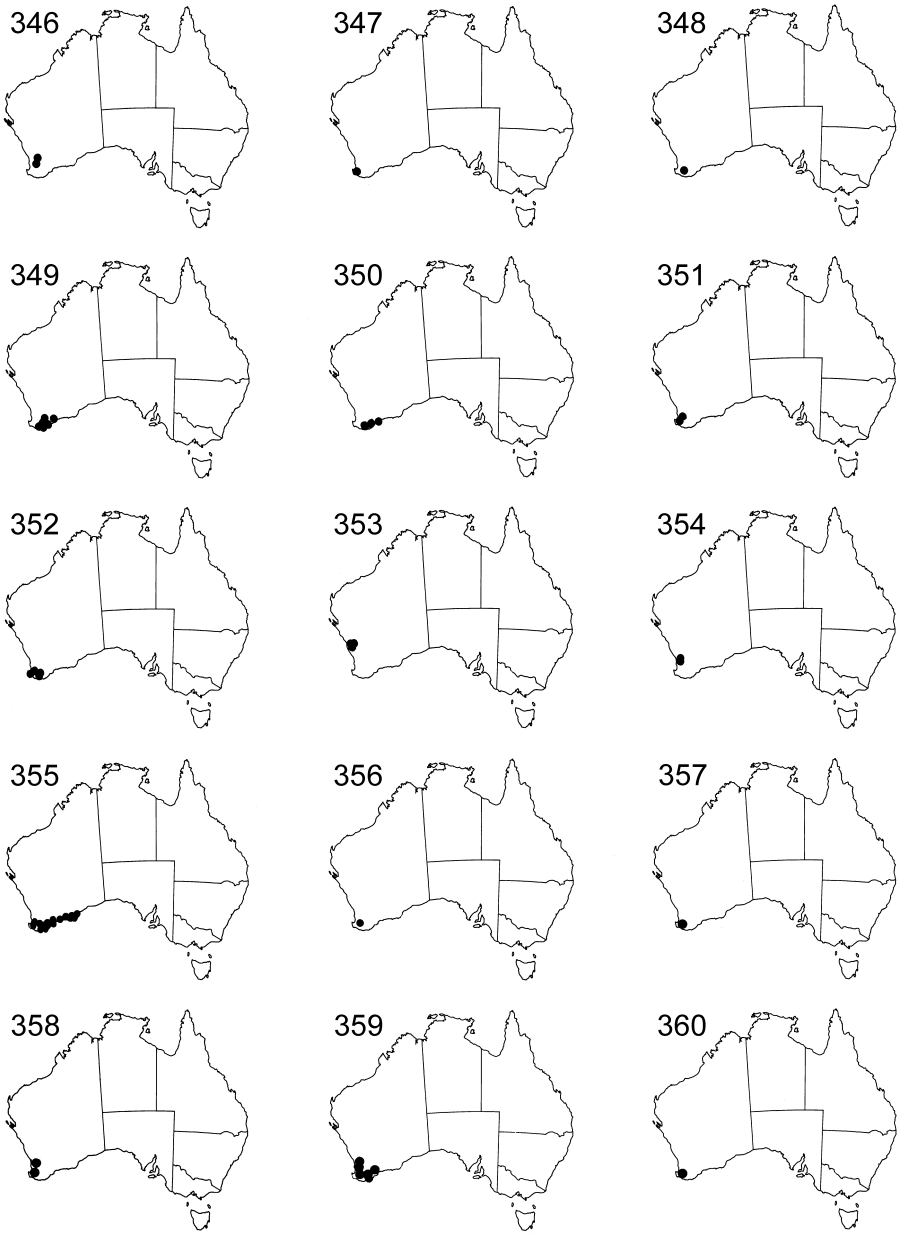



**301**. Synaphea spinulosa subsp. spinulosa (277)
**302**. Synaphea spinulosa subsp. borealis (278)
**303**. Synaphea spinulosa subsp. major (278)
**304**. Synaphea endothrix (278)
**305**. Synaphea media (280)
**306**. Synaphea sparsiflora (280)
**307**. Synaphea canaliculata (281)
**308**. Synaphea cervifolia (281)
**309**. Synaphea quartzitica (281)
**310**. Synaphea incurva (282)
**311**. Synaphea polymorpha (282)
**312**. Synaphea intricata (284)
**313**. Synaphea parviflora (284)
**314**. Synaphea tripartita (284)
**315**. Synaphea constricta (285)


**316**. Synaphea bifurcata (285)
**317**. Synaphea oligantha (286)
**318**. Synaphea flexuosa (286)
**319**. Synaphea divaricata (286)
**320**. Synaphea interioris (288)
**321**. Synaphea tamminensis (288)
**322**. Synaphea rangiferops (289)
**323**. Synaphea lesueurensis (289)
**324**. Synaphea aephynsa (289)
**325**. Synaphea gracillima (290)
**326**. Synaphea drummondii (290)
**327**. Synaphea acutiloba (291)
**328**. Synaphea stenoloba (291)
**329**. Synaphea odocoileops (292)
**330**. Synaphea recurva (292)




**331**. Synaphea grandis (294)
**332**. Synaphea decorticans (294)
**333**. Synaphea panhesya (294)
**334**. Synaphea boyaginensis (295)
**335**. Synaphea whicherensis (295)
**336**. Synaphea preissii (296)
**337**. Synaphea obtusata (296)
**338**. Synaphea platyphylla (298)
**339**. Synaphea nexosa (298)
**340**. Synaphea petiolaris subsp. petiolaris (299)
**341**. Synaphea petiolaris subsp. triloba (299)
**342**. Synaphea petiolaris subsp. simplex (299)
**343**. Synaphea otiostigma (301)
**344**. Synaphea flabelliformis (301)
**345**. Synaphea damopsis (302)




**346**. Synaphea cuneata (302)
**347**. Synaphea macrophylla (302)
**348**. Synaphea decumbens (303)
**349**. Synaphea reticulata (303)
**350**. Synaphea favosa (304)
**351**. Synaphea hians (304)
**352**. Synaphea floribunda (306)
**353**. Synaphea oulopha (315)
**354**. Synaphea pinnata (315)
**355**. Franklandia fucifolia (316)
**356**. Franklandia triaristata (317)
**357**. Adenanthos detmoldii (322)
**358**. Adenanthos barbiger (324)
**359**. Adenanthos obovatus (324)
**360**. Adenanthos × pamela (324)


**361**. Adenanthos drummondii (325)

**362**. Adenanthos dobagii (325)

**363**. Adenanthos apiculatus (326)

**364**. Adenanthos linearis (326)

**365**. Adenanthos pungens subsp. pungens (328)

**366**. Adenanthos pungens subsp. effusus (328)

**367**. Adenanthos gracilipes (328)

**368**. Adenanthos venosus (329)

**369**. Adenanthos dobsonii (329)

**370**. Adenanthos glabrescens subsp. glabrescens (330)

**371**. Adenanthos glabrescens subsp. exasperatus (330)

**372**. Adenanthos ellipticus (330)

**373**. Adenanthos cuneatus (331)

**374**. Adenanthos stictus (331)

**375**. Adenanthos ileticos (332)


**376**. Adenanthos forrestii (332)

**377**. Adenanthos eyrei (332)

**378**. Adenanthos cacomorphus (334)

**379**. Adenanthos flavidiflorus (334)

**380**. Adenanthos argyreus (334)

**381**. Adenanthos macropodianus (335)

**382**. Adenanthos terminalis (335)

**383**. Adenanthos sericeus subsp. sericeus (336)

**384**. Adenanthos sericeus subsp. sphalma (336)

**385**. Adenanthos × cunninghamii (336)

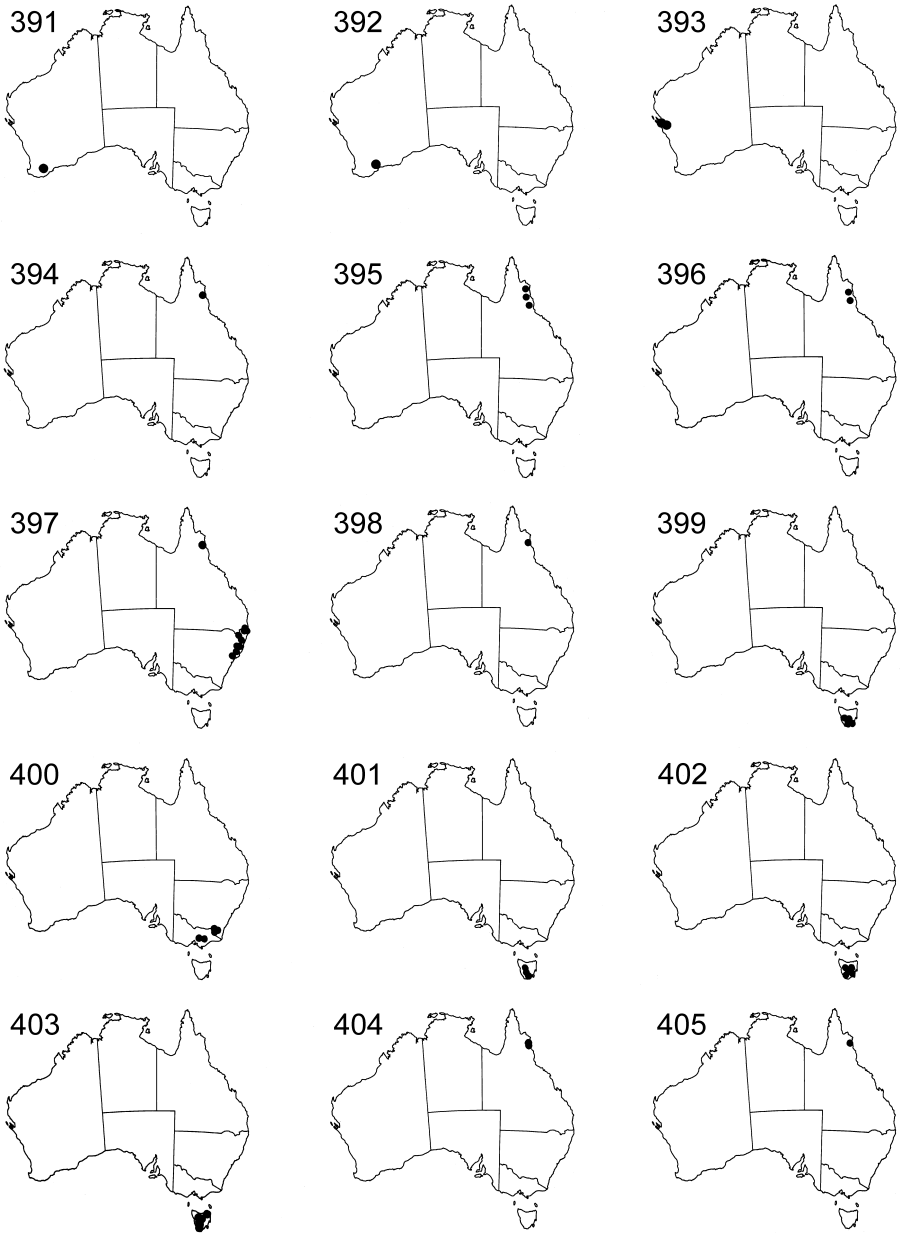
**386**. Adenanthos oreophilus (338)

**387**. Adenanthos cygnorum subsp. cygnorum (338)

**388**. Adenanthos cygnorum subsp. chamaephyton (339)

**389**. Adenanthos meisneri (339)

**390**. Adenanthos velutinus (339)




**391**. Adenanthos filifolius (340)

**392**. Adenanthos labillardierei (340)

**393**. Adenanthos acanthophyllus (340)

**394**. Sphalmium racemosum (342)

**395**. Carnarvonia araliifolia var. araliifolia (345)

**396**. Carnarvonia araliifolia var. montana (345)

**397**. Orites excelsa (347)

**398**. Orites megacarpa (348)

**399**. Orites diversifolia (349)

**400**. Orites lancifolia (349)

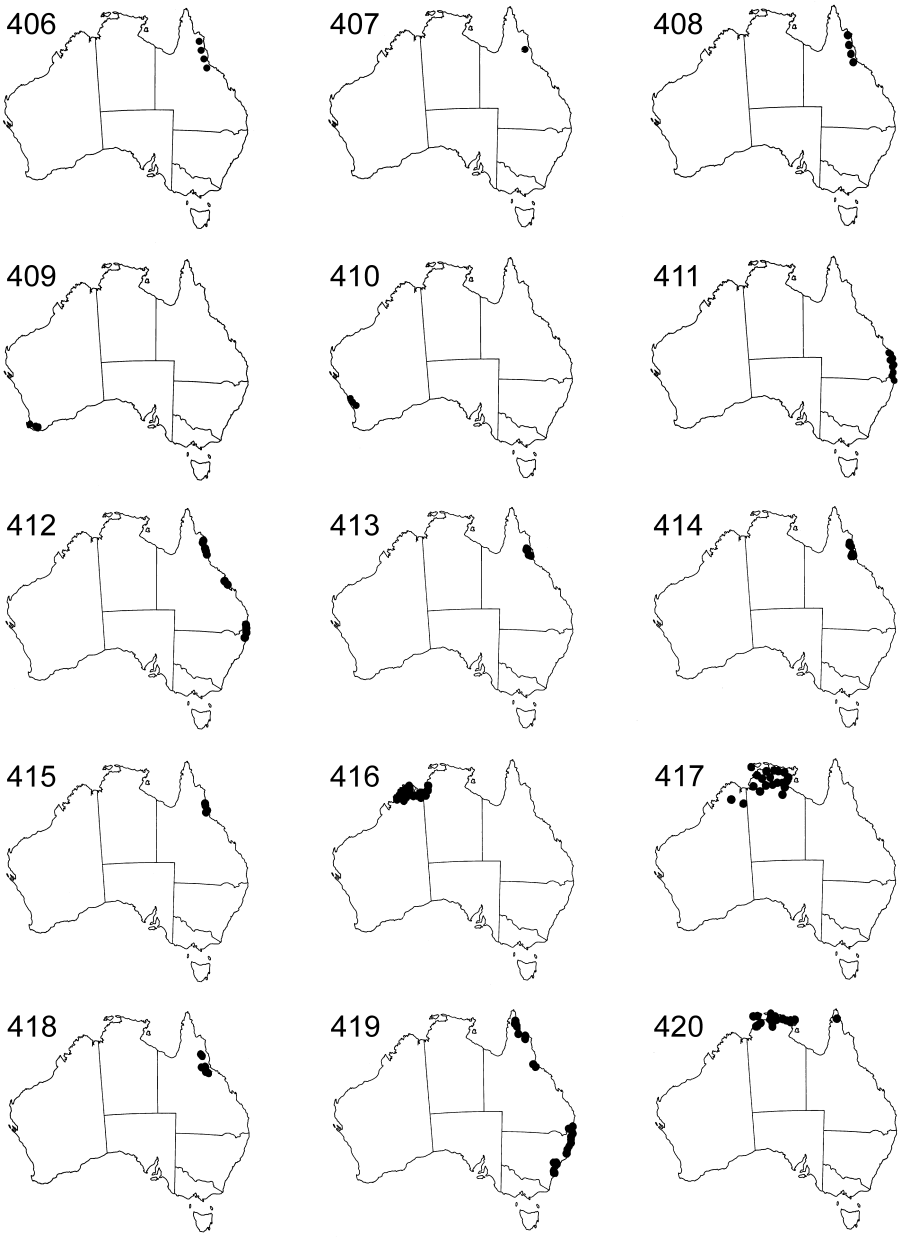
**401**. Orites milliganii (349)

**402**. Orites revoluta (351)

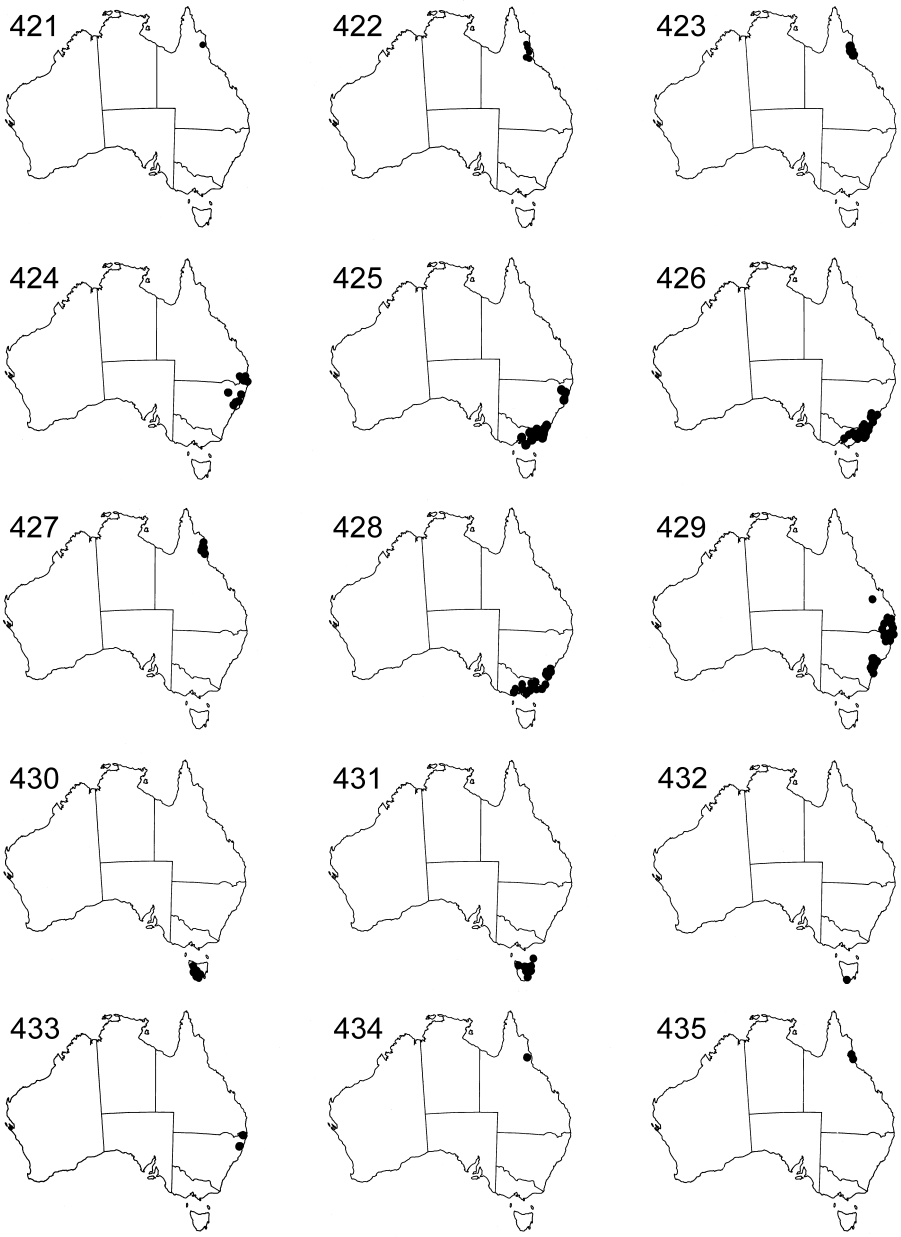
**403**. Orites acicularis (351)

**404**. Neorites kevediana (352)

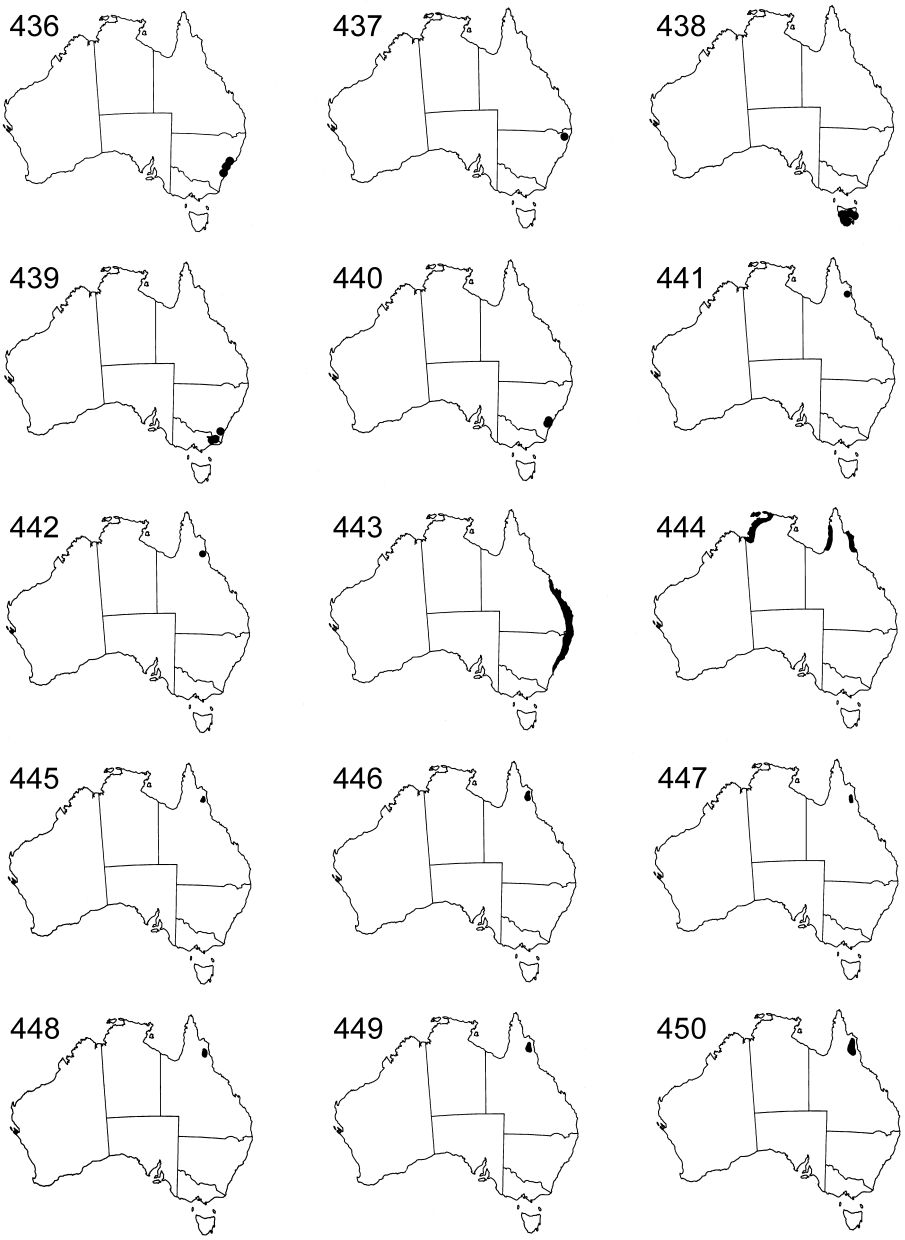
**405**. Megahertzia amplexicaulis (355)



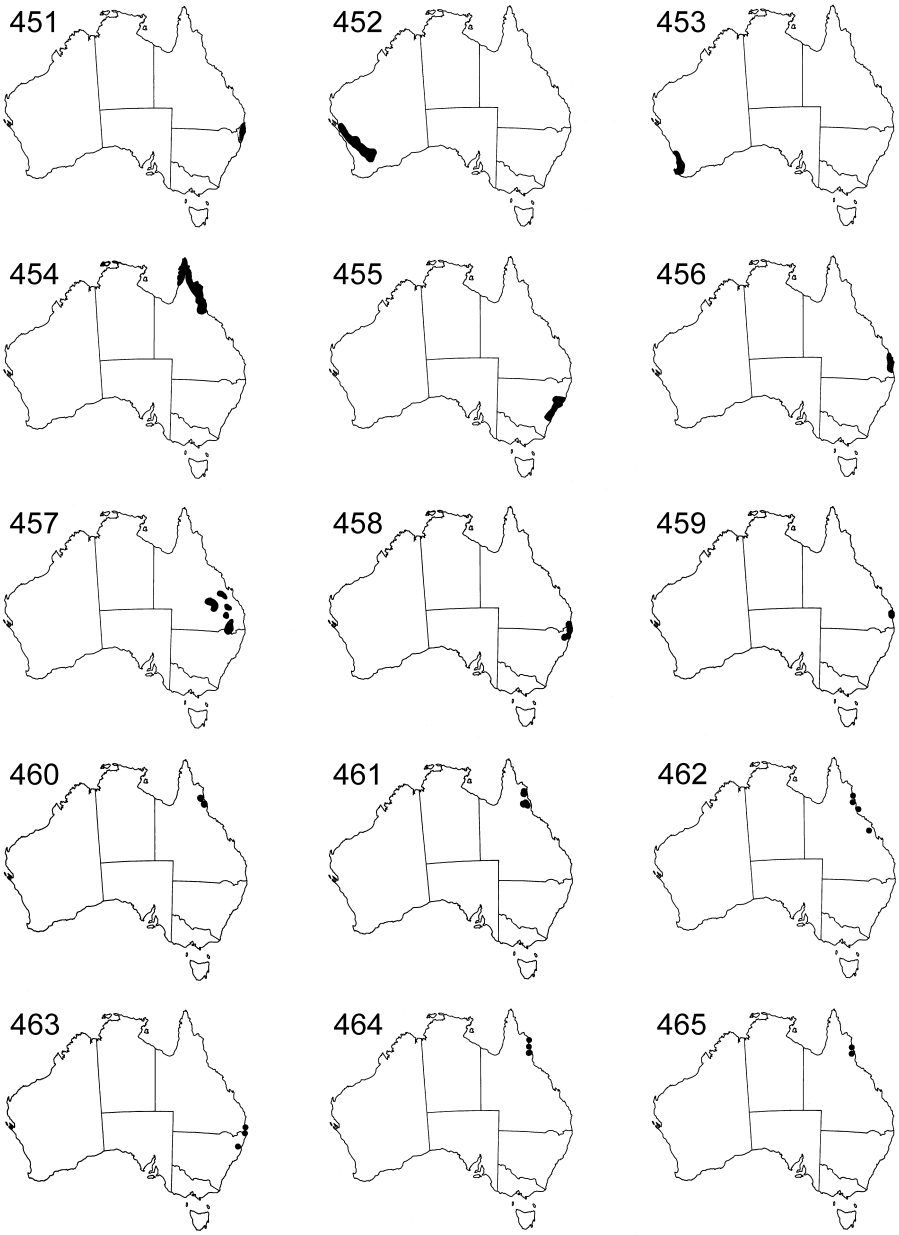

**406**. Darlingia darlingiana (357)
**407**. Darlingia ferruginea (357)
**408**. Cardwellia sublimis (359)
**409**. Strangea stenocarpoides (362)
**410**. Strangea cynanchicarpa (362)
**411**. Strangea linearis (362)
**412**. Stenocarpus sinuatus (364)
**413**. Stenocarpus davallioides (364)
**414**. Stenocarpus cryptocarpus (366)
**415**. Stenocarpus reticulatus (366)
**416**. Stenocarpus cunninghamii (367)
**417**. Stenocarpus acacioides (367)
**418**. Stenocarpus angustifolius (368)
**419**. Stenocarpus salignus (368)
**420**. Stenocarpus verticis (369)




**421**. Buckinghamia ferruginiflora (371)
**422**. Buckinghamia celsissima (371)
**423**. Opisthiolepis heterophylla (373)
**424**. Lomatia arborescens (375)
**425**. Lomatia fraseri (376)
**426**. Lomatia myricoides (376)
**427**. Lomatia fraxinifolia (377)
**428**. Lomatia ilicifolia (378)
**429**. Lomatia silaifolia (378)
**430**. Lomatia polymorpha (379)
**431**. Lomatia tinctoria (381)
**432**. Lomatia tasmanica (381)
**433**. Alloxylon pinnatum (383)
**434**. Alloxylon flammeum (384)
**435**. Alloxylon wickhamii (384)




**436**. Telopea speciosissima (387)
**437**. Telopea aspera (387)
**438**. Telopea truncata (389)
**439**. Telopea oreades (389)
**440**. Telopea mongaensis (390)
**441**. Hollandaea riparia (391)
**442**. Hollandaea sayeriana (393)
**443**. Helicia glabriflora (394)
**444**. Helicia australasica (395)
**445**. Helicia recurva (395)
**446**. Helicia grayi (397)
**447**. Helicia blakei (397)
**448**. Helicia lewisensis (397)
**449**. Helicia lamingtoniana (398)
**450**. Helicia nortoniana (398)




**451**. Helicia ferruginea (399)

**452**. Xylomelum angustifolium (400)

**453**. Xylomelum occidentale (402)

**454**. Xylomelum scottianum (402)

**455**. Xylomelum pyriforme (402)

**456**. Xylomelum salicinum (403)

**457**. Xylomelum cunninghamianum (403)

**458**. Triunia youngiana (405)

**459**. Triunia robusta (405)

**460**. Triunia montana (407)

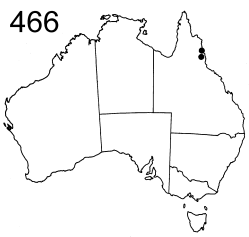
**461**. Triunia erythrocarpa (407)

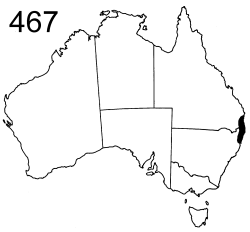
**462**. Gevuina bleasdalei (409)

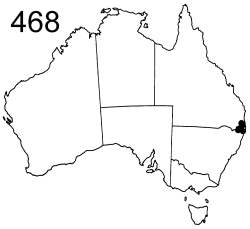
**463**. Hicksbeachia pinnatifolia (412)

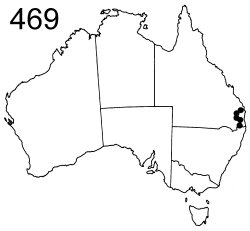
**464**. Hicksbeachia pilosa (412)

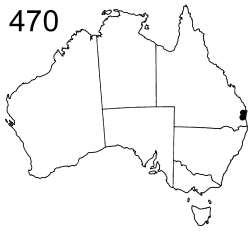
**465**. Athertonia diversifolia (413)



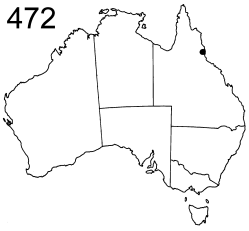



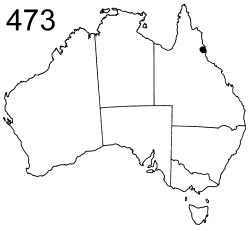



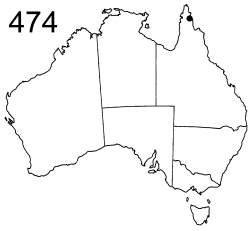



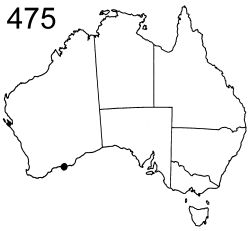



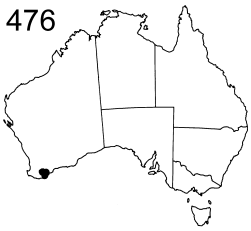


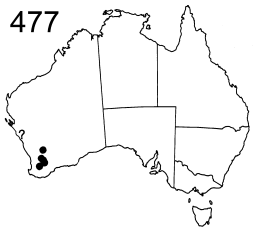


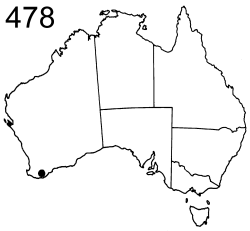



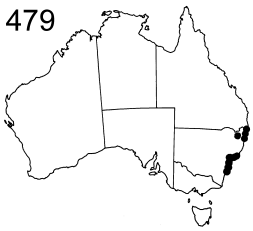



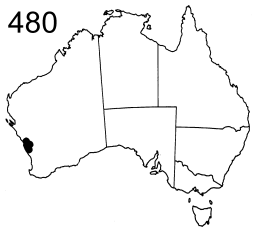




**466**. Catalepidia heyana (415)
**467**. Floydia praealta (417)
**468**. Macadamia tetraphylla (420)
**469**. Macadamia integrifolia (422)
**470**. Macadamia ternifolia (422)
**471**. Macadamia jansenii (422)
**472**. Macadamia whelanii (423)
**473**. Macadamia grandis (423)
**474**. Macadamia claudiensis (425)
**475**. Lambertia echinata subsp. echinata (427)
**476**. Lambertia echinata subsp. citrina (427)
**477**. Lambertia ilicifolia (429)
**478**. Lambertia fairallii (429)
**479**. Lambertia formosa (429)
**480**. Lambertia multiflora var. multiflora (432)


**481**. Lambertia multiflora var. darlingensis (432)

**482**. Lambertia uniflora (432)

**483**. Lambertia rariflora subsp. rariflora (433)

**484**. Lambertia rariflora subsp. lutea (433)

**485**. Lambertia orbifolia (433)

**486**. Lambertia ericifolia (435)

**487**. Lambertia inermis var. inermis (436)

**488**. Lambertia inermis var. drummondii (436)

# APPENDIX

## New taxa, combinations, lectotypifications and neotypifications

New taxa, combinations and lectotypifications occurring in this volume of the *Flora of Australia* are formally published here. Genera and higher level taxa are arranged in the order they appear in the text. Within genera the taxa are alphabetically arranged, except infrageneric taxa which are arranged alphabetically in descending order of rank. 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 28.

### PROTEACEAE

### Subfam. PERSOONIOIDEAE

### PERSOONIA

*P.H.Weston*

*Linkia levis* Cav., *Icon.* 4: 61, t. 389 (1797)

T: Port Jackson, N.S.W., *L.Née*; lecto (here chosen): MA *n.v.* (photo NSW).

The type sheet of *L. levis* Cav. is labelled *'Linkia levis Icon.* tab. 389 loc Nova–Hollandia Née dedit.' and includes sketches and notes (in Cavanille's handwriting) on which the published description and plate were clearly based. The three specimens mounted on this sheet are a mixed collection of two species to which the names *Persoonia levis* (Cav.) Domin and *P. lanceolata* Andrews are presently applied. The specimen at the top-left corner of the sheet, labelled 'Floris studium', is chosen as lectotype as it is consistent with the protologue and with the application of this name in current useage.

**Persoonia cornifolia** A.Cunn. ex R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 15 (1830)

T: [Yetman district, 29°S, 150°30'E], N.S.W., June–July 1827, *A.Cunningham 97*; lecto (here chosen): BM; ora orient., Moreton Bay [Qld], 1827, *C.Fraser*; syn: *n.v.*

**Persoonia lanceolata** Andrews, *Bot. Repos.* 2: t. 74 (1799)

T: cultivated from seeds, by L.Wilson, Islington, England, July 1799, *H.C.Andrews* (not found); lecto (here chosen): the plate in H.C.Andrews, *Bot. Repos.* 2: t. 74 (1799).

*Persoonia latifolia* Andrews, *Bot. Repos.* 4: t. 280 (1803)

T: cultivated at Hammersmith Nursery, England, Oct. 1802, from seeds sent by W.Paterson, from Port Jackson [N.S.W.], *H.C.Andrews* (not extant); lecto (here chosen): the plate in H.C.Andrews, *Bot. Repos.* 4: t. 280 (1802).

**Persoonia linearis** Andrews, *Bot. Repos.* 2: t. 77 (1799)

T: cultivated from seeds, by J.Robertson, Stockwell, Surry [Surrey], England, 1798, *H.C.Andrews* (not extant); lecto (here chosen): the plate in H.C.Andrews, *Bot. Repos.* 2: t. 77 (1799).

**Persoonia muelleri** subsp. **angustifolia** (Benth.) L.A.S.Johnson & P.H.Weston, *stat. nov.*

*Persoonia gunnii* var. *angustifolia* Benth., *Fl. Austral.* 5: 399 (1870); *P. muelleri* var. *angustifolia* (Benth.) Orchard, *Brunonia* 6: 232 (1984). T: Macquarie Harbour, Tas., *Milligan 738*; syn: K, NSW.

**Persoonia muelleri** subsp. **densifolia** (Orchard) L.A.S.Johnson & P.H.Weston, *stat. nov.*

*Persoonia muelleri* var. *densifolia* Orchard, *Brunonia* 6: 230 (1984). T: Coxs [Cox] Bight, W of Point Eric, Tas., 16 Mar. 1980, *A.Moscal 119*; holo: HO *n.v.*; iso: NSW.

## Subfam. BELLENDENOIDEAE

*P.H.Weston*

**Proteaceae** subfam. **Bellendenoideae** P.H.Weston, *subfam. nov.*

*Proteaceae* trib. *Bellendeneae* L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 171 (1975).

Radices proteoideae adsunt. Folia lobata vel integra. Inflorescentiae racemosae, ebracteatae. Glandulae hypogynae absentes. Filamenta staminum libera. Ovula 2. Fructus bialatus, indehiscens, siccus; pericarpium tenue, contexto mechanico carenti. Semen 1, fusiforme; cotyledones 2. Chromosomata modice magna, 4–6 µm longa metaphasi mitotica; $n = 5$.

Type: *Bellendena* R.Br.

A monogeneric subfamily restricted to alpine heathlands in Tas.

## Subfam. EIDOTHEOIDEAE

*A.W.Douglas & B.P.M.Hyland*

**Proteaceae** subfam. **Eidotheoideae** A.W.Douglas & B.Hyland, *subfam. nov.*

Inflorescentia racemiformis, floribus singulis in axillas bracteae dispositis; flores andromonoeci, regulares; tepala libera, imo tubo brevi; stamina libera vel ad tepala basin versus brevissima adnata; antherae latrorsae, dehiscentes per rimas longitudinales; glandulae hypogynae nullae; stylus sine pollinophoro; ovulum unum, orthotropum, pendulum, costis longistrorsum depositis; fructus indehiscens vel interius durus, fibrosus, strato interiore costis longistrorsum depositis, condylus simulans.

Type: *Eidothea* A.W.Douglas & B.Hyland

## EIDOTHEA

**Eidothea** A.W.Douglas & B.Hyland, *gen. nov.*

Arbor andromonoecia, anteridibus nullis. Cortex cinereus, fissilis, lenticellis pallidis, irregularibus vel rotundis. Surculi foliis pseudoverticillatis; foliis spiratim ascendentibus deminuentis, bracteae vel squameae ovatae similes. Folia integra, ad marginem recurva, elliptica vel obovata, venatione quasi-brochidodroma vel eucamptodroma; petiolus basi semiteres, paulo incrassatus versus laminam applanatus, glaber. Folia juvenilia simplicia margine dentato. Inflorescentiae axillares, simplices, racemos condensatos formantes, unaquaeque florum 6–10 sessilium, plerumque 1 flore perfecte, aliis masculis; pedunculus bracteis obovatis, multis, spiratim ascendentibus. Flores anteropostice positi. Tepala 4, eburnea, tubo brevi, aestivatione valvata, circinata post anthesi, trichomatibus longis ad basim interius affixis. Stamina 4, filamentis elongatis, gracilibus, cylindraceis, liberis vel ad

tepala basin versus brevissimis adnatis, longioribus quam tepala, antheris pendentibus. Antherae elongatae, connectivo lato sine appendicula terminali, loculis latrorse dehiscentibus. Pollinis grana poris 3. Glandulae hypogynae nullae. Ovarium brevissime stipitatum, pilis in positionibus alternitepalis ascendentibus. Stylus elongatus, sutura coalita, sine pollinophoro. Stigma leviter cristiforme labiata. Ovulum 1, orthotropum, apicale affixum. Fructus nux rotunda vel oviformis, glabra, pericarpium e stratis tribus formatum, stratum externum tenuissimum, medium spongiosum, interiorum durum, fibrosum, costis longistrorsum depositis, condylus simulans. Semen magnus et canaliculatus.

Type: *E. zoexylocarya* A.W.Douglas & B.Hyland

A monotypic genus endemic to mountain slopes in rainforest in north-eastern Qld. Affinities uncertain.

Named after Eidothea, one of the three daughters of Proteus in Greek mythology.

**Eidothea zoexylocarya** A.W.Douglas & B.Hyland, *sp. nov.*

Arbor 20–40 m procera, trunco usque 40–80 cm diametro. Lignum subroseum radiis latis. Folium lamina 6–10 cm longa, venatione quasi-brochidodroma vel eucamptodroma; petiolus 1–3 cm longus. Inflorescentiae per ramos extremos, 1.5–2 cm longae. Tepala eburnea, 6–7 mm longa. Stamina eburnea, longiora quam tepala, 7.5–9 mm longa, antheris pendentibus. Antherae eburneae. Gynoecium eburneum, 4–5 mm longum. Fructus 3.5–6 cm longus, 3–6.5 cm diametro.

T: Timber Reserve 1230, Boonjee Logging Area, Mt Bartle Frere, Qld, 9 Jan. 1980, *B.Gray 1611*; holo: QRS; iso: BRI, CANB, DNA, HO, K, L, LSU, MEL, MO, NSW, PERTH, PRE, QRS.

The specific name is derived from the Greek *zoè*, life, referring to the living plant and *xylocaryon* (woody nut) referring to the fossilised fruit description of *Xylocaryon lockii* F.Muell. by F.J.H. von Mueller, Observations on new vegetable fossils of the auriferous drifts, *Geologic Survey of Victoria*, 1883.

## Subfam. PROTEOIDEAE

## STIRLINGIA

*A.S.George*

**Stirlingia** Endl., *Gen. Pl.* 339 (1837)

Lecto (here chosen): *S. anethifolia* (R.Br.) Endl.

*Simsia* R.Br., *Trans. Linn. Soc. London* 10: 152 (1810), *nom. illeg. non* Pers. T: *S. anethifolia* R.Br.; lecto: (here chosen).

Several species were published for both generic names, and, although all are clearly congeneric, the generic names are here lectotypified so as to stabilise their application.

**Stirlingia divaricatissima** A.S.George, *sp. nov.*

Frutex ad c. 1.7 m altus. Folia mollia, divaricate et intricate ad 10× divisa, segmentis ultimis rectis ad leviter curvatis, gracillimis, 2–4 mm longis; petiolus 12–14 cm longus. Scapus ut minimum 45 cm longus (totus non visus), parce ramosus, ramulis ±rectis; capitula 9 mm diam.; bracteae ovatae, obtusae ad ±acutae, 1.5 mm longae, arcte tomentosae. Perianthium 4.5–5 mm longum; limbo quam tube latiore. Fructus non visus.

T: 20 miles [32 km] N of Bow Bridge, N of Peaceful Bay, W.A., 22 Oct. 1971, *J.Boyd 33*; holo: PERTH.

Named from the Latin *divaricatus* (divaricate, spreading widely) with the superlative suffix-*issimus*, in reference to the leaf lobing.

**Stirlingia simplex** Lindl., *Sketch Veg. Swan R.* xxx (1839)

*Simsia simplex* (Lindl.) F.Muell., *Syst. Cens. Austral. Pl.* 66 (1882). T: Swan River district, W.A., before 1839, *J.Drummond s.n.*; lecto (here chosen): CGE; Swan River, W.A., *D.Toward*; syn: CGE.

The two syntypes represent the same taxon, the Drummond specimen being the better.

## PETROPHILE

*D.B.Foreman*

**Petrophile acicularis** R.Br., *Trans. Linn. Soc. London* 10: 69 (1810)

T: Lewin's Land, New Holland [W.A.], Dec. 1801, *R.Brown s.n.*; lecto (here chosen): BM; King George Sound [W.A.], Dec. 1801, *R.Brown (Britten 3242)*; syn: BM.

There are two sheets at BM which are syntype material for this species. I have selected as lectotype the single specimen mounted separately and chosen by Brown 'for the public collection'. The remaining 4 pieces, mounted on a second sheet, have been given the Britten number 3242. For the present, I prefer to regard these as remaining syntypes rather than isolectotypes.

**Petrophile aculeata** Foreman, *sp. nov.*

Frutex parvus c. 35 cm altus. Folia hirsuta, glabrescentia, 4–9 cm longa, simplicia, plana, anguste obovata, irregulariter dentata in dimidium inferiorum; dentes ±retrocurvati; venae 3 longitudinales in superficiebus ambabus folii clare visibiles. Flores ad apicem villosi, c. 11 mm longi, colore ignoto; praebitor pollinis fusiformis.

T: Coorow Reserve, W of Coorow, W.A., 30 June 1967, *C.Chapman s.n.*; holo: PERTH; iso: MEL.

The specific epithet refers to the prickly appearance and feel of the specimens.

**Petrophile arcuata** Foreman, *sp. nov.*

Frutex effusus usque ad 1.2 m altus; *Petrophili phylicoidi* R.Br. simili, sed floribus villosis et superficiebus ambabus nucum glabris, differt.

T: 55 miles [c. 88 km] E of Southern Cross, towards Coolgardie, W.A., 9 Sept. 1968, *M.E.Phillips CBG 02766*; holo: CBG; iso: AD, BRI.

The specific epithet refers to the curved leaves seen on most of the dried collections.

**Petrophile cyathiforma** Foreman, *sp. nov.*

Frutex 30–65 cm altus; *Petrophili ericifoliae* R.Br. simili, sed inflorescentia et strobilis fructificantibus circumcinctis bracteis involucralibus persistentibus ±connatis glutinosis imbricatis, differt.

T: Hyden, W.A., 8 Sept. 1966, *M.Barrow 84*; holo: PERTH; iso: CANB.

The specific epithet refers to the cup-shaped structure formed by the involucral bracts, which persists through to the fruiting stage.

**Petrophile divaricata** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830)

T: Mt Gardener (?Gardner) [King George Sound, W.A.], 1823, *W.Baxter 309*; lecto (here chosen): BM; isolecto: NSW; south-west coast of New Holland, 1828–29, *W.Baxter s.n.*; syn: BM.

From the sheet that I have borrowed from the BM, I have selected as lectotype the flowering and fruiting specimen mounted at the bottom of the sheet. This specimen is associated with a Baxter label giving the locality as 'Mt Gardner' and the date of collection as '1823'. Mt Gardner is on the north side of King George Sound. The remaining two specimens which are at the same stage of development as the lectotype are associated with a second Baxter label

which merely gives the locality as 'South west coast of New Holland' and the dates '1828–29'. Both are regarded as remaining syntypes.

**Petrophile diversifolia** R.Br., *Trans. Linn. Soc. London* 10: 70 (1810)

T: Lewin's Land, New Holland [W.A.], Dec. 1801, *R.Brown (Britten 3237)*; lecto (here chosen): BM; syn: BM, MEL.

There are 3 sheets of syntype material at BM. The fruiting specimen that I have selected as the lectotype is mounted on the right-hand side of the sheet that I have designated 'sheet 1'. Two specimens mounted to the left of the lectotype are in flower and have a few immature fruits. These, together with those mounted on the other two sheets (which include a mixture of seedlings as well as flowering and/or fruiting collections), are regarded as remaining syntypes.

**Petrophile ericifolia** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 5 (1830)

T: south-west coast of New Holland [King George Sound, W.A.], 1828–29 [1829], *W.Baxter s.n.*; lecto (here chosen): BM; isolecto: BM.

Of the three specimens mounted on a single sheet at BM, the one mounted on the left-hand side is a syntype of *P. ericifolia* subsp. *subpubescens*. Of the remaining specimens (both of which are in fruit) I have selected the larger as lectotype. This is mounted on the bottom left-hand side of the sheet. The remaining piece is an isolectotype.

**Petrophile ericifolia** subsp. **subpubescens** (Domin) Foreman, *stat. nov.*

*Petrophile ericifolia* f. *subpubescens* Domin, *Vestn. Král. Ceské Spolecn. Nauk. Tr. Mat.-Prír.* 1921–22(2): 4 (1923). T: Avon district, W.A., July 1901, *E.Pritzel 476*; syn: AD, BM, NSW, PERTH.

*Petrophile ericifolia* subsp. *subpubescens* has a more northerly distribution (mostly around Northam and Kellerberrin, W.A.) than subsp. *ericifolia* which extends from the Fitzgerald River Natl Park to the vicinity of Lake Grace, and the Southern Cross–Coolgardie area, W.A. The smaller leaves, pubescent branchlets and the apparently non-viscid, villous flowers immediately distinguish subsp. *subpubescens* from subsp. *ericifolia*. These morphological differences, together with a disjunct distribution, warrant its recognition as a subspecies.

**Petrophile glauca** Foreman, *sp. nov.*

Frutex erectus vel semiprostratus, usque ad 1 m altus. Folia complanata, glauca, semel vel bis imparipinnata, costa ±distincta; 7–19.5 cm longa; petiolus complanatus, 3–11 cm longus. Flores sericei, eburnei, cremei, flavii ad lutei; tepala c. 14 cm longa; praebiror pollinis fusiformis; strobili fructificanti ±ovoidei ad globosos, c. 15 mm diametris. Nuces complanatae, margine lato aliformi.

T: 17 km N of Fitzgerald townsite, W.A., 4 Oct. 1979, *N.G.Marchant 79/96*; holo: PERTH; iso: MEL, PERTH.

The specific epithet refers to the glaucous leaves.

*Petrophile glauca* was, in the past, often called *P. trifida*, however, the type specimens of the latter are synonymous with the variable *P. squamata*.

**Petrophile imbricata** Foreman, *sp. nov.*

*Petrophili scabriusculae* Meisn. simili, sed bracteis involucralibus numerosis prominentibus, floribus longioribus, pilis foliorum brevis erectis nonpersistentibus, et apice folii ±obtuso, differt.

T: Boyagin Nature Reserve, NW of Pingelly, W.A., 18 Nov. 1985, *D.B.Foreman 1074*; holo: MEL; iso: PERTH.

The specific epithet refers to the imbricate arrangement of both the involucral bracts and the leaves.

**Petrophile merrallii** Foreman, *sp. nov*.

Frutex erectus, usque ad 1.1 m altus; *Petrophili ericifoliae* R.Br. subsp. *ericifoliae* simili, sed foliis scabrissimus et effusis (nonimbricatis), floribus nonviscidis brevioribus (usque ad 15 mm longis) et strobilis parvioribus (plerumque minoribus quam 20 mm diametris), differt.

T: 12 miles [c. 19 km] E of Southern Cross, at Summer Tank, W.A., 9 Sept. 1968, *M.E.Phillips CBG 028011*; holo: CBG; iso: NSW.

The specific epithet honours Edwin Merrall (c. 1844–1913), a gold miner who collected this species near Southern Cross in 1890 and again near Parker's Range in 1892.

**Petrophile misturata** Foreman, *sp. nov*.

*Petrophili chrysanthae* Meisn. simili, sed foliis simplicibus ad pinnatis, pilosis persistentibus, segmento terminali apex pungens destituto, et floribus fulvis, differt.

T: 1 mile [c. 1.6 km] E of Quairading, W.A., 22 Oct. 1964, *K.Newbey 1577*; holo: PERTH.

The specific epithet refers to the mixture of divided and simple leaves.

**Petrophile pauciflora** Foreman, *sp. nov*.

Frutex c. 1 m altus. Folia 15–35 mm longa, saepe 3-furcata, segmento medio interdum denuo diviso. Inflorescentia pauciflorata, globosa, c. 8 mm diametro. Flores tomentosi, colore ignoto; largitor pollinis ±lineatus, pilis reflexis dense tectis. Strobili fructificanti ovoidei ad globosos, 6–8 mm longi.

T: 3 km NW of Bimbijy Stn, W.A., 19 Apr. 1976, *A.S.George 14242*; holo: PERTH.

The specific epithet refers to the few-flowered inflorescence.

**Petrophile pedunculata** R.Br., *Trans. Linn. Soc. London* 10: 70 (1810)

T: near Port Jackson [N.S.W.], *R.Brown (Britten 3238)*; lecto (here chosen): BM; isolecto: BM, NSW.

I have selected as lectotype the largest of three pieces mounted on a single sheet at BM. It has both flowers and fruits. The two remaining specimens are at a similar stage of development, one having both flowers and fruit while the other only has flowers. They are regarded as isolectotypes.

**Petrophile phylicoides** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 6 (1830)

T: south-west coast of New Holland [Lucky Bay, W.A.], 1823, *W.Baxter 120*; lecto (here chosen): BM; inland from King George Sound [W.A.], 1829, *W.Baxter s.n.*; syn: BM.

Of the two specimens mounted on a single sheet at BM, the fruiting specimen on the right-hand side is chosen as the lectotype. A label attached below the specimen gives Baxter as the collector, the locality as 'South west coast of New Holland' and the date 1823. The syntype to the left of the lectotype is also in fruit but mounted beneath it is a label which again gives Baxter as the collector and the locality as 'inland from King George III's Sound' and the date 1829. It is worth noting that, according to the protologue, the type locality was Lucky Bay which is east of Esperance Bay.

*Petrophile propinqua* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830)

T: Swan River [W.A., 1827], *C.Fraser 4*; lecto (here chosen): BM; isolecto: BM.

The sheet at the BM has a total of 6 pieces mounted on it. The largest piece (right-hand side of sheet) is associated with a label with the name *W.Mylne*, a collector of algae who flourished about 1850. Two other pieces (mounted on the bottom left-hand corner of the sheet) are associated with a label giving the collector as *Drummond 567*. Neither of these collections is cited by Brown and they are regarded as not being associated with the typification of this name. The specimen I have selected as the lectotype is mounted at the top left-hand corner of the sheet and has a single fruit and several young inflorescences and is

associated with two labels which gives the locality as 'Swan River' and the collector as '*Fraser 4*'. The two specimens mounted immediately to the right of the lectotype are at a similar stage of development and are regarded as isolectotypes.

*Petrophile propinqua* var. *sericiflora* Benth., *Fl. Austral.* 5: 325 (1870)

T: Cape Arid [W.A.], date unknown, *G.Maxwell s.n.*; lecto (here chosen): K; syn: K.

Bentham's description refers to a plant which had 'leaves more divided, rigid, pungent-pointed, the segments 1/2 to 1 in[ch] long. Perianth rather smaller and more silky-villous' than the more typical *P. propinqua*. The specimen mounted on the left-hand side of the sheet fits this description well and is chosen as the lectotype. The remaining specimen is obviously from a different plant with longer flowers and shorter leaf segments and is regarded as a residual syntype.

**Petrophile recurva** Foreman, *sp. nov.*

*Petrophili scabriusculae* Meisn. simili, sed foliis minute scabris ad ±laevibus recurvis, bracteis involucralis minus pilosis, inflorescentia minora (10–15 mm diametro), et floribus pilosis ad tomentosis, non villosis, differt.

T: c. 17 miles [c. 27 km] from Moora, towards Jurien Bay, W.A., 23 Sept. 1962, *M.E.Phillips CBG 005328*; holo: CBG; iso: MEL, NSW.

The specific epithet refers to the recurved leaves.

**Petrophile rigida** R.Br., *Trans. Linn. Soc. London* 10: 69 (1810)

T: Lewins Land [W.A.], 1802–5, *R.Brown (Britten 3241)*; lecto (here chosen): BM; syn: BM; Cunningham in King's 1st Voyage no. 47 [W.A.]; lectopara: BM.

One sheet at BM has 5 separate pieces mounted on it; four of the pieces all appear to be associated with a blue Bennett label onto which has been mounted the original Brown label. There is sufficient variation in the leaf morphology to suggest that at least two of the specimens are from separate gatherings. The specimen I have selected as lectotype is mounted towards the bottom left-hand corner of the sheet and is in fruit, with a few old flower fragments remaining. The two specimens mounted on the left-hand side of this sheet and above the lectotype have somewhat stouter leaves with shorter segments and appear not only to be from a different gathering to that of the lectotype but also from different plants. The specimen mounted at the top right-hand corner of the sheet is a good match for the lectotype and may be part of that gathering. For the moment, I prefer to regard all three specimens as remaining syntypes. The fifth collection mounted on the bottom right-hand corner of the sheet is associated with a label bearing the inscription 'Cunningham in King's 1st Voyage no 47'. This collection is regarded as a lectoparatype.

**Petrophile seminuda** Lindl., *Sketch Veg. Swan R.* xxxiv (1840)

T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; lecto (here chosen): CGE; Swan River district [W.A.], date unknown, *D.Toward 42*; syn: CGE.

Lindley based his descriptions of new species from the Swan River Colony on specimens obtained from Drummond, Mangles and Toward. No collection was specified for *Petrophile seminuda*. The only specimens seen by Lindley are apparently housed in CGE (herb. J.Lindley). There is a single sheet at CGE with 2 specimens, one labelled 'Drummond, 1839, Swan River' and the other 'Toward 42'. The Drummond collection is the better of the two and is selected as lectotype. The Toward collection is regarded as a remaining syntype.

**Petrophile serruriae** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830)

T: south-west coast of New Holland [King George Sound, W.A.], 1828–29 [1829], *W.Baxter s.n.*; lecto (here chosen): BM; isolecto: BM; Swan River [W.A.], date unknown, *C.Fraser s.n.*; syn: BM.

The single sheet seen at BM has 4 pieces including a seedling on the right-hand side with

several fruits at the end of the shoot; it lacks collection details and I do not consider it to be part of the type collection. A small fruiting piece mounted towards the bottom of the sheet appears to have been collected by Fraser from the Swan River; however, it is undated and it is regarded as a remaining syntype. I have selected as lectotype the flowering piece mounted in the middle of the sheet. The piece mounted to the left of the lectotype appears to be from the same gathering, although it has fruits rather than flowers.

**Petrophile shirleyae** F.M.Bailey, *Queensland Bot. Bull.* 2: 17 (1891)

T: Moreton Island, Qld, Nov. 1890, *J.F.Shirley s.n.*; lecto (here chosen): BRI; Fraser Island, Qld, *H.Tryon s.n.*; syn: *n.v.*

The lectotype is, as far as I can determine, in fruit, although according to Bailey the specimen he saw was in flower and fruit.

**Petrophile squamata** R.Br., *Trans. Linn. Soc. London* 10: 70 (1810)

T: King George Sound [W.A.], Dec. 1801, *R.Brown s.n.*; lecto (here chosen): BM; towards Cape ?Howe, *R.Brown (Britten 3236)*; syn: BM.

Of the two sheets of syntype material seen at BM, I have chosen the single specimen selected by Brown 'for the public collection' and mounted on a separate sheet as the lectotype. Of the five pieces mounted on the second sheet none are a particularly good match with the lectotype nor with each other and probably represent separate gatherings of this variable species. Therefore, I prefer to regard them as remaining syntypes.

**Petrophile striata** R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 6 (1830)

T: Swan River [W.A.], date unknown, *C.Fraser 2*; lecto (here chosen): BM; *C.Fraser 3*; syn: BM.

Three specimens are mounted on one sheet at BM. The flowering specimen mounted across the bottom of the sheet was collected by C.Andrews in 1901 and so could not be part of the type collection. Of the remaining specimens, both of which are in fruit, I have selected the one mounted on the left-hand side of the sheet as the slightly better specimen. The specimen mounted to the right of the lectotype (*C.Fraser 3*) is regarded as a remaining syntype.

**Petrophile teretifolia** R.Br., *Trans. Linn. Soc. London* 10: 68 (1810)

T: Lucky Bay, New Holland [W.A.], Jan. 1802, *R.Brown s.n.*; lecto (here chosen): BM; isolecto: BM; ?NSW; syn: BM.

Specimens mounted on two separate sheets at BM. The specimen that I have selected as the lectotype is one of two chosen by Brown 'for the public collection' and is mounted on the top right-hand corner of the sheet. This specimen has both flowers and fruits. The specimen to the left of the lectotype is regarded here as an isolectotype and, although it is at the same stage of flowering, it lacks fruits. The second sheet has six specimens with two labels indicating that at least some of the collections were made from Bay I on the south coast of New Holland [i.e. Lucky Bay, E of Esperance Bay]. One of the collections mounted in the centre of the sheet has very narrow leaves and I believe it does not form part of the syntype material. Two of the remaining specimens also show a variation in leaf thickness but not to the same degree.

*Petrophile trifida* R.Br., *Trans. Linn. Soc. London* 10: 70 (1810)

T: Lucky Bay [W.A.], Jan. 1802, *R.Brown s.n.*; lecto (here chosen): BM; isolecto: BM.

I have seen 2 sheets from BM carrying suites of specimens which can be regarded as syntype material of *P. trifida*. The specimen chosen as lectotype is the one selected by Brown 'for the public collection' and mounted on a separate sheet. This collection and the four mounted on a second sheet are all at the same stage of fruiting and appear to be part of a single gathering. The four collections mounted on the second sheet are regarded as isolectotypes. Most of the herbarium material previously assigned to *P. trifida* was misidentified and has now been reassigned to *Petrophile glauca*.

**Petrophile trifurcata** Foreman, *sp. nov.*

*Petrophili misturatae* Foreman simili, sed foliis ±glabris et plerumque 3-furcatis ad apicem, et bracteis involucralis glabris externis et persistentioribus, differt.

T: Reserve 16418, Wongan Hills, W.A., 9 Sept. 1983, *P.Roberts 172*; holo: PERTH; iso: MEL.

The specific epithet refers to the characteristic, 3-pronged leaves.

**Petrophile wonganensis** Foreman, *sp. nov.*

*Petrophili ericifoliae* R.Br. subsp. *ericifoliae* simili, sed bracteis involucralis glutinosissimis, foliis et ramulis pilosis albescentibus curtis crispis ±persistentibus tectis, et apicibus foliorum obtusis non pungentibus, differt.

T: 10 km E of Wongan Hills on road to Manmanning, W.A., 30 Sept. 1984, *J.H.Ross 2838*; holo: MEL; iso: CBG, PERTH.

The specific epithet refers to its geographical locality.

## ISOPOGON

*D.B.Foreman*

**Isopogon dubius** (R.Br.) Druce, *Rep. Bot. Soc. Exch. Club Brit. Isles* 1916, Suppl. 2: 629 (1917)

*Petrophile dubia* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830). T: Swan River [W.A.], 1827, *W.Baxter*; lecto (here chosen): BM.

**Isopogon formosus** subsp. **dasylepis** (Meisn.) Foreman, *comb. et stat. nov.*

*Isopogon formosus* var. *dasylepis* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 278 (1856). T: *s. loc.* [W.A.], *J.Drummond 295*; syn: MEL; *s. loc.*, *L.Preiss 670*; syn: MEL.

This taxon is certainly worthy of subspecies status being geographically and morphologically distinct from the material here assigned to subsp. *formosus*.

**Isopogon gardneri** Foreman, *sp. nov.*

*Dryandra petrophiloides* C.A.Gardner, *J. & Proc. Roy. Soc. W. Australia* 19: 82–83 (1932), *nom. illeg.* T: near Newdegate, W.A., Nov. 1931, *W.E.Blackall s.n.*; holo: PERTH.

Frutex aculeatus ad 1.6 m altus; folia teretia divaricata, pungentia, intertexta, dumentum densum formatia; petiolus 25 mm longus; lamina 40 mm longa. Infloresecentia terminalis, sessilis; bracteae involucrales campanulatae, glabrescentes, rufae, canescentes, ovatae, acutae ad acuminatas, numerosae, usque ad 8 mm longae. Flores usque ad 30 mm longi, numerosi, ±erecti, pallide rosei vel flavi, villosi. Largitor pollinis c. 4 mm longus; pars ad basim tumida, pilis bevissimis reflexis tectis; pars media manifeste constricta; supra constrictionem tumidus et glaber, versus cupulam stigmaticam contractus.

T: 22 km S of Hyden on road to Newdegate, W.A., 18 Aug. 1984, *D.B.Foreman 774*; holo: MEL; iso: CANB, PERTH.

The epithet commemorates Mr Charles Austin Gardner (1896–1970), a former Government Botanist of Western Australia.

**Isopogon inconspicuus** (Meisn.) Foreman, *comb. nov.*

*Petrophile inconspicua* Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 68 (1855). T: between Moore R. and Murchison R. [W.A.], date unknown, *J.Drummond 6: 172*; syn: MEL, PERTH.

This species was clearly misplaced in *Petrophile*. Characters such as pollen presenter, cone scales and fruit all confirm its position in *Isopogon*.

**Isopogon longifolius** R.Br., *Trans. Linn. Soc. London* 10: 73 (1810)

T: King George's Sound [W.A.], 1801–2, *R.Brown (Britten 3252)*; lecto (here chosen): BM; isolecto: BM.

Four pieces are mounted on a single sheet with one label. I have selected the large, fruiting piece mounted on the left-hand side as the lectotype. Of the other remaining pieces, two are also in fruit and may be regarded as isolectotypes. A piece on the extreme right of the sheet has flowers and may be part of another collection.

**Isopogon polycephalus** R.Br., *Trans. Linn. Soc. London* 10: 73 (1810)

T: in Novae Hollandiae ora australi, Lewin's Land [W.A.], Jan. 1802, *R.Brown (Britten 3255)*; lecto (here chosen): BM; isolecto: BM, ?NSW; west coast of New Holland [W.A.], 1828–9, *W.Baxter*; syn: BM.

Four specimens are mounted on a single BM sheet with two labels. The topmost specimen is associated with a Maxwell label '*Isopogon polycephalus* R.Br. from the West Coast of New Holland, 1828–9, Mr William Baxter'. The specimen has dried a somewhat different colour to the other three which are associated with a Robert Brown label. I select the middle piece mounted towards the left-hand side as the lectotype. The remaining two pieces are designated isolectotypes. The Maxwell collection is regarded as a remaining syntype. There is a possible isolectotype at NSW.

*Isopogon scaber* Lindl., *Sketch Veg. Swan R.* xxxiv (1840)

T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; lecto (here chosen): CGE; isolecto: CGE.

Two pieces are mounted on a single sheet at CGE. I have selected the specimen mounted on the left-hand side of the sheet as the lectotype as it appears to adequately typify the original species concept. The second specimen can be regarded as an isolectotype.

**Isopogon scabriusculus** subsp. **pubifloris** Foreman, *subsp. nov.*

*Isopogonem scabriusculum* Meisn. subsp. *scabriusculum* et subsp. *stenophyllum* Foreman simulans, sed foliis simplicibus, nunquam furcatis, teretibus, minute pubescentibus, glabrescentibus, minute scabris, usque ad c. 13 cm longis; floribus usque ad 16 mm longis, roseis, tubis perianthiorum pubescentibus, differt.

T: c. 110 km SW of Norseman, 11.5 km WSW of Dog Rock, *J.Taylor 726, M.D.Crisp & R.Jackson*; holo: CBG; iso: PERTH.

The epithet is derived from the Latin *pubi-* and *-flos* referring to the pubescent flowers.

**Isopogon scabriusculus** subsp. **stenophyllus** Foreman, *subsp. nov.*

*Isopogonem scabriusculum* Meisn. subsp. *scabriusculum* simulans, sed foliis simplicibus, nunquam furcatis, ±teretibus (ovalibus in sectione transversali), ±sulcatis, scabris, interdum minute scabris, usque ad c. 16 cm longis, sericeis ad minute pubescentibus, glabrescentibus; floribus usque ad 15 mm longis, roseis vel rubris, tubis perianthiorum glabris, differt.

T: 17 km S of Pingaring on Lake Grace–Kalgarin road, 18 Sept. 1984, *D.B.Foreman 767*; holo: MEL; iso: CANB, K, NSW, PERTH.

The epithet derived from the Greek *stenos-* and *-phyllos* refers to long, slightly flattened leaves.

**Isopogon sphaerocephalus** Lindl., *Sketch Veg. Swan R.* xxxiv (1840)

T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; lecto (here chosen): CGE.

Of the three pieces mounted on a single sheet, two are associated with labels. There is a small fragment mounted on the left-hand side without a label and, for the purpose of this revision, I have ignored it. I have selected the specimen mounted on the top left hand side of the sheet associated with a Drummond label as the lectotype. The specimen mounted below and to the right of the lectotype was apparently collected from the Swan River district [W.A.] by J.Mangles. It lacks a number and date and probably has no type status.

**Isopogon teretifolius** subsp. **petrophiloides** (R.Br.) Foreman, *comb. et stat. nov.*

*Isopogon petrophiloides* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 7 (1830). T: south-west coast of New Holland, near William [W.A.], *W.Baxter s.n.*; holo: BM.

The decision to recognise subsp. *petrophiloides* was taken to accommodate specimens which, although having the flower and inflorescence structure of *Isopogon teretifolius*, consistently had simple rather than divided leaves. They also showed a distinct geographical distribution to the north and north-east of the Stirling Range whereas the specimens with divided leaves had a wider distribution from Mt Lesueur to the Stirling Range and then eastwards to Bremer Bay and East Mt Barren, W.A. However, I do not believe these differences are sufficient to maintain *Isopogon petrophiloides* as a distinct species.

**Isopogon trilobus** R.Br., *Trans. Linn. Soc. London* 10: 72 (1855)

T: (near base of mountain in granite hills) [Lucky Bay?, W.A.], *R.Brown (Britten 3251)*; lecto (here chosen): BM; isolecto: BM.

Five pieces are mounted on a single sheet; all are at the same stage of fruiting. I have selected the largest piece mounted on the bottom right-hand side of the sheet as the lectotype. The four remaining pieces are probably part of the same collection and are here regarded as isolectotypes.

*Isopogon tripartitus* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 8 (1830)

T: ora occid.-merid., King George's Sound [W.A.], 1828–1829, *W.Baxter*: lecto (here chosen): BM; isolecto: BM.

Two pieces are mounted on a sheet with one Baxter label. Both are in fruit and appear to be part of a single collection. I have chosen the larger piece as the lectotype; the remaining piece is regarded as an isolectotype.

## CONOSPERMUM

*E.M.Bennett*

**Conospermum** subg. **Chilurus** (R.Br.) E.M.Benn., *stat. nov.*

*Conospermum* sect. *Chilurus* R.Br., *Trans. Linn. Soc. London* 10: 155 (1810). Lecto (here chosen): *C. teretifolium* R.Br.

**Conospermum** subg. **Isomerium** (R.Br.) E.M.Benn., *stat. nov.*

*Conospermum* sect. *Isomerium* R.Br., *Suppl. Prodr. Fl. Nov. Holl.* 11 (1830); *Isomerium* (R.Br.) Spach, *Hist. Nat. Vég.* 10: 401 (1841). T: *C. flexuosum* R.Br.

**Conospermum** sect. **Axillaria** (Meisn.) E.M.Benn., *stat. nov.*

*Conospermum* subsect. *Axillaria* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 318 (1856). Lecto (here chosen): *C. amoenum* Meisn.

**Conospermum** sect. **Capitatae** Diels & E.Pritzel ex De Wild., *Pl. Nov. Horti Then.* 1: 139, 149 (1905)

Lecto (here chosen): *C. capitatum* R.Br.

**Conospermum** sect. **Corymbocephala** (Meisn.) E.M.Benn., *stat. nov.*

*Conospermum* sect. *Euconospermum* subsect. *Corymbocephala* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 319 (1856), *nom. illeg.* T: *C. ericifolium* Sm.

**Conospermum** sect. **Eriostachya** (Meisn.) E.M.Benn., *stat. nov.*

*Conospermum* sect. *Euconospermum* § *Eriostachya* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 316 (1856). T: *C. stoechadis* Endl.

**Conospermum** sect. **Paniculata** (Meisn.) E.M.Benn., *stat. nov.*

*Conospermum* subsect. *Paniculata* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 322 (1856). Lecto (here chosen): *C. ephedroides* Kippist ex Meisn.

**Conospermum** sect. **Scaposa** (Meisn.) E.M.Benn., *stat. nov.*

*Conospermum* subsect. *Scaposa* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 322 (1856). T: *C. scaposum* Benth.

**Conospermum** sect. **Teretifolia** E.M.Benn., *sect. nov.*

Folia teretia. Flores glabri, in paniculae extensae.

Type: *C. teretifolium* R.Br.

**Conospermum** subsect. **Foliosa** E.M.Benn., *subsect. nov.*

Inflorescentia spicarum simplicium ex axillis foliorum summorum oriens. Lobi perianthii breviores quam tubum.

Type: *C. distichum* R.Br.

**Conospermum** subsect. **Multibracteata** E.M.Benn., *subsect. nov.*

Inflorescentia terminalis, folia excedentia. Pedunculus bracteis numerosis sterilis.

Type: *C. incurvum* Lindl.

**Conospermum** subsect. **Pedunculata** E.M.Benn., *subsect. nov.*

Inflorescentia terminalis, ex foliis basalibus oriens. Pedunculus bracteis sterilibus paucis.

Type: *C. crassinervium* Meisn.

**Conospermum** subsect. **Ramosa** E.M.Benn., *subsect. nov.*

Inflorescentia panicula ramosissima, in axillas foliorum summorum oriens; flores late dispositi.

Type: *C. stoechadis* Endl.

**Conospermum** subsect. **Sericea** E.M.Benn., *subsect. nov.*

Inflorescentia spicarum axillarium, in axillas foliorum summorum oriens. Lobi perianthii tubum aequantes vel excedentes.

Type: *C. bracteosum* Meisn.

**Conospermum acerosum** subsp. **hirsutum** E.M.Benn., *subsp. nov.*

Caules dense tomentosi. Folia effusa vel declinata, basi decurrenti tomentosa.

T: Northampton (Champion Bay), W.A., Sept. 1901, *W.D.Campbell*; holo: PERTH.

**Conospermum amoenum** Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 522 (1845)

T: Darling's Range, Perth, W.A., Sept. 1841, Herb. *L.Preiss 745*; lecto (here chosen): MEL.

**Conospermum amoenum** subsp. **cuneatum** E.M.Benn., *subsp. nov.*

Folia caulina et floralia non auriculata sed basi leviter dilatata.

T: 41 km E of Midland, on Toodyay road, W.A., 23 Aug. 1987, *E.M.Bennett 5307*; holo: PERTH.

**Conospermum boreale** E.M.Benn., *sp. nov.*

Frutex erectus, 1–1.5 m altus. Folia ascendentia vel effusa, tenuia, ovata ad elliptica vel oblanceolata, 5.7–9.6 cm longa, 6–10 mm lata, venis 2 lateralibus et costis ±prominentibus. Pedunculus et rami primarii inflorescentiae glabri vel puberuli.

T: c. 5 km S of Kalbarri on Northampton road at turnoff to Eagle Point, W.A., 17 July 1987, *E.M.Bennett 5300*; holo: PERTH; iso: CANB, MEL.

**Conospermum boreale** subsp. **ascendens** E.M.Benn., *subsp. nov.*

Folia omnia ascendentia; apex conicus persistens. Pedunculus et ramus primarius inflorescentii glabrus.

T: 11 km from Great Northern Highway on Tathra–Carnamah road, W.A., 30 Aug. 1985, *E.M.Bennett 5143*; holo: PERTH.

**Conospermum caeruleum** subsp. **contortum** E.M.Benn., *subsp. nov.*

Folia 2–7 cm longa, 2–5 mm lata, margine undulata, pilis albis secus costam. Bracteolae fulvae, velutinae. Corollae tubus velutinus, apprime basi loborum.

T: W of Nannup, W.A., 29 Oct. 1948, *R.D.Royce 3000*; holo: PERTH.

**Conospermum caeruleum** subsp. **debile** (Kippist ex Meisn.) E.M.Benn., *stat. nov.*

*Conospermum debile* Kippist ex Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 70 (1855). T: locality unknown [W.A.], *J.Gilbert 164*; holo: K (photo seen).

**Conospermum caeruleum** subsp. **marginatum** (Meisn.) E.M.Benn., *stat. nov.*

*Conospermum marginatum* Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 2: 248 (1848). T: Swan R. [W.A.], *J.Drummond 2: 306*; iso: K, MEL.

**Conospermum caeruleum** subsp. **oblanceolatum** E.M.Benn., *subsp. nov.*

Folia basalia oblanceolata; petiolus minus quam 5 cm longus; lamina usque ad 3 cm longa, usque ad 1.7 cm lata; folia caulina supera margine incrassata. Bracteolae tomentosae basi et ad marginem infernam. Corollae tubus sparsim tomentosus.

T: S of Stirlings [Stirling Ra.], Borden–Albany area, W.A., *E.Wittwer 231*; holo: PERTH.

The epithet refers to the shape of the basal leaves.

**Conospermum caeruleum** subsp. **spathulatum** (Benth.) E.M.Benn., *stat. nov.*

*Conospermum caeruleum* var. *spathulatum* Benth., *Fl. Austral.* 5: 369 (1870). T: between Perth and King George Sound [W.A.], *W.H.Harvey*; holo: K.

**Conospermum canaliculatum** subsp. **apiculatum** E.M.Benn., *subsp. nov.*

Folia grisea tomentosa, 4–7.5 mm longa.

T: Badgingarra, W.A., 10 Sept. 1960, *L.Steenbohm*; holo: PERTH.

**Conospermum capitatum** subsp. **glabratum** E.M.Benn., *subsp. nov.*

Folia glabra. Pedunculi 4–5 mm longi. Perianthium tomentosum.

T: Cowaramup, W.A., 9 Nov. 1946, *R.D.Royce 1411*; holo: PERTH.

The epithet refers to the glabrous leaves.

**Conospermum capitatum** subsp. **velutinum** E.M.Benn., *subsp. nov.*

Folia alba-velutina inter venas marginales prominentes glabras. Pedunculi 4–5 mm longi. Perianthium sericeum.

T: 1 km E of junction of Mercer Rd on Emu Point Rd, Albany, W.A., 14 Jan. 1986, *E.M.Bennett 5265*; holo: PERTH; iso: CANB, K, MEL.

**Conospermum cinereum** E.M.Benn., *sp. nov.*

Frutex pauciramosus, usque ad 1.5 m altus. Folia lanceolata, 1.1–6.3 cm longa, 1–10 mm lata, puberula, interdum glabra; apex conicus. Inflorescentia panicula spicarum laxarum. Perianthium album, lanatum; tubus 2.5–3.5 mm longus; labium superum perianthii 1.5–2.3 mm longum, lanatum ad basim, puberulum ad apicem; lobi inferi 0.8–1 mm longi, apice acuto.

T: 4.3 km E of Toolibin South Rd on Toolibin–Tincurrin road, W.A., 21 Oct. 1985, *E.M.Bennett 5240*; holo: PERTH; iso: CANB, MEL.

**Conospermum coerulescens** subsp. **adpressum** E.M.Benn., *subsp. nov.*

Folia ascendentia, effusa, nec incurva nec ±appressa nec recurva. Perianthium azureum. Bracteolae pilis aliquot brevibus. Nux pilis ±adpressis; pili circumferentiae 1–1.25 mm longi.

T: southern boundary of Stirling Range Natl Park, 115 km N of Albany, on Chester Pass Rd, W.A., 8 Sept. 1985, *E.M.Bennett 5190*; holo: PERTH; iso: CANB, MEL.

**Conospermum coerulescens** subsp. **dorrienii** (Domin) E.M.Benn., *stat. nov.*

*Conospermum dorrienii* Domin, *Vestn. Král. Ceské Spolecn. Nauk, Tr. Mat.-Prír.* 1921–22(2): 8 (1923). T: Warriup Hill, Stirling Range, W.A., *A.A.Dorrien-Smith*; isosyn: PERTH; Stirling Range, W.A., 1909, *A.A.Dorrien-Smith*; isosyn: PERTH.

**Conospermum densiflorum** subsp. **unicephalatum** E.M.Benn., *subsp. nov.*

Subsp. *densifloro* simili, sed inflorescentia spica terminalis.

T: 4 km S of Gillingarra, W.A., 17 Sept. 1983, *R.J.Cranfield 4101*; holo: PERTH.

The epithet refers to the solitary, terminal spike.

*Conospermum diffusum* Benth., *Fl. Austral.* 5: 367 (1870)

T: locality unknown [W.A.], *J.Drummond s.n.*; lecto (here chosen): MEL; isolecto: NSW, PERTH.

**Conospermum elongatum** E.M.Benn., *sp. nov.*

Frutex multicaulis, usque ad 65 cm altus. Inflorescentia paniculata effusa spicarum interruptarum ex axillis foliorum summorum oriens.

T: E side of Mt Abrupt, Grampians, Vic., 3 Oct. 1982, *A.C.Beauglehole 71150, H.M.Beauglehole, G.W. & K.C.Beaton*; holo: MEL.

**Conospermum filifolium** subsp. **australe** E.M.Benn., *subsp. nov.*

Folia incurvata ad sigmoidea, erecta. Spica interrupta. Labium superum perianthii glabrum; labium inferum lanatum.

T: 3 km N of Hopetoun, W.A., 10 Sept. 1985, *E.M.Bennett 5208*; holo: PERTH; iso: CANB, MEL.

**Conospermum flexuosum** subsp. **laevigatum** (Meisn.) E.M.Benn., *stat. nov.*

*Conospermum flexuosum* var. *laevigatum* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 325 (1856). T: locality unknown [W.A.], *J.Drummond 2: 309*; syn: MEL, NSW, PERTH.

*Conospermum flexuosum* var. *asperulum* Meisn. *in* A.L.P.P. de Candolle, *Prodr*. 14: 325 (1856).

T: locality unknown [W.A.], *L.Preiss 753*; lecto (here chosen): MEL; Swan River [W.A.], *J.Drummond 5: 402*; syn: PERTH.

**Conospermum floribundum** Benth., *Fl. Austral.* 5: 373 (1870)

T: locality unknown [W.A.], *L.Preiss 740*; lecto (here chosen): MEL.

**Conospermum galeatum** E.M.Benn., *sp. nov.*

Folia filiformia, 4–5 cm longa, incurvata, canaliculata. Pedunculus 16–20 cm longus, glaber. Perianthium album, lanatum; labium superum caeruleum, glabrum (praeter pilos dispersos albos secus lineam mediam), apice recurvo.

T: between Bruce Rock and Narembeen, W.A., Sept. 1929, *W.E.Blackall*; holo: PERTH.

**Conospermum hookeri** (Meisn.) E.M.Benn., *stat. nov.*

*Conospermum taxifolium* var. *hookeri* Meisn. *in* A.L.P.P. de Candolle, *Prodr*. 14: 320 (1856). T: Spring Bay, Tas., *J.Backhouse*; syn: G-DC (photo seen).

**Conospermum leianthum** subsp. **orientale** E.M.Benn., *subsp. nov.*

Folia caulina 4–7 (–10) cm longa. Inflorescentia compacta, folia leviter excedentia. Perianthium album, fauce rosea.

T: 7 km W of Balladonia road junction with Esperance–Israelite Bay road, W.A., 10 Sept. 1985, *E.M.Bennett 5218*; holo: PERTH; iso: CANB, MEL.

**Conospermum microflorum** E.M.Benn., *sp. nov.*

Frutex rotundatus densus. Folia teretia, 2.5–17 cm longa. Inflorescentia panicula spicarum elongatarum. Perianthium album tomentosum; tubus 2.5–5.5 mm longus, c. 1.25 mm latus, sed ad apicem tumidus, c. 2 mm latus. Labium inferum perianthii conjunctum per 1–1.5 mm; lobi lineari 0.4–0.6 mm longi.

T: 147.2 km N of Geraldton, W.A., 28 Aug. 1985, *E.M.Bennett 5097*; holo: PERTH; iso: CANB, K, MEL.

**Conospermum multispicatum** E.M.Benn., *sp. nov.*

Frutex rotundatus usque ad 1 m altus. Folia arcte appressa, teretia, ±quadrangularia, 9–25 (–40) mm longa, 0.5–0.75 mm lata. Inflorescentia spicarum multarum axillarium, in axillas foliorum summorum. Flores albi lanati; tubus 4.5–5.5 mm longus; labium superum perianthii 0.7–1.25 mm longum, dense albo-lanatum.

T: 2 km E along Toolibin–Tincurrin road from Toolibin Road South, W.A., 21 Oct. 1985, *E.M.Bennett 5241*; holo: PERTH; iso: K, MEL, NSW.

**Conospermum nervosum** Meisn., *Hooker's J. Bot. Kew Gard. Misc.* 7: 71 (1855)

T: locality unknown [W.A.], *J.Drummond 6: 175*; lecto (here chosen): MEL; isolecto: NSW, PERTH.

**Conospermum paniculatum** E.M.Benn., *sp. nov.*

Folia erecta, 3-nervia; petiolus 1.5–10 cm longus; lamina 5–15 mm lata. Inflorescentia composita paniculata, usque ad 11.5 cm longa, ex axillis foliorum summorum orta. Pedunculus 3–6-angularis, saepe nervatus inter angulos.

T: 3.6 km S on Scott River Rd from Stewart Rd, W.A., 4 Sept. 1985, *E.M.Bennett 5160*; holo: PERTH; iso: CANB, K, MEL.

The specific epithet refers to the paniculate inflorescence.

**Conospermum quadripetalum** E.M.Benn., *sp. nov.*

Folia basalia, teretia, 13–35 cm longa, 0.75–1 mm lata. Inflorescentia panicula, parce ramosa, foliosa. Bracteolae 2.5–3 mm longae, 2.5–3 mm latae. Flores caerulei; lobis 4, ±aequalibus, 2–2.5 mm longis, 0.75–1 mm latis; tubis corollae 3–4 mm longis.

T: Scott River Rd, W.A., 4 Sept. 1985, *E.M.Bennett 5159*; holo: PERTH; iso: CANB, K, MEL.

The epithet refers to the 4 ±equal perianth lobes.

**Conospermum sigmoideum** E.M.Benn., *sp. nov.*

Folia sigmoidea, teretia, 1.5–3.5 cm longa, 0.2–0.3 mm lata. Inflorescentia terminalis, ultra folia extensa. Perianthium caeruleum; tubus 5–6 mm longus, valde constrictus ad 1–1.5 mm latus infra lobos perianthiorum.

T: Frank Hann Natl Park, 11 Aug. 1978, *D.Butcher 334*; holo: PERTH; iso: NSW.

**Conospermum spectabile** E.M.Benn., *sp. nov.*

Folia teretia, sigmoidea, ascendentia, 15–22 mm longa, 0.2–0.4 mm lata. Bracteolae deltoideae, 4.5–7 mm longae, 3–4 mm latae, caeruleae, glabrae sed ad margines prope basim tomentosae. Perianthium album et caeruleum, lanatum; labium superum perianthii caeruleum, glabrum.

T: Ross Peak, Stirling Ra., W.A., 27 Nov. 1934, *C.A.Gardner*; holo: PERTH.

**Conospermum stoechadis** subsp. **sclerophyllum** (Lindl.) E.M.Benn., *stat. nov.*

*Conospermum sclerophyllum* Lindl., *Sketch Veg. Swan. R.* xxx (1839). T: Swan River district [W.A.], 1839, *J.Drummond s.n.*; syn: CANB; Swan River [W.A.], *Mr Toward*; syn: CANB.

**Conospermum unilaterale** E.M.Benn., *sp. nov.*

Folia spathulata, 1.2–4.8 cm longa, 0.7–2.5 mm lata, ascendentia, sigmoidea, costa prominenti. Inflorescentia panicula vel spica. Pedunculus bracteis numerosis appressis sub floribus.

T: 1.2 km N from Lake Indoon turnoff on Brand Hwy, W.A., 27 Aug. 1985, *E.M.Bennett 5073*; holo: PERTH; iso: CANB, MEL.

**Conospermum wycherleyi** E.M.Benn., *sp. nov.*

Folia puberula ad sparsim pilosa vel glabra vel velutina. Bracteolae 3–8.5 mm longae. Labium superum perianthii 2.25–3.5 mm longum; labium inferum perianthii conjunctum per 1.5–2.5 mm.

T: Eneabba Creek, W.A., 27 Aug. 1948, *C.A.Gardner 9125*; holo: PERTH; iso: MEL, NSW.

**Conospermum wycherleyi** subsp. **glabrum** E.M.Benn., *subsp. nov.*

Folia glabra ad velutina. Bracteolae 3–3.8 mm longae. Labium superum perianthii 2.25–2.5 mm longum; labium inferum perianthii conjunctum per 1.25–1.5 mm.

T: 6 km S of Lake Indoon turn-off on Brand Hwy, W.A., 27 Aug. 1985, *E.M.Bennett 5071*; holo: PERTH; iso: MEL, NSW.

APPENDIX

# SYNAPHEA

*A.S.George*

The large number of new taxa in *Synaphea* reflects the lack of systematic study since the treatment by Bentham in 1870, the great increase in collections (many from areas easily accessible only within the past 30 years) and the superficial similarity of many taxa that led to misapplication of available names and 'lumping' of material under those names. The genus is divided into four sections, three of which are newly described here.

**Synaphea** R.Br., *Trans. Linn. Soc. London* 10: 155 (1810)

Lecto (here chosen): *S. polymorpha* R.Br.

With the protologue Brown described four species, all agreeing well with the description and still considered congeneric. *Synaphea polymorpha* is slightly preferable to the others in having the lower simple leaves mentioned in the second paragraph of the description.

**Synaphea** sect. **Bicornis** A.S.George, *sect. nov.*

Folia integra, dentata vel breviter lobata. Stigma oblongum ad ellipticum cornibus 2 angustis apicalibus; ovarium glandibus translucentibus apicalibus magnis.

Type: *S. reticulata* (Sm.) Druce

**Synaphea** sect. **Oulopha** A.S.George, *sect. nov.*

Folia pinnatipartita. Stigma oblongum, recurvum, marginibus lateralibus incurvis; ovarium sine glandibus apicalibus.

Type: *S. oulopha* A.S.George

**Synaphea** sect. **Pinnata** A.S.George, *sect. nov.*

Folia pinnatisecta, plerumque lobis 1–3 lanceolatis e quoque nodo rhachidis. Bracteae magnae. Stigma rotundatum, concavum, non lobatum; ovarium glandibus translucentibus apicalibus magnis.

Type: *S. pinnata* Lindl.

**Synaphea acutiloba** Meisn. *in* J.G.C.Lehmann, *Pl. Preiss.* 1: 528 (1845)

T: Darling Ra., W.A., 25–26 July 1839, *L.Preiss 782*; lecto (here chosen): P; isolecto: B, L, MEL, MO, P.

Meisner also cited *Preiss 777* from the 'head' of the Swan River [Darling Ra.] and, in brackets, *J.Drummond 589*. The collection *Preiss 782* is chosen as lectotype since it preserves the usage of the name as it has been applied over recent decades. *Preiss 777* represents a coarser-leaved plant with a larger perianth and more hirsute ovary.

**Synaphea aephynsa** A.S.George, *sp. nov.*

Ab *S. gracillima* Lindl. foliis crassioribus reticulo tenuiore exsiccatis flavidis differt. Tepalum adaxiale 4.5–5 mm longum, 2–2.2 mm latum. Stigma orbiculare ad late ovatum, 1 mm longum, 0.9–1 mm latum.

T: Mt Adams Rd, just W of intersection with Sundalara Rd, N of Eneabba, W.A., 12 Aug. 1993, *A.S.George 17034*; holo: PERTH; iso: CANB, K, NSW.

Epithet an anagram of the generic name.

**Synaphea bifurcata** A.S.George, *sp. nov.*

Caulibus dense appresso-pubescentibus, foliis bis bifurcatis et flores parvis glabris distinguitur. Tepalum adaxiale 3–3.5 mm longum, 1.3 mm latum. Stigma trapeziforme, 0.7–0.8 mm longum latumque.

T: 14 km N of Newdegate–Lake King road on Holt Rock South Rd, W.A., 32°58'S, 119°23'E, 11 Oct. 1994, *A.S.George 17237*; holo: PERTH; iso: AD, CANB, K, MEL, NSW.

Epithet from the Latin *bi-* (two-) and *furcatus* (forked), in reference to the leaves.

**Synaphea boyaginensis** A.S.George, *sp. nov.*

Foliis divaricater pinnatipartitibus lobis rectis angustis et stigmate grande distinguitur. Tepalum adaxiale 5–5.5 mm longum, 2–3 mm latum. Stigma ovato-rhombiforme, 2–2.2 mm longum, 1.6–1.7 mm latum.

T: Boyagin [Nature] Reserve, W.A., c. 32°29'S, 116°56'E, 7 Oct. 1973, *A.S.George 11714*; holo: PERTH; iso: CANB, MEL.

Named from the type and only known locality with the Latin suffix *-ensis* indicating place.

*Synaphea brachystachya* Lindl., *Sketch Veg. Swan R.* xxxii (1839)

T: Swan River district, W.A., 183-, *J.Drummond s.n.*; lecto (here chosen): CGE; Swan River district, W.A., 183-, *per J.Mangles*; syn: CGE.

Lindley cited no collection and there are two on the type sheet annotated by him as *S. brachystachya*; the second collection is per J.Mangles. The Drummond collection is selected as lectotype since it bears the lower leaves as described by Lindley; the Mangles specimen lacks these.

**Synaphea canaliculata** A.S.George, *sp. nov.*

Lobis foliorum angustis canaliculatis et spicis brevibus compactis distinguitur. Spicae 1–5 cm longae. Tepalum adaxiale 3.8–4.6 mm longum, 2–2.2 mm latum. Stigma transverse oblongum ad ±quadratum, 0.7–0.8 mm longum, 0.9–1 mm latum.

T: between Newdegate and Lake King, W.A., 33°05'S, 119°31'E, 11 Oct. 1994, *A.S.George 17239*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Named from the Latin *canaliculatus* (channelled), in reference to the leaf lobes.

**Synaphea cervifolia** A.S.George, *sp. nov.*

Lobis foliorum angustis ±flexuosis planis, perianthio in dimidio infero puberulo supra glabro, et tepalo adaxiali valde convexo distinguitur. Tepalum adaxiale 5–5.2 mm longum, 1.5–1.8 mm latum. Stigma transverse oblongo-ellipticum ad trapeziforme, 0.7–0.8 mm longum, 0.9 mm latum.

T: S of Hyden, W.A., 32°34'S, 118°50'E, 30 June 1970, *A.S.George 9887*; holo: PERTH; iso: CANB, K, MEL, NSW.

Epithet from *Cervus*, the generic name of the European Red Deer (*C. elaphus*) and the Latin *folium* (a leaf), the leaf lobing having a form reminiscent of the antlers of that animal.

**Synaphea constricta** A.S.George, *sp. nov.*

Habitu fere omnino glabro, floribus parvis et stigmate oblongo ad medium constricto distinguitur. Tepalum adaxiale 3.7–4.5 mm longum, 1.5 mm latum. Stigma oblongum sed constrictum, 0.7–0.9 mm longum, 0.5–0.6 mm latum.

T: N of Wongan Hills on road to Ballidu, W.A., 8 July 1988, *A.S.George 16917*; holo: PERTH; iso: CANB, K, MEL, NSW.

Epithet from the Latin *constrictus* (narrowed, constricted), in reference to the stigma.

**Synaphea cuneata** A.S.George, *sp. nov*.

Ad *S. damopsem* A.S.George et *S. flabelliformem* A.S.George affinis, a quibus foliis cuneatis vel obovatis, et floribus majoribus (tepale adaxiali 6 mm longo, 3–3.4 mm lato), praecipue differt. Stigma transverse elliptico-lunatum cornibus obtusis divergentibus, 0.9–1 mm longum, 1.8 mm latum.

T: 7 km S of Bannister, Albany Hwy, W.A., 32°37'S, 116°29'E, 14 Oct. 1993, *K.F.Kenneally 11394*; holo: PERTH; iso: CANB, K, MEL.

Named from the Latin *cuneatus* (wedge-shaped), in reference to the leaf lamina.

**Synaphea damopsis** A.S.George, *sp. nov*.

Ad *S. flabelliformem* A.S.George affinis, a qua floribus majoribus (tepale adaxiali 5.2–5.5 mm longo, 2.5 mm lato), et stigmate trapeziformi 0.8–1.1 mm longo, 1–1.5 mm lato, differt. Caules decumbentes, pubescentes. Folia flabelliformia, apicaliter dentata ad lobata, reticulo parvulo.

T: c. 8 km S of Collie, W.A., 25 Oct. 1973, *A.S.George 17174*; holo: PERTH; iso: AD, BRI, CANB, K, MEL, NSW.

Epithet from the name of the Fallow Deer (*Cervus (Dama) dama*) with the Greek suffix -*opsis* (-like), the leaves being somewhat reminiscent of the antlers of that animal in being cuneate with short lobes.

**Synaphea decorticans** Lindl., *Sketch Veg. Swan R.* xxxii (1839)

T: Swan River district, W.A., 183-, *J.Drummond s.n.*; lecto (here chosen): CGE.

A lectotype is needed for this name since the epithet refers to a large piece of the bark of a species of *Persoonia* (possibly *P. longifolia* R.Br.) mounted on the type sheet. Quite clearly Lindley was misled into believing it to belong to *Synaphea*, although his diagnosis makes no mention of it, describing instead the specimen of *Synaphea*. Selection of a lectotype avoids the possibility of the piece of bark being so chosen.

**Synaphea decumbens** A.S.George, *sp. nov*.

*Synaphea hiantis* A.S.George similis, sed stigmate oblongo ad basin dilatato, 1.5 mm longo, 1 mm lato, distinguitur. Caules decumbentes, pubescentes et pilosi. Folia cuneata ad flabelliformia, irregulariter dentata vel lobata. Spicae 4–5 cm longae floribus confertis, in pedunculo 5–10 cm longo. Tepalum adaxiale 6–6.5 mm longum, 2.8 mm latum, abaxiale 5–5.5 mm longum.

T: near Moorinup Lake, W.A., 34°15'S, 116°42'E, 3 Oct. 1971, *A.S.George 11129*; holo: PERTH.

Epithet from the Latin *decumbens* (prostrate with the ends turned upwards), in reference to the branchlets.

**Synaphea divaricata** (Benth.) A.S.George, *stat. nov*.

*Synaphea favosa* var. *divaricata* Benth., *Fl. Austral*. 5: 361 (1870). T: Eyre's Relief, W.A., *G.Maxwell*; lecto (here chosen): K; isolecto: MEL.

This taxon warrants recognition at specific rank, being characterised by the leaves, small glabrous flowers and obovate emarginate stigma. A lectotype is chosen since the Maxwell collection at Kew is annotated only as '*Synaphea favosa* var.', in Bentham's hand.

**Synaphea endothrix** A.S.George, *sp. nov*.

Ad *S. spinulosam* (Burm.f.) Merr. affinis, a qua habitu grossiore, petiolo plerumque longiore (1.5–6 cm longo), perianthio late aperiente intus hirsutiore, et fructu majore (7 mm longo), differt.

T: c. 5 km W of Brand Hwy on Jurien Rd, W.A., 12 Aug. 1993, *A.S.George 17044*; holo: PERTH; iso: AD, CANB, K, MEL, NSW.

Epithet from the Latinised Greek prefix *endo-* (within) and *thrix* (a hair), in reference to the indumentum inside the perianth.

**Synaphea favosa** R.Br., *Trans. Linn. Soc. London* 10: 156 (1810)

T: King George Sound [W.A.], Dec. 1801, *R.Brown Iter Australiense (Britten 3264)*; lecto (here chosen): BM; isolecto: BM, K, MEL.

One of two sheets at BM, that bearing Brown's own label, is selected as lectotype. The other is labelled 'for the public collection'.

**Synaphea flabelliformis** A.S.George, *sp. nov.*

Caulibus decumbentibus pubescentibus pilosisque, foliis flabelliformibus undulatis apicaliter dentatis vel lobatis, perianthio parvo (tepale adaxiali 3–3.5 mm longo, 1.5–1.8 mm lato), et stigmate transverse elliptico late emarginato 0.6 mm longo, 1.1 mm lato, distinguitur.

T: Boyagin Nature Reserve, W.A., 32°29'S, 116°51'E, 4 Sept. 1971, *A.S.George 10895*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Epithet from the Latin *flabellum* (a fan) and *-formis* (-formed, -shaped), in reference to the leaf lamina.

**Synaphea flexuosa** A.S.George, *sp. nov.*

Foliis arcte 3–5-lobatis flexuosis lobis angustis, et floribus parvis late dispositis, distinguitur. Tepalum adaxiale 4.5 mm longum. Stigma ±transverse oblongum, 0.8 mm longum, 1 mm latum.

T: SE of Kulin, W.A., 32°43'S, 118°17'E, 11 Oct. 1994, *A.S.George 17231*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Epithet from the Latin *flexuosus* (zig-zag, bent alternately in opposite directions), in reference to the markedly wavy leaf lobing.

**Synaphea floribunda** A.S.George, *sp. nov.*

Caulibus numerosis decumbentibus pilosis et pubescentibus, foliis oblanceolatis planis integris, spicis rhachidi villosa floribus confertis, et stigmate lunato bicorni, praecipue distinguitur. Ad *S. hiantem* A.S.George affinis, a qua foliis integris et floribus minoribus praecipue differt.

T: edge of Darling Scarp, SE of Capel, W.A., 19 Oct. 1993, *A.S.George 17078*; holo: PERTH; iso: CANB, K, MEL.

Epithet from the Latin *florere* (to flower) and the suffix *-bundus* (doing, or something accomplished), in reference to the abundant flowers.

**Synaphea grandis** A.S.George, *sp. nov.*

Habitu grandi (caulibus ad 30 cm longis, pedunculo ad 1 m alto), perianthio grandi (tepale adaxiali 5.5–7 mm longo, 2.5 mm lato, abaxiali 5 mm longo), et stigmate oblongo apice incurvo, 1.5–2 mm longo, 1.1–1.2 mm lato, distinguitur.

T: c. 1 mile [c. 1.6 km] E of Muchea turnoff from Great Northern Hwy on Chittering road, W.A., 1 Nov. 1971, *A.S.George 11158*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Epithet from the Latin *grandis* (large), in reference to the habit and typically large flowers.

**Synaphea hians** A.S.George, *sp. nov.*

Ad *S. floribundam* A.S.George affinis, a qua foliis cuneatis undulatis profunde lobatis et floribus majoribus (tepale adaxiali 6.5–7.5 mm longo, 2.8–3.5 mm lato) differt. Caules

numerosi decumbentes, pubescentes et pilosi. Folia discolora reticulo aperto vadoso. Stigma transverso-oblongum cornibus rectis vel incurvis, 1.7–2.5 mm longum, 1.8 mm latum.

T: c. 6 km E of Busselton on road to Nannup, W.A., 20 Oct. 1993, *A.S.George 17082*; holo: PERTH; iso: AD, CANB, K, MEL, NSW.

The epithet is the Latin for gaping or open-mouthed, in reference to the widely-opening perianth.

**Synaphea incurva** A.S.George, *sp. nov.*

Species variabilis ad *S. polymorpham* R.Br. affinis, sed foliis lanceolatis, trilobatis vel pinnatipartitis, perianthio parum majore (tepalo adaxiali 6.5–7 mm longo, abaxiali 6–6.5 mm longo), et stigmate ovato lobis incurvis, 1.3–1.6 mm longo, 1 mm lato, differt.

T: near Albany Airport, W.A., 23 Oct. 1993, *A.S.George 17147*; holo: PERTH; iso: CANB, K, NSW, PERTH.

The epithet is the Latin for incurved, in reference to the lobes of the stigma.

**Synaphea interioris** A.S.George, *sp. nov.*

Ad *S. divaricatam* (Benth.) A.S.George affinis, a qua omnino majore, lobis foliorum plerumque curvatis et perianthio late aperiente, differt. Tepalum adaxiale 5–6 mm longum, 1.5–2 mm latum, abaxiale 3.5–4 mm longum. Stigma oblongum ad anguste trapeziforme, 0.8–1 mm longum, 0.7–1 mm latum.

T: Kokardine, W.A., 30°41'S, 117°10'E, 3 Aug. 1987, *B.H.Smith 872*; holo: PERTH; iso: CANB, MEL.

The epithet is Latin for interior, in reference to the inland distribution of the species.

**Synaphea intricata** A.S.George, *sp. nov.*

Ad *S. spinulosam* (Burm.f.) Merr. affinis, a qua habitu gracile, foliis intricate divisis lobis angustissimis (0.5–1.5 mm latis), perianthio minore (tepale adaxiali 4.9–5.2 mm longo), et stigmate planiore, differt.

T: c. 19 km S of Muir Hwy on Nornalup Rd, W.A., 22 Oct. 1993, *A.S.George 17139*; holo: PERTH; iso: AD, CANB, K, MEL, NSW.

The epithet is the Latin for entangled or intricate, in reference to the divaricately lobed leaves.

**Synaphea lesueurensis** A.S.George, *sp. nov.*

Foliis bis vel ter tripartitis, multiplanaribus, spicis ad 10 cm longis in pedunculo ad 18 cm longo, floribus late dispositis, perianthio glabro vel parce puberulo late aperiente, tepale adaxiali 3.8–5 mm longo, abaxiali 2.5–3.5 mm longo, stigmate ovato minute emarginato concavissimo 1–1.2 mm longo, 0.7–0.8 mm lato, distinguitur.

T: Mt Lesueur, W.A., 30°16'S, 115°11'E, 13 Oct. 1974, *A.S.George 12891*; holo: PERTH; iso: CANB, MEL.

Named after Mt Lesueur, where a number of localised taxa occur, with the Latin suffix *-ensis* indicating place of occurrence.

**Synaphea macrophylla** A.S.George, *sp. nov.*

Foliis magnis (lamina ad 18 cm longa, petiolo ad 17 cm longo) et stigmate transverse oblongo bilobato parvo (0.7 mm longo, 1 mm lato) distinguitur. Caules decumbentes, ad 20 cm longi, appresso-puberuli. Spicae 7–10 cm longae in pedunculo ad 30 cm longo. Tepalum adaxiale 5.5 mm longum, 2 mm latum, abaxiale 4 mm longum.

T: W of Blackwood R., Nannup–Augusta Hwy, W.A., 21 Oct. 1993, *A.S.George 17112*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Epithet from the Greek *macros* (large) and *phyllon* (a leaf), in reference to the unusually large leaves.

**Synaphea media** A.S.George, *sp. nov.*

Inter *S. spinulosam* (Burm.f.) Merr. et *S. polymorpham* R.Br. intermedia, sed stigmate oblongo-trapeziformi, parum constricto, 0.8–1 mm longo, 0.7–1 mm lato, praecipue differt.

T: near Howick Hill, 5.5 km E of woolsheds of Mt Howick Stn, W.A., 18 Sept. 1968, *A.E.Orchard 1057*; holo: PERTH.

Epithet from the Latin *medius* (midway between), in reference to the species being morphologically intermediate between *S. spinulosa* and *S. polymorpha*.

**Synaphea nexosa** A.S.George, *sp. nov.*

Ad *S. petiolarem* R.Br. affinis, a qua habitu majore (ad 1 m alto) foliis implexissimis, spicis ad 30 cm longis floribus late dispositis, et fructu longiore (8–9 mm longo), differt. Folia triloba.

T: near Scott R., W.A., 21 Oct. 1993, *A.S.George 17114*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

The epithet is the Latin for much intertwined, complicated, in reference to the dense, tangled habit.

**Synaphea obtusata** (Meisn.) A.S.George, *stat. nov.*

*Synaphea preissii* var. *obtusata* Meisn. *in* A.L.P.P. de Candolle, *Prodr.* 14: 315 (1856). T: Swan R., W.A., 1844, *J.Drummond 3: 257*; syn: BM, K (2 sheets).

This taxon is sufficiently distinct from *S. preissii* to warrant specific rank. In particular it has longer, narrower obtuse leaf lobes, a wider adaxial tepal and shorter abaxial tepal and usually a slightly larger stigma.

**Synaphea odocoileops** A.S.George, *sp. nov.*

Ad *S. stenolobam* A.S.George affinis, a qua foliis minus divisis lobis longioribus planis, petiolo piloso, floribus minoribus (tepalo adaxiali 3.5–4 mm longo), et stigmato lobis reflexis, differt.

T: near Elgin railway siding, S of Bunbury, W.A., 19 Oct. 1993, *A.S.George 17072*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Epithet from the generic name of the Mule Deer (*Odocoileus hemionus*) with the Greek suffix *-ops* (-like), in reference to the resemblance of the leaf lamina to the antlers of that species.

**Synaphea oligantha** A.S.George, *sp. nov.*

Habitu parvo, foliis profunde dichotome vel trichotome partitis, scapis gracilibus, spicis paucifloris, floribus parvis (tepalum adaxiale 3.5–4 mm longum) et stigmate trapeziformi 0.6–0.8 mm longo distinguitur.

T: 1 mile [c. 1.6 km] N of Mt Le Grand, W.A., 11 Sept. 1971, *A.S.George 11020*; holo: PERTH; iso: CANB, K, MEL.

Named from the Greek *oligos* (few, small) and *anthos* (a flower), in reference to the few-flowered inflorescence.

**Synaphea otiostigma** A.S.George, *sp. nov.*

Caulibus longo-hirsutis, foliis ±cuneatis lobis triangularibus reticulo vadoso, et stigmate late lunato 0.8–1 mm longo, 1–1.1 mm lato lobis basalibus et marginibus ±recurvis, distinguitur.

T: 9 km S of Nannup on Pemberton Rd, W.A., 34°03'S, 115°46'E, 21 Oct. 1993, *A.S.George 17130*; holo: PERTH; iso: CANB, K, MEL, NSW.

Epithet from the Greek *otion* (a little ear or auricle) and *stigma* (stigma), in reference to the small basal lobes of the stigma.

**Synaphea oulopha** A.S.George, *sp. nov.*

Species bene distincta ovario glandibus apicalibus translucentibus carenti. Caules villosi. Folia pinnatipartita, multiplanaria, lobis linearibus, acuminatis, 1.5–2.5 mm latis, vadose reticulatis. Spicae ad 15 cm longae, floribus late dispositis. Perianthium glabrum, late aperiens; tepalum adaxiale 3–4 mm longum, 1.5 mm latum, arcte curvatum; tepalum abaxiale 2.1–2.3 mm longum. Stigma oblongum, vix emarginatum, marginibus incurvis, 0.7–0.8 mm longum, 0.2 mm latum.

T: Bunney Rd, NNE of Eneabba, W.A., 12 Aug. 1993, *A.S.George 17036*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Named from the Greek *ou* (no, not) and *lophos* (a crest), in reference to the lack of glands on the ovary; all other species have these glands.

**Synaphea panhesya** A.S.George, *sp. nov.*

Ad *S. decorticantem* Lindl. affinis, a qua lobis primariis foliorum latioribus ultimis pungentibus, floribus minoribus (tepale adaxiali 4.5–5.5 mm longo, 1.8–2 mm lato, abaxiali 3 mm longo) stigmate minore (0.7–0.9 mm longo, 0.9–1 mm lato) differt.

T: near NW corner of Bindoon Military Firing Range, W.A., c. 31°09'S, 116°15'E, 28 Aug. 1976, *A.S.George 14326*; holo: PERTH.

Epithet an anagram of *Synaphea*.

**Synaphea parviflora** A.S.George, *sp. nov.*

Floribus parvis et reticulo foliorum crasso distinguitur. Tepalum adaxiale 4–4.2 mm longum, abaxiale 2.8–3 mm longum. Ab *S. tripartita* A.S.George cognata foliis pinnatipartitis, pedunculo breviore et rachide bracteisque minus pubescentibus, differt.

T: Tarin Rock, W.A., 23 Sept. 1964, *A.R.Fairall 1647*; holo: PERTH; iso: CANB, K.

Epithet from the Latin *parvus* (small) and *flos* (a flower), the flowers being smaller than in most species of the genus.

**Synaphea petiolaris** R.Br., *Trans. Linn. Soc. London* 10: 156 (1810)

T: King George Sound [W.A.], Dec. 1801, *R.Brown Iter Australiense (Britten 3265)*; lecto (here chosen): BM; isolecto: BM, K.

One of two sheets at BM, that bearing Brown's own label, is selected as lectotype. The other is labelled 'for the public collection'.

**Synaphea petiolaris** subsp. **simplex** A.S.George, *subsp. nov.*

Ab subspeciebus aliis foliis simplicibus differt.

T: Ruabon, near Busselton, W.A., 33°39'S, 115°30'E, 20 Oct. 1993, *A.S.George 17103*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

**Synaphea petiolaris** subsp. **triloba** A.S.George, *subsp. nov.*

Ab subspeciebus aliis foliis omnibus trilobis differt.

T: near Acton Park, E of Busselton, W.A., 20 Oct. 1993, *A.S.George 17083*; holo: PERTH; iso: AD, CANB, K, MEL, NSW.

**Synaphea platyphylla** A.S.George, *sp. nov.*

Foliis latis simplicibus vel 2–3-lobatis et inflorescentia fere glabra, distinguitur. Tepalum adaxiale 5–5.5 mm longum, 2–2.2 mm latum, abaxiale 3.2 mm longum. Stigma quadratum ad obtrapeziforme, profunde bilobatum, 0.8–0.9 mm longum et latum. Ad *S. petiolarem* R.Br. affinis.

T: Dongolocking Nature Reserve, W.A., 13 Oct. 1994, *A.S.George 17248*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Named from the Greek *platys* (broad) and *phyllon* (a leaf), in reference to the leaves.

**Synaphea polymorpha** R.Br., *Trans. Linn. Soc. London* 10: 156 (1810)

T: probably King George Sound [W.A.], Dec. 1801, *R.Brown Iter Australiense (Britten 3263)*; lecto (here chosen): BM; isolecto: BM, K.

**Synaphea quartzitica** A.S.George, *sp. nov.*

Foliis pinnatipartitis undulatis lobis latis, spicis longis (6–18 cm longis), tepalo adaxiali manifeste curvato, tepalo abaxiali brevi (2.5–3.5 mm longo) et stigmate angusto (0.8–1 mm longo, 0.3–0.4 mm lato) distinguitur.

T: N of Moora, W.A., c. 30°33'S, 116°02'E, 13 Aug. 1993, *A.S.George 17055*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

The epithet refers to the rock type on which the species is found.

**Synaphea rangiferops** A.S.George, *sp. nov.*

Ad *S. tamminensem* A.S.George affinis, a qua foliis pinnatipartitibus reticulo aperto vadoso, spicis multo longioribus (ad 12 cm longis), perianthio angustiore (tepale adaxiali 1.5 mm lato), stigmate oblongo, 0.5 mm lato, ovario glabro praeter ad basin pubescente, et fructu longiore (5–6.5 mm longo), differt.

T: 10 km SW of Calingiri, W.A., 31°09'S, 116°23'E, 29 Aug. 1976, *A.S.George 14331*; holo: PERTH; iso: CANB.

Epithet from the generic name of the Reindeer or Caribou (*Rangifer tarandus*) with the Greek suffix *-ops* (-like), the leaf lobing being somewhat reminiscent of the form of the antlers of that animal.

**Synaphea recurva** A.S.George, *sp. nov.*

Foliis aperte pinnatipartitibus reticulo vadoso, inflorescentia longa (spicis ad 14 cm longis in pedunculo ad 30 cm longo), floribus ±horizontalibus, tepale adaxiali arcte curvato, et stigmate obovato ad V-forme lobis recurvis, distinguitur.

T: E of Northampton, W.A., 28°21'S, 114°42'E, 10 Aug. 1993, *A.S.George 17019*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

The epithet refers to the flowers that are clearly recurved relative to the rachis.

**Synaphea sparsiflora** A.S.George, *sp. nov.*

Floribus magnis late dispositis distinguitur. Ad *S. spinulosam* (Burm.f.) Merr. arcte affinis, sed petiolo pedunculoque longiore etiam differt.

T: First North Rd, just N of Three Springs–Eneabba road, W.A., 12 Aug. 1993, *A.S.George 17040*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Epithet from the Latin *sparsus* (bestrewn, scattered) and *flos* (a flower), in reference to the flowers being widely spaced in the spike.

**Synaphea spinulosa** subsp. **borealis** A.S.George, *subsp. nov.*

Ab subspeciebus aliis spicis longioribus floribus confertis, floribus minus puberulis et fructu minore distinguitur. Perianthium in dimidio infero pubescens, supra ±glabrum. Fructus c. 3.5 mm longus.

T: Howatharra, W.A., 19 Aug. 1966, *A.M.Ashby 1907*; holo: PERTH; iso: CANB, MEL.

The epithet is Latin for northern, in reference to the distribution of this subspecies relative to that of the other taxa.

**Synaphea spinulosa** subsp. **major** A.S.George, *subsp. nov.*

Ab subspeciebus aliis perianthio majore praecipue distinguitur. Tepalum dorsale 6.5–7 mm longum, 3 mm latum.

T: just N of Wongan Hills on road to Ballidu, W.A., 8 July 1988, *A.S.George 16918*; holo: PERTH; iso: CANB, K.

The epithet, Latin for larger, refers to the slightly larger flower size compared with the other subspecies.

**Synaphea stenoloba** A.S.George, *sp. nov.*

Habitu multicauli et foliis multipartitibus lobis angustissimis (1–2 mm latis) concavis, distinguitur. Tepalum adaxiale 4.5–5 mm longum, 2 mm latum, abaxiale 3.5 mm longum. Stigma ovatum, profunde bilobum, 1 mm longum, 1–1.2 mm latum.

T: NE of Pinjarra, W.A., 32°37'S, 115°54'E, 12 Oct. 1993, *A.S.George 17060*; holo: PERTH; iso: AD, CANB, K, MEL, NSW, PERTH.

Named from the Greek *stenos* (narrow) and *lobos* (a lobe), in reference to the leaf lobes.

**Synaphea tamminensis** A.S.George, *sp. nov.*

Inter species inflorescentiis arcte folia excedentibus foliis multipartitibus multiplanaribus reticulo parvulo, floribus parvis (tepale adaxiali 4–5 mm longo, abaxiali 3.2 mm longo), et fructu parvo (c. 2 mm longo), differt.

T: Charles Gardner Flora Reserve, S of Tammin, W.A., 31°47'S, 117°28'E, 29 Aug. 1971, *A.S.George 10888*; holo: PERTH; iso: CANB, K, MEL, NSW.

Named from the town near the type locality, with the Latin suffix *-ensis*.

**Synaphea tripartita** A.S.George, *sp. nov.*

Ad *S. parvifloram* A.S.George affinis, a qua foliis minus divisis (plerumque semel vel bis tripartitis) ±planis, pedunculo longiore (ad 7 cm longo), floribus majoribus (tepale adaxiale 5 mm longo) confertioribus, et rhachide bracteisque pubescentioribus, differt.

T: E of Pingaring, W.A., 11 Oct. 1994, *A.S.George 17234*; holo: PERTH; iso: CANB, K, MEL.

Epithet from the Latin *tri-* (three-) and *partitus* (divided), in reference to the leaves.

**Synaphea whicherensis** A.S.George, *sp. nov.*

Foliis pinnatipartitibus planis lobis arcuatis angustis (1.2–4 mm latis), spicis brevis (2–3 cm longis) floribus confertis in pedunculo longo (ad 28 cm longo), tepale adaxiali 6 mm longo, 2.5 mm lato, stigmate ovato, crasso, non emarginato, 2 mm longo, 1.2–1.2 mm lato, distinguitur.

T: Sabina Rd, Whicher Ra., W.A., 20 Oct. 1993, *A.S.George 17086*; holo: PERTH; iso: CANB, K, MEL, NSW, PERTH.

Named for the Whicher Range east of Busselton, W.A., where a number of endemic taxa occur.

APPENDIX

## FRANKLANDIA

*A.S.George*

**Franklandia triaristata** Benth., *Fl. Austral.* 5: 377 (1870)

T: south-western W.A., *J.Drummond s.n.*; lecto: K (in fruit) (here chosen); isolecto: MEL; Tone R., W.A., *A.Oldfield*; syn: K (in flower); Capel R., W.A., *A.Oldfield*; syn: B, K, MEL (in flower).

## Subfam. CARNARVONIOIDEAE

## CARNARVONIA

*B.P.M.Hyland*

**Carnarvonia araliifolia** var. **montana** B.Hyland, *var. nov.*

*Carnarvonia araliifolia* var. *araliifolia* affinis sed pilis pedicellis ferrugineis tortilibus erectiusculis differt.

T: State Forest Reserve 194 Western, Qld, 6 Jan. 1972, *B.P.M.Hyland 5744*; holo: QRS.

The epithet is the Latin for 'pertaining to mountains', in reference to the montane rainforest habitat of this taxon.

## Subfam. GREVILLEOIDEAE

## ORITES

*A.S.George & B.P.M.Hyland*

**Orites** R.Br., *Trans. Linn. Soc. London* 10: 189 (1810)

Type: *O. diversifolia* R.Br.; lecto (here chosen by A.S.George).

Brown named two species in the above work, both Tasmanian endemics and still considered congeneric. The generic description is appropriate to both species, and *O. diversifolia* is selected as the first of the two as arranged by Brown.

**Orites** sect. **Excelsae** A.S.George & B.Hyland, *sect. nov.*

Arbores vel frutices elati sylvarum pluvialium et dumetorum lianarum tropicorum et subtropicorum. Folia tenuia vel coriacea, late elliptica vel lanceolata, 15–45 mm lata. Conflorescentia 5–11 cm longa. Folliculi 28–44 mm longi.

T: *O. excelsa* R.Br.

The large habit, leaves and conflorescence readily distinguish species of this section from those of sect. *Orites*, all of which occur in temperate south-eastern Australia. Floral and fruit morphology is similar in the two sections with the exception of *O. megacarpa*, which has a much larger follicle than other species.

*Orites excelsa* var. *fissifolia* F.Muell., *Fragm.* 5: 153 (1866)

T: Hastings R., N.S.W., *coll. unknown*; neo: MEL (here nominated by A.S.George); isoneo: MEL.

Mueller cited no collection in the protologue and no sheet has been found bearing his name. At MEL there are several sheets variously annotated by Mueller as *O. excelsa* var. *trifida* or *O. excelsa* var. *pinnatifida*. His brief diagnosis included both terms to describe the leaves

('foliis trifidis vel pinnatifidis'), and this seems to have been one of several instances when he altered the epithet for publication. The neotype is a sheet from the Hastings River, N.S.W., labelled by Mueller *'Orites excelsa* var. *pinnatifida* ferd. Mueller'. The specimen has both trifid and pinnatifid leaves. Another sheet appears to be a duplicate and is considered to be an isoneotype.

**Orites lancifolia** F.Muell., *Defin. Austral. Pl.* 31 (June–July 1855); *Trans. Philos. Soc. Victoria* 1: 108 (10 Sept. 1855)

T: Australian Alps [Vic.], Dec. 1854, *F.Mueller*; lecto: MEL (here chosen by A.S.George); isolecto: MEL; Mt Hotham [Vic.], date unknown, *F.Mueller*; syn: MEL; Mt Wellington, Gippsland [Vic.], Nov. 1854, *F.Mueller*; syn: MEL; Munyang Mountains [Vic.], Jan. 1855, *F.Mueller*; syn: MEL.

In the protologue, Mueller cited collections that he made from 'Mt Wellington, Mt Hotham, Mt Latrobe, Munyang Mts, upper Mitta Mitta etc.', all localities in the high country of eastern Vic. At MEL there are several sheets collected by Mueller during his explorations of 1854–55, labelled 'Mt Hotham, no date', 'Mt Wellington Gippsland Nov. 1854', 'Munyang Mountains Jan. 1855' and 'Australian Alps Dec. 1854', all determined by Mueller as *O. lancifolia*. All agree with the protologue in morphological features. The sheet labelled Australian Alps Dec. 1854 is selected as lectotype since it bears the best specimens.

**Orites megacarpa** A.S.George & B.Hyland, *sp. nov.*

Arbor ad summam sylvis attingens. Surculi appresso-hirsuti, glabrescentes. Cortex lenticellis confertis. Folia elliptica, obtusa, integra, coriacea, supra nitentia; lamina 5–10 cm longa, 2–3 cm lata; petiolus 5–12 mm longus, glaber. Flores in paniculo racemorum terminali; rhachis ferrugineo-villosa; bracteae lineares, 2–3 cm longae, villosae; pedicelli 2–4 mm longi, cremei-villosi. Perianthium 5–6 mm longum, villosum, cremeum. Gynoecium 4.2–4.5 mm longum; ovarium et basin styli longo-sericeum, supra basin pilis paucis sparsis; squamae hypogynae cordatae, connatae. Folliculi oblique obovati, rostrati, 28–44 mm longi, crassissimi, ±plane aperienta. Semina elliptica ad fere orbicularia, 15–20 mm longa, ala 2–4 mm lata.

T: Mt Bartle Frere, Qld, 27 Dec. 1986, *M.Godwin C2960 & J.P.Stanton*; holo: QRS 095401; iso: BRI, QRS.

The epithet comes from the Greek *megas* (large) and *carpos* (a fruit).

## MEGAHERTZIA

*A.S.George & B.P.M.Hyland*

**Megahertzia** A.S.George & B.Hyland, *gen. nov.*

Arbores sylvae pluvialis. Folia alterna, simplicia. Flores in racemis simplicibus infra folia insertis. Bracteae communes et florales praesentes. Perianthium actinomorphum; tepala fere ad basin separata, caduca. Antherae apiculatae. Gynoecium rectum; praebitor pollinis paene amplificatus; sulcus stigmaticus terminalis, parvus; ovuli 2. Glandulae hypogynae irregulariter lobatae. Fructus folliculus. Semina alata.

Type: *M. amplexicaulis* A.S.George & B.Hyland

Name a pun on Roaring Meg Creek where an early collection was made, and from the Greek *megas* (large) and hertz, the term for measuring frequency of sound.

**Megahertzia amplexicaulis** A.S.George & B.Hyland, *sp. nov.*

Arbor ad 10 m alta. Ramuli minute appresso-puberuli. Folia elliptica ad lanceolata, obtusa, plerumque amplexicaula, aliquando breviter petiolata, integra, undulata, discolora; lamina 8–23 cm longa, 2.5–6 cm lata. Flores in racemis simplicibus usque ad 26 cm longis, terminalibus vel infra foliis insertis; rhachis glabra. Bracteae communes ±triangulares, acutae, 1–1.3 mm longae, marginibus parce puberulis; bracteae florales ±triangulares, c. 0.5

mm longae. Pedicelli ad angulum c. 90° patentes, 6–7 mm longi, ±glabri. Perianthium 22–29 mm longum, album, glabrum; limbum 5 mm longum; tepala post anthesin laxa. Antherae 3.5–4 mm longae, apiculatae. Gynoecium 24–28 mm longum, rectum, glabrum; praebitor pollinis 4–5 mm longus, costatus. Glandulae hypogynae c. 1 mm longae, irregulariter et obtuse lobatae. Fructus 30–35 mm longus, 5–7 mm latus, post dehiscentiam navicularis. Semina 22–25 mm longa, 4 mm lata, alata, alis in latere uno quam altero multo latiore et ad extremis latiore.

T: branch of Cooper Creek, Qld, 16°10'S, 145°24'E, 22 Aug. 1987, *G.Sankowsky 638 & N.Sankowsky*; holo: BRI.

Epithet from the Latin *amplexus* (clasping) and *folium* (a leaf), in reference to the juvenile and some adult leaves.

## STENOCARPUS

*D.B.Foreman*

**Stenocarpus verticis** Foreman, *sp. nov.*

Arbor usque ad 20 m alta, *Stenocarpo saligno* R.Br. affinis. Folia juvenalia 3–7-lobata, 1.8–3 cm lata; folia adulta elliptica, late elliptica vel late lanceolata, 5.5–15 cm longa, 1.7–7 cm lata. Flores 7–9 mm longi, cremei, 40–50 in umbellas; pedicelli 5–12 mm longi.

T: Gunn Point, N.T., 2 May 1984, *G.Wightman 1298 & C.R.Dunlop*; holo: DNA; iso: BRI, CANB, DNA, K, MEL.

The epithet refers to the geographical distribution of the species across the 'top end' of Australia.

## BUCKINGHAMIA

*D.B.Foreman*

**Buckinghamia celsissima** F.Muell., *Fragm.* 6: 248 (1868)

T: Six Mile Creek, Qld, 11 Jan. 1865, *J.Dallachy s.n.*; lecto (here chosen): MEL 1538566.

The lectotype is one of a suite of 6 collections at MEL made by Dallachy. Four are without dates and are annotated in Mueller's hand '*Buckinghamia celsissima* F.v.M., Rockingham('s) Bay'. The two remaining specimens have, in addition to the same Mueller annotation, original Dallachy labels with a clear indication of the date of collection. The specimen selected as lectotype is the only one in full flower and accompanied by precise locality details.

## TELOPEA

*M.D.Crisp & P.H.Weston*

**Telopea aspera** Crisp & P.H.Weston, *sp. nov.*

A *T. speciosissima* foliis ellipticis vel obovato-ellipticis, plerumque 3–11 dentes infra medium utraeque marginis ferentibus, subtus manifeste vel moderate ferrugineo-tomentosis, magis coriaceis et asperis differt.

T: Gibraltar Ra., N.S.W., 1 Nov. 1984, *M.D.Crisp 7536 & J.M.Taylor*; holo: CBG; iso: AD, K, MEL, NSW.

Differs from *T. speciosissima* as follows: ferrugineous-hairy on the axes and especially the

leaf under-surface; the latter with 30–80 hairs per mm². Adult leaf lamina elliptic to obovate-elliptic or narrowly so, with 3–11 teeth extending below centre of either margin, abruptly contracted to the petiole, very coriaceous and harsh to the touch.

The name *aspera* is Latin for rough or harsh and refers to the texture of the leaves.

## HOLLANDAEA

*B.P.M.Hyland*

**Hollandaea riparia** B.Hyland, *sp. nov.*

*Hollandaea sayeriana* affinis sed lamina minus quam 4 cm lata; ovulis minus quam 6; fructu verrucosi et minus quam 6 cm longo differt.

T: Timber Reserve 165, Baird Logging Area, Qld, 16°02'S, 145°19'E, 22 Sept. 1980, *B.P.M.Hyland 10626*; holo: QRS.

The name *riparia* refers to the usual habitat of this species, i.e. stream banks.

## CATALEPIDIA

*P.H.Weston*

**Catalepidia** P.H.Weston, *gen. nov.*

Arbores. Hypocotylus obsoletus. Trichomata nulla. Folia alterna, simplicia, integra. Conflorescentia lateralis, non ramosa. Pedunculi evoluti, bracteati. Flores actinomorphi, hermaphroditi, bracteati, pedicellati. Glandulae hypogynae 4, liberae. Ovarium sessile; ovula 2, orthotropa, pendula; pollenophorum ovoideum; stigma terminale. Fructus ±globosus, indehiscens; mesocarpium externum succulentum, sine fibris; mesocarpium internum osseum, laeve.

Type: *C. heyana* (F.M.Bailey) P.H.Weston

*Catalepidia heyana* was placed in *Helicia* by Bailey (*Queensland Fl.* 4: 1329, 1901), in *Macadamia* by Sleumer (*Blumea* 8: 5, 1955) and was tentatively (but not formally) placed in *Virotia* by Johnson & Briggs (*Bot. J. Linn. Soc.* 70: 176, 1975), none of whom had seen fruits. As pointed out by Sleumer, it differs from *Helicia s. str.*, in its orthotropous, pendulous ovules (hemitropous to anatropous, laterally to sub-basally inserted ovules in *Helicia*) and also in its consistently entire leaves (dentate, at least in the juvenile phase, in *Helicia*). Johnson & Briggs observed that it differs from *Macadamia s. str.*, in its alternate leaves, free hypogynous glands, pedunculate flower pairs, and also in its succulent outer mesocarp and bony inner mesocarp (leaves whorled; hypogynous glands fused into a cup; flower pairs sessile; mesocarp leathery in *Macadamia*). It differs from *Virotia* in its obsolete hypocotyl, the series of cataphylls between the cotyledons and the first foliose leaves, free hypogynous glands, and in its red, globose fruits in which the outer mesocarp lacks radiating vascular bundles and fibrous strands (hypocotyl elongates substantially after germination; cataphylls absent between cotyoledons and first foliose leaves; hypogynous glands partially connate; fruits brown to black at maturity, laterally compressed, with abundant radiating vascular bundles in the outer mesocarp in *Virotia*).

Named from the Greek *kata* (low), and *lepis, lepidos* (a scale), in reference to the series of cataphylls at the base of each shoot, including the plumule.

**Catalepidia heyana** (F.M.Bailey) P.H.Weston, *comb. nov.*

*Helicia heyana* F.M.Bailey, *Queensland Fl.* 4: 1329 (1901). T: Palm Camp, Bellenden Ker, Qld, 1889, *F.M.Bailey s.n.*; holo: BRI 011499.

APPENDIX

## LAMBERTIA

*R.J.Hnatiuk*

**Lambertia echinata** subsp. **citrina** Hnatiuk, *subsp. nov*.

Frutex erectus vel patens. Folia crassa, saepe non prominente reticulata. Perianthum flavum.

T: last hill overlooking Cheynes Beach, c. 4 km from town [W.A.], 16 Nov. 1982, *G.J.Keighery 5727;* holo: PERTH.

Named from the Latin *citrinus* (lemon yellow), in reference to the perianth.

**Lambertia inermis** var. **drummondii** (Fielding & Gardner) Hnatiuk, *comb. et stat. nov*.

*Lambertia drummondii* Fielding & Gardner, *Sert. Pl* part 1: t. 22 (1843). T: Swan River Colony, New Holland [W.A.], *J.Drummond 594*; holo: OXF.

The colour variation appears clinal and has horticultural significance and thus should be formally recognised. As there is intermixing in the middle part of the ranges a rank above variety is not appropriate.

**Lambertia multiflora** Lindl., *Sketch Veg. Swan R.* xxxii (1839)

T: Swan River district [W.A.], *J.L.Drummond s.n.*; lecto (here chosen): CGE.

Lindley based his names in the *Sketch* on Drummond's collections which are now housed primarily in CGE. G.Guymer, the Australian Botanical Liaison Officer at Kew, 1986, reported that there was a duplicate at LIV which, if verified, would be a syntype (*n.v.*). The large specimen on the right hand side of the CGE sheet, marked as Drummond's, is selected as the lectotype. There is a similar specimen attributed to Toward, on the upper left hand corner of the sheet, which is not known to be part of the type gathering.

**Lambertia multiflora** var. **darlingensis** Hnatiuk, *var. nov*.

Frutex cum lignotubero, caulibus erectis vel patentibus. Folia conspicue reticulata. Flores 7 per conflorescentiam. Perianthium flavum. Fructus 8–10 mm longus, 9 mm latus, in angulo stylare rostro uno, in angulo altero cornibus 2, rectis vel curvatis, latibus laevibus vel irregulariter mamillatis.

T: Crystal Brook W.A., Aug. 1971, *S.Paust s.n.;* holo: PERTH.

Named after the Darling Range escarpment, where it occurs along the face and at the base.

**Lambertia rariflora** subsp. **lutea** Hnatiuk, *subsp. nov*.

Frutex vel arbor parva, caule uno usque ad 12 cm diametro, sine lignotubere; cortex in caule principali infra fibrosus, superne laevis et lenticellatus. Folia breviter petiolata, 2–3 mm longa, plerumque anguste oblanceolata, subinde linearia, 1.5–9 cm longa, 2–5 mm lata, marginibus irregularibus et parum revolutis. Flores 1, axillares; perianthium flavum. Fructus gracilis, cuneatus, erectus, c. 7–15 mm longus, c. 3–5 mm latus, laevis vel leviter striatus; rostrum erectum in infima parte, in media parte valde extrinsecus curvatum, ad apicem extrinsecus curvatum vel sursum recurvatum; rostrum interdum erectum et incurvatum in superne quarto.

T: 30 km N of Walpole, W.A., 31 Mar. 1995, *A.S.Weston 95.4.1*.; holo: PERTH; iso: CBG.

Named after its yellow perianth, from the Latin *luteus*.

# SUPPLEMENTARY GLOSSARY

**acrodromous:** with two or more primary or strongly developed secondary veins running in convergent arches towards the leaf apex. Arches not recurved at base.

**acrotonic:** *of flowering seasonal growth units (seasonal shoots)*, producing leaves below the inflorescence, cf. **basitonic.**

**allantoid:** sausage-shaped.

**alternitepalous:** *of floral parts*, inserted alternately with the tepals.

**amplexicaul:** *of a leaf base*, stem-clasping.

**anauxotelic:** applied to inflorescences, parts of inflorescences or to axes that do not end in a flower, and in which growth does not continue beyond the flowering region, cf. **auxotelic.**

**autapomorphic:** *of a character*, derived and unique to a given taxon or monophyletic group.

**auxotelic:** applied to inflorescences, parts of inflorescences or to axes that do not end in a flower, and in which growth continues beyond the flowering region, cf. **anauxotelic.**

**basitonic:** *of flowering seasonal growth units (seasonal shoots)*, producing no leaves (but sometimes some bracts) below the inflorescence, cf. **acrotonic.**

**brochidodromus:** pinnate venation in which the secondary veins do not terminate at the margins but are joined in a series of prominent arches.

**cataphyll:** a simple, scale-like leaf.

**cauliflorous:** *of flowers and fruits*, produced on a well-developed trunk or major branch.

**divaricate:** widely spreading and ±horizontal.

**eucamptodromous:** pinnate venation in which the secondary veins do not terminate at the margins but which gradually diminish inside the margin, connected to the superadjacent secondary veins by a series of cross-veins without forming prominent marginal loops.

**flabelliform:** fan-shaped.

**fulvous:** dull yellowish brown or yellowish grey.

**glabrate:** glabrous, but obviously having previously had an indumentum.

**guard cells:** the two cells that open and close the stomata to allow gas exchange.

**kwongan:** low sand heath or sand plain sclerophyllous vegetation common in south-western W.A.

**lamellose:** composed of or arranged in layers or thin plates.

**linguiform:** tongue-shaped.

**lumen:** the cavity of a plant cell.

**morphocline:** a graded series of character states of an homologous character.

**mellitophily:** an insect-flower pollination syndrome involving bees.

**multiplanar:** *of divided leaves*, with the lobes held in several to many planes.

**parapatric:** *of distributions of two taxa or populations*, having non-overlapping but contiguous ranges.

**paraphyletic:** a group of taxa derived from a single ancestral taxon, but which does not contain all the descendants of the most recent common ancestor.

**pinnatipartite:** *of leaves*, pinnatifid, where the lobes pass beyond the middle (or are within the middle third) and the parenchyma is not interrupted.

**plesiomorphic:** *of a character*, ancestral or primitive.

**pollen presenter:** *of many Proteaceae*, a structural modification, usually a swelling, of the style around or below the stigma which enables pollen, shed in the bud, to be retained.

**pseudanthium:** a compact inflorescence of several to many small flowers which simulates a single flower.

**pyrene:** the endocarp and enclosed seed of a drupaceous fruit.

**ramiflorous:** *of flowers and fruits*, borne below the current leaves on recently formed woody branches.

**sclereid:** a cell (usually elongated) with a strongly lignified wall.

**semicraspedodromus:** pinnate venation in which the secondary veins branch just inside the margin, one of the branches terminating at the margin, the other joining the superadjacent secondary vein.

**stone cell:** a ±isodiametric sclereid.

**synapomorphic:** the common possession by two taxa of a derived, homologous character.

**tannin:** a complex, aromatic compound occurring in the bark of many shrubs and trees.

**tanniniferous:** producing tannins.

**trapeziform:** having four straight unequal sides.

**tripartite:** divided into three parts.

**wallum:** coastal vegetation on sandy acidic soils, in south-eastern Qld.

# 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) and G.D.R.Bridson & E.R.Smith, *Botanico-Periodicum-Huntianum/Supplementum* (Hunt Institute for Botanical Documentation, Pittsburgh, 1991).

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 as used in statements of distribution and citation of collections are:

| | |
|---|---|
| A.C.T. | Australian Capital Territory |
| N.S.W. | New South Wales |
| N.T. | Northern Territory |
| 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) |
| *auct. non* | *auctorum non* (of authors [but] not....), used for misapplied names |
| c. | *circa* (about) |
| Ck/Cks | Creek/Creeks |
| cm | centimetre |
| col. | colour |
| coll. | collector |
| colln | collection |
| *comb.* | *combinatio*/combination |
| *cons.* | *conservandus* |
| cult. | cultivated |
| cv. | cultivar |
| d.b.h. | diameter at breast height |
| Dept | Department |
| diam. | diameter |
| E | east |
| ed. | editor |
| edn | edition |
| eds | editors |
| *e.g.* | *exempli gratia* (for example) |
| *et al.* | *et alii*/*et aliorum*; and others/and of others |
| f. | *forma/*form |
| fam. | *familia/*family |
| fig./figs | figure/figures (in other works) |
| Fig. | Figure (referring to a Figure in this volume of the *Flora*) |
| gen. | *genus/*genus |
| *gen. nov.* | *genus novus* (new genus) |
| Gt | Great |
| holo | holotype |
| *hort.* | *hortus* (garden)/*hortensis* (of a garden) |
| HS | Homestead |
| Hwy | Highway |
| *i.e.* | *id est* (that is) |
| *ined.* | *ineditus* (unpublished) |
| *in litt.* | *in litteris* (in correspondence) |
| Is. | Island/s |
| iso | isotype |
| isolecto | isolectotype |
| km | kilometre |
| L. | Lake |
| 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/Mts | Mount/Mounts |

| | |
|---|---|
| Mtn/Mtns | Mountain/Mountains |
| N | north |
| *n* | haploid chromosome number |
| *2n* | diploid chromosome number |
| Natl | National |
| NE | north-east (ern) |
| *nom. cons.* | *nomen conservandum* (conserved name) |
| *nom. cons. prop.* | *nomen conservandum propositus* (proposed conserved name) |
| *nom. illeg.* | *nomen illegitimum* (illegitimate name) |
| *nom. inval.* | *nomen invalidum* (name not validly published) |
| *nom. nov.* | *nomina nova* (new name) |
| *nom. nud.* | *nomen nudum* (name published without a description or reference to a published description) |
| *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) |
| NW | north-west (ern) |
| *op. cit.* | *opere citato* (in the work cited above) |
| orth. | orthography, orthographic |
| *p./pp.* | page/pages |
| penin. | peninsula |
| pers. comm. | by personal communication |
| pl./pls | plate/plates |
| P.O. | Post Office |
| *p.p.* | *pro parte* (in part) |
| *p.p. max* | *pro parte maxima*, the larger part |
| *p.p. min* | *pro parte minore*, the smaller part |
| *q.v.* | *quod vide* (which see) |
| R. | River |
| Ra. | Range |
| Rd | Road |
| rly | railway |
| S | south |
| SE | south-east (ern) |
| 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) |
| *sp. aff.* | *species affinis* (species related to) |
| *sp. nov.* | *species nova* (new species) |
| *s. str.* | *sensu stricto* (in a narrow sense) |
| St | Street |
| *stat.* | *status*/status |
| Stn | (pastoral) Station |
| subg. | subgenus |
| subsp./subspp. | subspecies (singular/plural) |
| *subsp. nov.* | *subspecies nova* (new subspecies) |
| suppl. | supplement |

| | |
|---|---|
| SW | south-west (ern) |
| 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 |
| *viz.* | *videlicet* (namely) |
| UV | ultraviolet |
| W | west |
| *x* | basic chromosome number |

**Symbols**

| | |
|---|---|
| D | taxon included in key but not treated further in text |
| * | naturalised taxon, not originally native |
| [ ] | 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 |
| ± | *in lichen chemistry*, with or without |
| µm | micrometre |
| ♀ | female |
| ♂ | male |

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| Volume 3 | 24 April 1989 |
| Volume 4 | 12 November 1984 |
| Volume 8 | 9 December 1982 |
| Volume 18 | 8 June 1990 |
| Volume 19 | 27 June 1988 |
| Volume 22 | 17 May 1984 |
| Volume 25 | 25 December 1985 |
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| Volume 35 | 6 August 1992 |
| Volume 45 | 15 May 1987 |
| Volume 46 | 2 May 1986 |
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| Volume 54 | 4 September 1992 |
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ISBN 0-643-05692-0
9 780643 056923

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