



TELOPEA

ROYAL BOTANIC GARDENS, SYDNEY

Contributions from the National Herbarium of New South Wales

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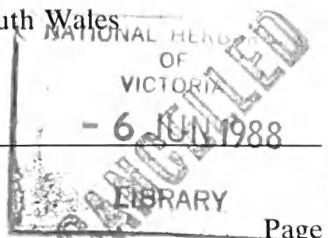
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TELOPEA

Contributions from the National Herbarium of New South Wales

ROYAL BOTANIC GARDENS, SYDNEY



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OF

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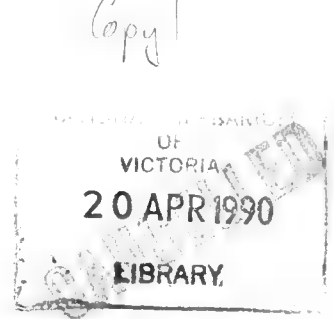
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Taxonomic studies in *Stipa* (Poaceae) in Australia

J.W. Vickery†, S.W.L. Jacobs and J. Everett

Abstract

Vickery, J.W., Jacobs, S.W.L. and Everett, J. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1986. *Taxonomic studies in Stipa (Poaceae) in Australia. Telopea* 3(1): 1–132.—In a revision of *Stipa* in Australia sixty-one native species with five subspecies, and five introduced species are recognized and described. *Stipa nullarborensis*, *S. lanata*, *S. wakoolica*, *S. centralis*, *S. dongicola*, *S. feretacea*, *S. velutina*, *S. aquarii*, *S. pilata*, *S. blakei* and *S. echinata* are described as new with a new combination made for *S. scabra* subsp. *falcata*.

Introduction

Bentham (1878) made the first attempt to revise the Australian species of *Stipa*, treating some 15 species. Hughes (1921) revised the Australian species from specimens held at Kew, increasing the number of species to 40. The following year she published the results of her examination of material held in the U.S. National Herbarium, clarifying some nomenclatural problems and describing two further species.

Since 1922 most studies have been on a regional basis or occasional taxa published in isolation, the best example of these being Townrow's (1978) recent study of Tasmanian *Stipa*. As a result of these and other publications, and the introduction of some species from other countries, the number of Australian species described had risen to 50 before the commencement of the present study by the late Dr Joyce Vickery. Vickery (1980) published four species, and Everett and Jacobs (1983) three species to date as part of this study. This treatment describes a further 11 species and reduces two others to subspecies, recognizing 66 species and five subspecies.

Although we are satisfied that the Australian species are congeneric with *Stipa*, there are, as yet, no adequate studies examining the relationships within *Stipa* on a worldwide basis. One of us (JE) is undertaking such a study, but progress to date is insufficient for any comments on relationships.

Organisation of the Text

The species are arranged alphabetically. The systematic relationships of the Australian species and their affinities with non-Australian species still require further study. Our present thoughts on the relationships of the Australian species are presented in the 'natural' Key 1, which suffers from being a one-dimensional presentation. Although the composition of the groups is useful information, the arrangement within the groups and the arrangement of the groups is not necessarily significant. At present we include some species in two groups.

†Died 29 May 1979

Key 2 is in a tabular format and is more or less equivalent to a 'multiple-access' key.

The descriptions are mostly organized conventionally and where there are two or more alternative states (e.g. glabrous or hairy) the more common state is mentioned first.

An index to the major place of mention of extant names, synonyms, uncertain and excluded taxa follows the descriptions.

The list of specimens cited represents only a selection of specimens examined, especially for the more widespread species. A further list is available from the Library, Royal Botanic Gardens, Sydney, 2000. Even this additional list, however, does not include all the specimens examined. Standard abbreviations are used for the herbaria with the addition of ACB (Herbarium of A.C. Beauglehole), JEST (Herbarium of J.E.S. Townrow) and Corrick herb. (Herbarium of M.J. Corrick).

Evaluation of Characters

Life cycle: all Australian species of *Stipa* are facultative perennials. Minute plants producing one spikelet can be found during extremely dry seasons.

Rootstock and shoots: most species are caespitose, but some are wiry and scrambling in habit; others have thickened culms, produce numerous branches at the nodes and are reminiscent of small bamboos. In Australia there are rhizomatous species but no truly stoloniferous species.

New culms may be either intravaginal or extravaginal. The distinction is not always consistent within a species, but the general appearance it gives to the base can be a useful character.

Culm: the culms are basically circular in cross-section. The internodes are hollow. The nodes are frequently swollen and often coloured differently from the internodes. The number of nodes is a useful character in a few cases.

Leaves: the sheaths, blades and ligules of the leaves are variable within the one plant depending on whether the leaf is an innovation-leaf or a culm-leaf, and if a culm-leaf then on its position relative to the inflorescence. Unless otherwise stated all descriptions of these characters are based on the second culm-leaf below the inflorescence, i.e. the leaf directly below the flag.

Sheaths: the sheaths are open and glabrous, scabrous or hairy. Long-hairy sheaths can be a distinguishing character. In some species the sheaths become loose with age. The top of the sheath can merge with the ligule forming a complex structure consisting of both ligule and sheath lobes (\equiv auricles?). Although there is some doubt as to when these lobes can be regarded as auricles, we have used the latter term throughout.

Ligule: the ligule and auricles are useful characters. The combined structure is frequently asymmetric. The auricles may be thickened or have a thickened base with membranous margins and, when present, the membranous margins are often continuous with the ligule. The ligule is membranous but may be reduced to a thickened ridge.

Blades: the blades may be flat, rolled or folded. Most species have linear leaves but some species have leaves that are only about 5 times as long as broad, although the shape is influenced greatly by environmental factors. *S. stipoides*,

S. echinata and *S. pilata* have pungent-pointed leaves. Some species have more or less rigid leaves but most leaves are more or less lax.

Townrow (1978) emphasized the adaxial leaf surface ornamentation ('ALSO' sensu Townrow) as a diagnostic character in her work on Tasmanian species of *Stipa*. This approach appears to be worth developing but requires refining to make it useful on an Australia-wide basis. In particular it will be important to distinguish the macrohairs and siliceous outgrowths, which are known to vary with habitat, from the significant epidermal features. In Tasmania this distinction would possibly be of little consequence but it is significant when the whole area of Australia is considered. The ornamentation characters seem also to have been partly responsible for some differences between our taxonomic conclusions and those of Townrow.

We have not yet critically examined leaf anatomy or epidermal features for the genus. Such a study would be useful for examining the subgeneric relationships within Australia and the relationships of Australian *Stipa* to those in the rest of the world.

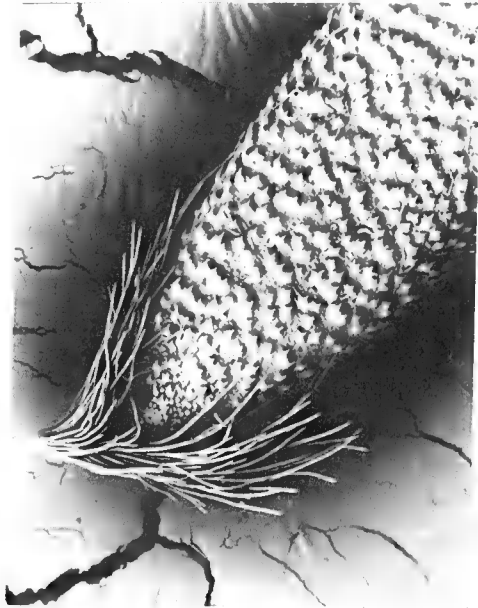
Inflorescence: the inflorescence is basically a panicle, in the sense of being open and much branched. Some species, e.g. *S. muelleri*, have inflorescences reduced to 1 or few spikelets whereas others, e.g. *S. verticillata*, have large, much-branched inflorescences. Most species fall between these two extremes but the extreme inflorescence types are useful diagnostic characters, as to a lesser extent is the size of the inflorescence.

The inflorescences appear to be terminal but it is not uncommon to find a second inflorescence produced from either the first or second node immediately below the terminal inflorescence. This inflorescence is produced intravaginally and in most cases is not easy to distinguish from the terminal inflorescence. The occurrence of a 'second inflorescence' appears to be more common during periods of stress and does not appear to be of much value as a taxonomic character.

Spikelets: the spikelets are 1-flowered and in none of the specimens we examined was there any evidence of a rachilla extension. (One specimen of *S. bigeniculata* (NSW 117419) has 2-flowered spikelets.) The spikelets can appear laterally flattened due to the often-keeled glumes, even though the floret is virtually cylindrical.

Glumes: the glumes are unequal or subequal. The number of nerves varies from 1 to 7 and, within certain limits, can be useful as a diagnostic character. Glume length is a very useful key character. The glume tips are important in affecting the general appearance of the spikelets. In some species the glume tips are quite membranous and easily torn; when examining such species, care is necessary to ensure that undamaged glumes are examined for both appearance and measurements.

The mid-nerve extends from the base to the tip. The lateral nerves usually occur in pairs, with one of each pair on either side of the midrib. The lateral nerves continue for varying distances along the glume from the base and this distance can be a distinguishing character. We have expressed this as the percentage of the glume length with a particular number of nerves, e.g. 'the lower 50% 5-nerved, the next 25% 3-nerved', means that the two outermost nerves extend halfway, the next pair extending to three quarters the length of the glume, the midvein continuing to the tip.



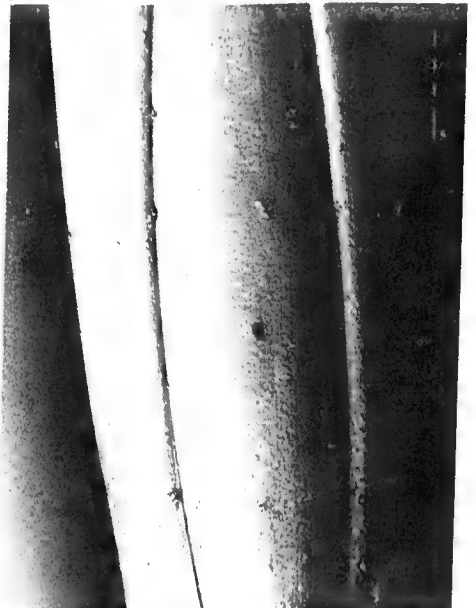
a.



b.



c.



d.

Fig. 1 a. *S. ramosissima* showing the short, blunt callus and the lemma surface covered with short tubercles. Approx. $\times 35$. b. The callus of *S. oligostachya* showing the drawn-out tip, the vascular strand for the floret and the antrorse hairs. Lower marker bar 100 μm , approx. $\times 90$. c. The long callus of *S. aphylla* showing the base of the lemma, the strong, antrorse hairs and the glabrous, pungent tip. Lower marker bar = 100 μm , approx. $\times 35$. d. The exposed smooth palea, and the smooth lemma, with the margins not meeting, of *S. lanata*. Lower marker bar = 100 μm , approx. $\times 35$.

Floret: the floret (diaspore) includes the callus, lemma, palea and awn. In *Stipa* the term 'lemma' is frequently used instead of 'floret'. This usage is not uncommon in grass terminology but it is necessary to remember, perhaps more so in *Stipa*, that the callus, in particular, consists mainly of rhachilla tissue. Most measurements of 'lemmas' in descriptions by other authors refer to floret length but usually exclude the awn.

Callus: the callus is a prominent feature of the *Stipa* floret. It is mainly rhachilla but externally grades imperceptibly into the base of the lemma. The callus has an oblique disarticulation zone (Fig. 1a, b, c) which results in a pungent point at the base of the floret. In some species the callus is comparatively short, less obliquely attached, and consequently less pungent (Fig. 1a).

The hairs on the callus are antrorse, fairly stiff and usually dense. It is these hairs that seem to prevent the callus from being readily dislodged from soil, wool, skin, clothes, etc., allowing the diaspore to work its way gradually downwards or inwards. Usually there is a clear distinction between the callus hairs and the lemma hairs but, as the callus hairs are antrorse, this demarcation appears above the callus/lemma junction.

Lemma: lemma size, shape, vestiture, surface and awn features are the more important diagnostic characters. The apex of the lemma may be extended into two or, more rarely, one membranous lobe(s) above the insertion of the awn (Fig. 2a, b, c).

The lemma surface varies from quite smooth to having at least some areas almost crystalline or granular in appearance (e.g. *S. rudis* complex). Hairs may be almost absent (e.g. *S. lanata* (Fig. 1d)) to quite uniformly dense (e.g. *S. petraea*). The hairs may be distributed in a consistent pattern (e.g. *S. eremophila*, *S. rudis* group) (Fig. 3). Frequently longer hairs are produced near the apex of the lemma in two lateral tufts or in a more or less complete ring around the base of the awn. The 'ring' of hairs is known as a coma (Fig. 4a, b, 6a) and its presence, length, and completeness are very useful characters. In four of the five introduced species there is a membranous cup-like growth produced in this same position (Fig. 4c, 6c). This growth is known as a corona and, while it is common in non-Australian species of *Stipa*, it does not occur in any Australian native species.

Awn: the awn is a prominent feature of *Stipa* diaspores. Even though there is an apparent disarticulation zone at the lemma/column junction, the awn is usually persistent. However, diaspores found embedded in soil or animal skins, etc., usually do not have the awn still attached and the break is at the disarticulation zone.

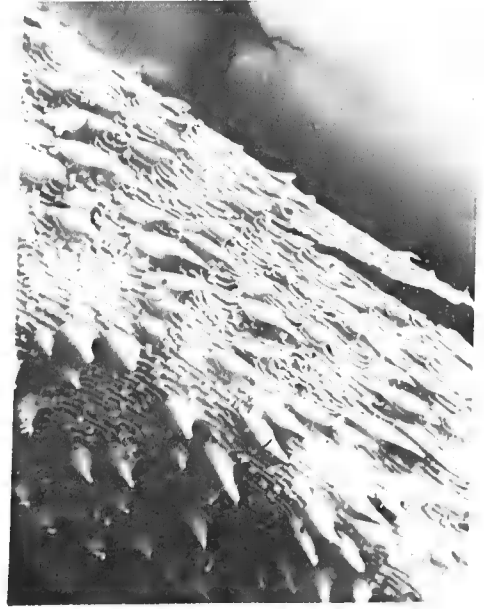
The awn is divided into the column and bristle. The column is the basal portion, which usually twists on drying or at maturity, and may be once or twice bent. By convention the column is defined as extending to either the second bend or to the top of the closely twisted portion if only one bend is present (Fig. 6a, b).

The column length and width are useful characters as are the length and pattern of hairs. The hairs range from quite long (villous or plumose, Fig. 5a) to short (scabrous, Fig. 5b), and from being present only on one side (appearing to spiral as the column twists, Fig. 5a, 6d) to present all around (Fig. 5c).

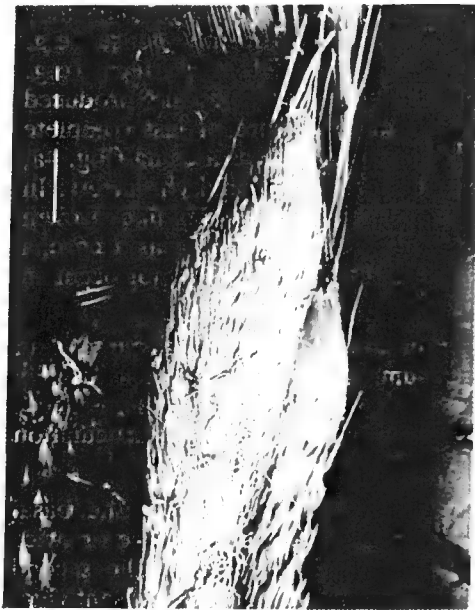
The bristle has a characteristic sickle-shape (Fig. 6b) in the group informally known as the Falcateae (approximately equivalent to the Falcateae of Hughes,



a.



b.



c.

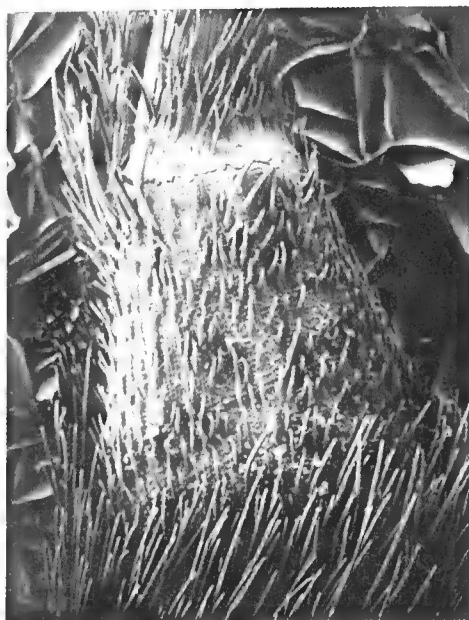


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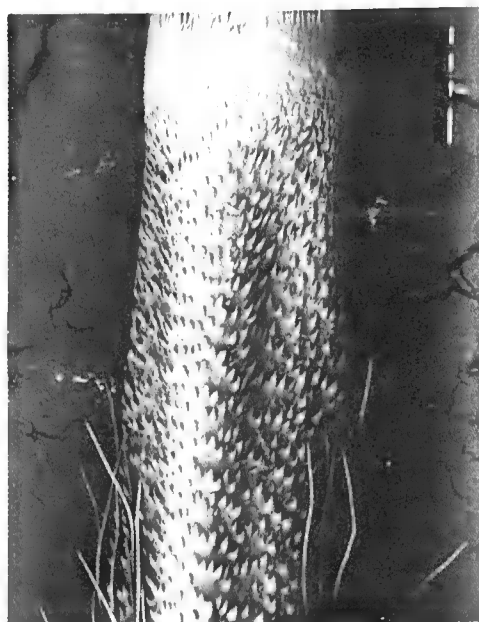
Fig. 2 a. The two long, hairy lobes at the apex of the lemma of *S. stipoides*. Lower marker bar = 100 μ m, approx. $\times 20$. b. The minute lemma lobe of *S. tuckeri*. Approx. $\times 80$. c. The lemma lobe of *S. oligostachya*. Lower marker bar = 100 μ m, approx. $\times 65$. d. The penicillate anthers of *S. petraea*. Lower marker bar = 100 μ m, approx. $\times 60$.



a.



b.



c.



d.

Fig. 3 a. The lemma of *S. nullanulla* showing the neck region with very few hairs, the line of hairs down the lemma margins, and a coma. Approx. $\times 40$. **b.** The neck area of the lemma of *S. eremophila* showing the well-defined patch of short hairs. Approx. $\times 25$. **c.** The neck area of the lemma of *S. pubescens* with a large area covered with short antrorse tubercles. Lower marker bar = 100 μm , approx. $\times 30$. **d.** The neck area of *S. puberula* with an ill-defined zone of shorter hairs, longer hairs below, and a short lobe at the apex. Approx. $\times 180$.

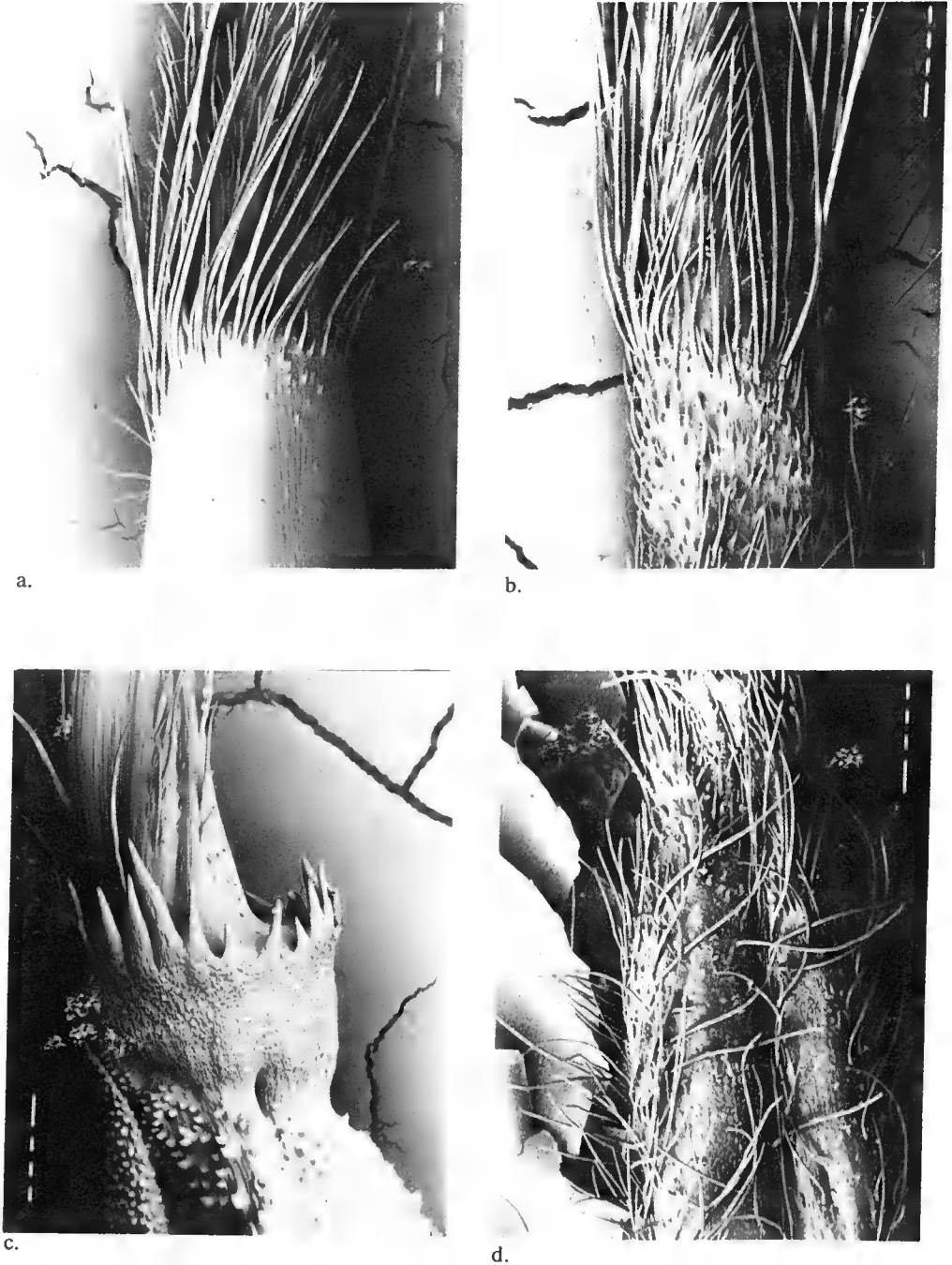
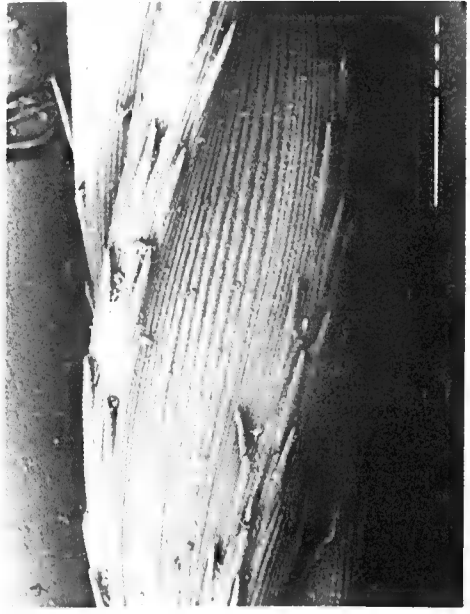


Fig. 4 a. The coma of *S. lanata*. Lower marker bar = 100 μ , approx. $\times 30$. **b.** The coma, column base, and neck of *S. metatoris*. Lower marker bar = 100 μ , approx. $\times 30$. **c.** The corona at the apex of the lemma of *S. neesiana*. Upper marker bar = 100 μ , approx. $\times 30$. **d.** The lemma of *S. setacea* showing the adaxial groove on the floret formed by the inrolled margins of the lemma exposing a small section of the palea (not visible in this print). Lower marker bar = 100 μ , approx. $\times 30$.



a.



b.

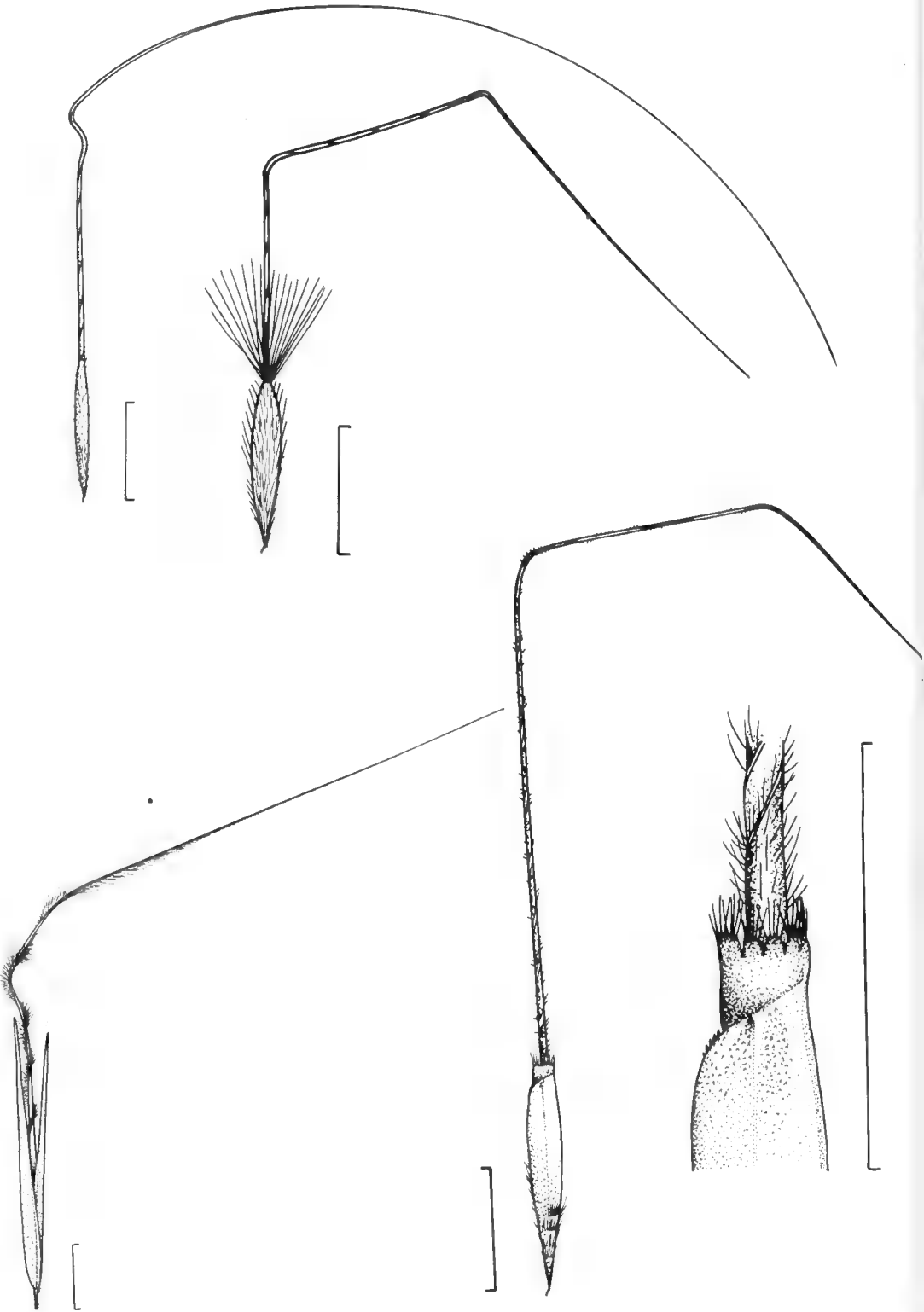


c.



d.

Fig. 5 a. The column hairs of *S. hemipogon* with the long hairs arising on one side of the column. Approx. $\times 90$. **b.** The column of *S. macalpinei* with very short hairs in lines up the column. Lower marker bar = $100\ \mu\text{m}$, approx. $\times 90$. **c.** The column of *S. densiflora* with long hairs all around the circumference. Lower marker bar = $100\ \mu\text{m}$, approx. $\times 30$. **d.** The bristle of *S. plumigera* with the hairs arising in two bands over the fibres, and a row of stomates over the chlorenchyma. Upper marker bar = $100\ \mu\text{m}$, approx. $\times 60$.



1921) and could perhaps be interpreted as the last twist in the awn. This sickle-shape is more difficult to detect in pressed specimens than in the fresh state. In other species the bristle is more or less straight. Although mostly triangular in transection, the bristle may be laterally flattened; *S. platychaeta* is the extreme example here.

The hairs on the bristle are usually similar to, but shorter than, those of the column, the notable exception in Australia being the long hairs on the bristle of *S. plumigera* (Fig. 5d).

The anatomy of the awn is different from that in most other grasses (Duval-Jouve 1871; Zimmerman 1881; Murbach 1900) and, although there have been attempts to explain the twisting and untwisting motion, more work could be usefully done on the subject. The awn in transection consists mainly of thickened cells (fibres) with two lateral pockets of chlorenchyma. The chlorenchyma breaks down with age and, apparently, the awn does not twist until this breaking-down process has been initiated.

Palea: the palea varies from about one quarter the length of the lemma to being subequal. Although the relative length of the palea is a useful diagnostic character it is awkward to observe.

Cleistogamy: spikelets are either chasmogamous or cleistogamous. In the Australian species there are no externally visible differences between the two, but the cleistogamous spikelets usually have shorter stamens. Both types may be found scattered throughout a panicle and the relative proportion of each may vary quite considerably within a particular taxon, presumably indicating a strong environmental influence on the expression of either state. The expression of cleistogamy or chasmogamy is clearly a subject worthy of further study on a population basis.

Stamens: there are three stamens per floret and the main character of use is whether the stamens are penicillate or not (Fig. 2d).

Lodicules: lodicule number is usually quoted as three in the literature and this is true for most species, the major exception being those of the Falcateae which mostly have two lodicules. When the third (the adaxial or paleal) is present its size may vary, from minute to almost equalling the palea, between spikelets in the same panicle. Normally it is either less well developed than, or similar to, the two abaxial lodicules. All are membranous, glabrous and entire; their shapes vary from lanceolate to spatulate or almost long-cuneate.

Ovary: the only ovary characters recorded are those of the caryopsis and, where possible, include the length of the mature caryopsis and the relative length of both the hilum and the embryo.

Fig. 6 (Reproduced from Wheeler, Jacobs & Norton (1982), Grasses of New South Wales, with permission of University of New England Press). a. The floret of *S. blackii* showing the long coma and a bigeniculate awn. b. The floret of *S. nodosa* showing the hairy lemma and falcate awn typical of the group 'Falcateae'. c. The floret and lemma apex of *S. neesiana* showing the corona and bigeniculate awn. d. A spikelet of *S. mollis* showing the long glumes and the awn with hairs along one side. Bar = 5 mm.

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Excluded species and names yet to be typified

Stipa appendiculata Mez, Feddes Repert. Spec. Nov. Regni Veg. 19: 204 (1921). HOLOTYPE cited as 'Australien, ohne Angabe des Standorts und Sammlers (herb. Berl.)'. The specimen is not extant at B (nor in the Willdenow herbarium) and without evidence of either locality or collector we have not been able to trace this name.

Stipa dielsii Mez, Feddes Repert. Spec. Nov. Regni Veg. 17: 209 (1921). HOLOTYPE cited as 'Western Australia: Oldfield (Diels)'. The holotype was in B and is not extant there nor in the Willdenow herbarium. We have been unable as yet to find any specimen that could reasonably be regarded as a duplicate of the Type. The description is inadequate to determine the species being described, but could apply to *S. flavescens*.

Stipa micrantha Cav., Icon. 5: 42, fig. 467 (1799). HOLOTYPE: 'Habitat in Nova-Hollandia' (MA, not seen).

= *Dichelachne micrantha* (Cav.) Domin; see Veldkamp, Blumea 22: 9 (1974).

Stipa pubescens var. *tenuior* Reader, Victorian Naturalist 17: 156 (1901). HOLOTYPE cited as 'November, 1898. Desert, Lowan'. There are several specimens in MEL with this general locality information but none bears this name and we could find no other specimen in MEL bearing this name. The specimens belong to several different species of *Stipa* and the description is too inadequate to give any clues.

Stipa striata Link, Hort. Berol. 1: 98 (1827). HOLOTYPE cited as 'Hab. in Australia?'. The Type was in B and is not extant there nor in the Willdenow herbarium. The lack of collector information, reliable locality and adequate description makes this taxon indeterminable.

Stipa L., Sp. Pl.: 78 (1753)

Caespitose or spreading, often rhizomatous perennials (rarely annuals). Leaves and branches either basal or cauline. Spikelets all alike, 1-flowered with the rhachilla not produced beyond the floret, hermaphrodite. Glumes persistent, hyaline to chartaceous, narrow, more or less keeled, to several cm long, usually acute or acuminate, less commonly muticous or mucronate, 1-5 (-7)-nerved, equal or unequal, usually longer than the floret (excluding awn). Floret articulate above the glumes, many times longer than broad, cylindrical, fusiform, pyriform or turbinate, rarely slightly gibbous, with a long, oblique, bearded, usually pungent-pointed (or rarely short and obtuse) callus. Lemma coriaceous, indurated, with convolute or involute margins usually enclosing the palea and flower, 3-5 (-7)-nerved, tapering at the tip and often, though only minutely, 1- or 2-lobed, awned from the tip or between the lobes. Awn flexuose or once or twice geniculate, with a twisted column (when mature) and a straight or curved bristle, variously glabrous to plumose. Palea membranous, hyaline or somewhat indurated, 2-nerved or nerveless, subequal to or shorter than the lemma. Lodicules 3 or 2, membranous, glabrous, lanceolate to spatulate, non-vascular. Stamens 3, frequently penicillate. Ovary glabrous; styles 2, free; stigmas plumose, tips exerted. Caryopsis fusiform-terete, tightly enclosed by the lemma and palea; the embryo about 20-35% the length of the grain; the hilum linear, nearly as long as the grain.

A large genus with probably over 300 species, mostly in temperate regions.

Type species: *Stipa pennata* L. HOLOTYPE: 'In Austria, Gallia' (LINN, 94.1!; possible duplicate S).

The genus contains many species that are useful fodder grasses, not so much for their intrinsic nutritive value as because they provide reasonably palatable fodder in arid regions.

Stipa tenacissima, 'Esparto Grass', of southern Europe has a strong fibre that is an important raw material for the manufacture of paper.

The diaspores are often troublesome on account of their pungent callus and twisted awn (which is hygroscopic and helps the diaspore act like a corkscrew), and may penetrate the hides, eyes and mouth-parts of livestock, causing considerable discomfort to the animals and reducing the value of their meat.

Some species are of decorative value.

Australian species of *Stipa* grow in virtually all non-aquatic habitats in the winter-dominated rainfall zones with a few species growing in higher altitude or arid areas of the summer-dominated rainfall zones. The genus is absent from monsoonal areas.

Key 1

1. Summit of the lemma forming a cylindrical corona 0.5-2.5 mm long around the base of the awn Group A
- 1*. Summit of the lemma without a corona 2
2. Panicle pyramidal when mature and spreading, with whorled branches, the branches and pedicels plumose with fine hairs mostly 0.5 mm long or longer Group C
- 2*. Panicle linear-cylindrical to ovate-cylindrical, the branches and pedicels glabrous, scabrous or pubescent with most hairs less than 0.3 mm long 3

3. Culms branched Group D
- 3*. Culms not branched 4
4. Panicle reduced to 1–3 spikelets. Culms spreading and decumbent; leaf blades rudimentary (1 mm long) or deciduous Group K (*S. muelleri*)
- 4*. Panicle with more than 8 spikelets. Culms erect or geniculate at the base; leaf blades longer than 20 mm (deciduous in *S. aphylla*) 5
5. Lemma with acute, hairy lobes 1.5–3 mm long at the apex Group G
- 5*. Lemma with lobes absent or less than 0.8 mm long 6
6. Awn falcate, the bristle curved Group L
- 6*. Awn bigeniculate or almost straight, the bristle straight 7
7. Lemma with a coma of hairs at the apex 18
- 7*. Coma absent 8
8. Column of the awn scabrous or puberulous with hairs less than 0.3 mm long 12
- 8*. Column of the awn pubescent to plumose with hairs more than 0.3 mm long 9
9. Lemma glabrous except on the nerves, surface crystalline-tuberculate Group H (*S. oligostachya*)
- 9*. Lemma pubescent overall, surface smooth or granular 10
10. Foliage densely and shortly velvety overall, appearing bluish Group I (*S. velutina*)
- 10*. Foliage glabrous, scabrous or pubescent 11
11. Panicle not exerted above the basal leaves, sparse with less than 30 spikelets Group I (*S. centralis*)
- 11*. Panicle exerted well above the basal leaves, with more than 30 spikelets Group J
12. Ligule less than 3 mm long 15
- 12*. Ligule more than 3 mm long 13
13. Awn less than 45 mm long. Leaf sheaths and blades usually very narrow Group H (*S. setacea*)
- 13*. Awn 60–200 mm long. Leaf sheaths broad or narrow, blades moderately broad 14
14. Bristle of the awn flattened, wider at its base than the column, curved. Lemma brown, 6 mm long or less (excluding awn) Group D (*S. platychaeta*)
- 14*. Bristle of the awn terete to triangular in transection, narrower at the base than the column, straight. Lemma white, 6.5 mm long or more (excluding awn) Group F
15. Lemma glabrous for varying lengths below the apex, surface often tuberculate, especially at apex. Nerves of the glumes heavily overlaid with sclerenchyma forming strong ridges Group K
- 15*. Lemma pubescent overall, hairs occasionally sparser at the apex, surface smooth or granular. Glume nerves visible but not raised noticeably above the glume surface 16
16. Foliage densely and shortly velvety overall, appearing bluish Group I (*S. velutina*)
- 16*. Foliage glabrous, scabrous or pubescent 17
17. Panicle not exerted above the basal leaves, sparse with less than 30 spikelets Group I (*S. centralis*)
- 17*. Panicle exerted well above the basal leaves, with more than 30 spikelets Group D
18. Lemma glabrous or almost so, surface smooth and shining Group E
- 18*. Lemma pubescent, surface granular 19

19. Awn 12–18 mm long; floret narrowly cylindrical tapering to form a neck at the apex. Glumes broadly acute Group B (*S. caudata*)
- 19*. Awn 20 mm long or more; if awn as short as 20–25 mm then floret broadly turbinate to oblong-cylindrical with no neck, or glumes linear and truncate 20
20. Glumes acuminate, very broad and inflated around the floret, sharply narrowing at the tip. Floret broadly turbinate to oblong-cylindrical; callus sturdy and strongly curved or hooked, relatively short (usually 10–30% the length of the floret); awn relatively short (usually 4.5–6.5 (–8) times the length of the floret). Panicle expanded, usually with long branches Group H
- 20*. Glumes acute or narrowly acuminate, not inflated around the floret, tapering gradually to the tip. Floret linear-cylindrical to narrowly turbinate; callus fine or sturdy, straight, only the proximal naked tip bent, relatively long (usually 25–40% the length of the floret); awn often relatively long (usually (5–) 6–13 times the length of the floret). Panicle contracted or expanded, usually with short branches Group I

Group A: Lemma with a corona. Palea less than half the lemma length. Introduced from South America.

1. Floret about 4 mm long, awn 35–40 mm long, column minutely scabrous with hairs less than 0.05 mm long *S. hyalina**
- 1*. Floret 5.5–10 mm long, awn 45–85 mm long, column scabrous or pubescent with hairs usually more than 0.2 mm long 2
2. Corona 1.5–2.5 mm long with a firm basal part 0.5–1 mm long, upper part ciliate with thick hairs 1–1.5 mm long *S. leucotricha**
- 2*. Corona 0.5–1.5 mm long, with a firm basal part 0.5–1 mm long, upper part of spines 0.1–0.5 mm long 3
3. Lower glume 8–10 mm long. Floret 5.5–6 mm long, coronal spines about 0.1 mm long *S. megapotamia**
- 3*. Lower glume 14–18 mm long. Floret 6–10 mm long, coronal spines about 0.5 mm long *S. neesiana**

Group B: Cleistogenes present in the basal sheaths. Introduced from South America.

- Onespecies *S. caudata**

Group C: Panicle pyramidal with whorled branches. Palea less than half the lemma length.

1. Branches of the panicle plumose with hairs 1.5–2 mm long. Culms glabrous. Glumes pilose on the nerves, scabrous between the nerves *S. elegantissima*
- 1*. Branches of the panicle plumose with hairs about 0.5 mm long. Culms pubescent around the nodes. Glumes scabrous overall *S. tuckeri*

Group D: Culms usually branched. Leaves with long ligules. Panicle large, sparse and spreading.

1. Callus 0.5 mm long or less, blunt. Palea 60% the length of the lemma or less 4
- 1*. Callus 0.5 mm long or more, sharp. Palea more than 60% the length of the lemma 2
2. Lower glume 4–5.5 mm long. Floret 3–4 mm long *S. nullarborensis*
- 2*. Lower glume 6–15 mm long. Floret 4.5–6.5 mm long 3
3. Bristle quite flattened, distinctly wider at its base than the column, strongly curved.
Column scabrous *S. platychaeta*
- 3*. Bristle round-triangular in transection, as wide as or narrower at the base than the
column, straight. Column pubescent *S. acrociliata*
4. Culms sturdy, simply branched at the nodes. Lower glume more than 5 mm long *S. breviglumis*
- 4*. Culms cane-like with whorled branches at the nodes. Lower glume 5 mm long or less 5
5. Lemma glabrous, 1.8–2.5 mm long *S. ramosissima*
- 5*. Lemma scattered with short white hairs, 2.7–4 mm long *S. verticillata*

Group E: Lemma glabrous or almost so, the surface shining.

1. Lower glumes 19–26 mm long. Ligule 0.4–1.5 mm long *S. lanata*
- 1*. Lower glumes less than 18 mm long. At least some ligules more than 2 mm long 2
2. Lower glume 14–18 mm long. Awn (8–) 9–12.5 cm long *S. vickeryana*
- 2*. Lower glume 9–11 mm long. Awn 5–7 cm long *S. nullanulla*

Group F: Apparently annuals with very broad leaves. Lemma white with a long, almost straight awn.

1. Leaf sheaths covered with transparent, flattened and flexuose hairs although these
sometimes visible only on lower sheaths *S. macalpinei*
- 1*. Leaf sheaths glabrous or minutely scaberulous *S. compressa*

Group G: Lemma with long, acute lobes at the apex.

1. Panicle reduced to 1–3 spikelets. Culms spreading and decumbent *S. muelleri*
- 1*. Panicle with more than 8 spikelets. Culms caespitose and erect 2
2. Ligule 0.1–1 mm long, truncate. Mature lemma with fulvous hairs *S. petraea*
- 2*. Ligule 2.5–10 mm long, obtuse. Mature lemma with white to slightly yellow hairs 3
3. Lower glume 10–12 mm long. Floret 6.5–8 mm long; awn long with respect to floret,
3–6 mm long. Panicle usually slightly expanded, 3.5–8.5 cm wide (excluding awns),
sparse and open with longest branches 8–10 cm long *S. juncifolia*
- 3*. Lower glume (12–) 14–20 mm long. Floret 8–13 mm long; awn very short with
respect to floret length, 2–4 mm long. Panicle contracted, 1–3.5 cm wide (excluding
awns), condensed with longest branches up to 5 cm long *S. stipoides*

Group H: Glumes very broad and inflated around the floret. Lemma with a coma and a short, strongly hooked callus. Panicle expanded with long branches.

1. Lemma glabrous except on the nerves, surface crystalline-tuberculate *S. oligostachya*
- 1*. Lemma with hairs overall, surface granular 2
2. Ligule 2–8 mm long, usually more than 3.5 mm long. Palea with a deep adaxial central groove 8
- 2*. Ligule 2 mm long or less. Palea convex on the adaxial surface or only very slightly depressed between the nerves 3
3. Coma 2–3 (–5) mm long. Foliage of the lower leaves pubescent or hirsute *S. blackii*
- 3*. Coma 2 mm long or less; if 2 mm then foliage of the lower leaves scabrous or glabrous, not noticeably pubescent 4
4. Column of the awn long-pubescent with most hairs 0.5–1.5 mm long; awn 30–40 mm long. Nullarbor Plain *S. dongicola*
- 4*. Column of the awn scabrous or pubescent with hairs less than 0.5 mm long; if pubescent then awn more than 45 mm long 5
5. Column of the awn pubescent with spreading hairs 0.25–0.5 mm long. Coma 0.5–1 mm long. Auricles with tufts of hairs 1 mm long *S. curticoma*
- 5*. Column of the awn scabrous with hairs less than 0.2 mm long. Coma 0.4–2 mm long; if less than 1.3 mm long then auricles glabrous 6
6. Mature floret fusiform; callus 0.4–1 (–1.5) mm long, very short with respect to the floret ((5.8–) 6.5–8 mm long). Ligule 0.8–1.5 mm long *S. aristiglumis*
- 6*. Mature floret oblong-cylindrical; callus 1–2.5 mm long, long with respect to the floret (4.5–8.5 (–9.5) mm long). Ligule 0.3–0.5 mm long (not including auricles) 7
7. Coma 0.8–1.3 mm long. Floret 4.5–6 mm long (excluding awn), gibbous with an eccentric awn; awn 25–35 (–50) mm long *S. gibbosa*
- 7*. Coma (1.2–) 1.4–2 mm long. Floret 6–8.5 (–9.5) mm long (excluding awn); awn centric, 30–60 mm long *S. bigeniculata*
8. Floret 3–4.5 mm long, awn 12–18 mm long *S. feresetacea*
- 8*. Floret 5.5–7 mm long, awn 25–40 mm long *S. setacea*

Group I: Glumes narrow, close around the floret. Lemma with a coma and a long, fine and straight callus. Panicle often contracted, with short branches.

1. Floret with a dense and obvious coma 2–3.5 mm long 12
- 1*. Floret with a coma 1.5 mm long or less, often obscure 2
2. Leaves rigidly erect and pungent-pointed. Awn 90–110 mm long, the column 30–35 mm long *S. echinata*
- 2*. Leaves erect or flexuose, acute-tipped but not pungent. Awn 23–90 (–110) mm long, the column usually less than 30 mm long (but longer in *S. eremophila*) 3

3. Entire awn plumose (including the bristle) with hairs 0.5–1 mm long *S. plumigera*
- 3*. Column of the awn scabrous, pubescent or villous, bristle scabrous or shortly pubescent with hairs less than 0.3 mm long 4
4. Hairs on the lemma continued evenly to the apex, white or slightly fulvous at maturity. Floret linear-cylindrical to narrow-turbinate with no neck 6
- 4*. Hairs on the top 1–2 mm of the lemma abruptly shorter by about half than those on the lower part of the lemma, fulvous early in development. Floret broad turbinate to broad oblong-cylindrical with a neck 5
5. Lower glume 8–12 mm long. Column of the awn scabrous with hairs 0.05–0.1 mm long *S. puberula*
- 5*. Lower glume 15–25 mm long. Column of the awn pubescent with hairs 0.2–0.4 mm long *S. eremophila*
6. Foliage bluish, densely and shortly velvety overall *S. velutina*
- 6*. Foliage green, scabrous, pubescent or hirsute, the individual hairs discretely seen 7
7. Panicle not exerted above the basal leaves *S. centralis*
- 7*. Panicle exerted well above the basal leaves 8
8. Lower glume 15–23 mm long. Column of the awn villous with hairs 0.5–1 mm long. Leaf sheaths usually hirsute or pubescent especially near the base. Panicle 20–35 cm long *S. stuposa*
- 8*. Lower glume 17 mm long or less. Column of the awn scabrous, pubescent or villous; if villous then leaf sheaths scabrous or minutely puberulous and panicle up to 12 cm long 9
9. Culms slender, up to 1 mm wide near the base. Panicle 6–18 mm long, sparse. Ligule 0.3–3 mm long, the abaxial surface glabrous or minutely puberulous 11
- 9*. Culms sturdy, (1.5–) 3–4 mm wide near the base. Panicle 15–40 mm long, dense. Ligule 0.3–0.7 mm long, the abaxial surface sericeous 10
10. Lower glume 8.5–10 mm long. Callus 0.5–1.2 mm long. Awn 25–40 mm long *S. multispiculis*
- 10*. Lower glume 9–14 (–16) mm long. Callus 1.6–3 mm long. Awn (35–) 40–65 mm long *S. flavescens*
11. Lower glume 8–10 mm long. Leaves pubescent, fine and flexuose *S. exilis*
- 11*. Lower glume 12–17 mm long. Leaves almost glabrous, sturdy and erect *S. mundula*
12. Column of the awn villous with hairs 0.5–1 mm long *S. stuposa*
- 12*. Column of the awn scabrous or pubescent with hairs 0.3 mm long or less 13
13. Coma spreading, formed from the spreading upper hairs of the lemma overlapping the base of the awn and hiding the awn/lemma junction. Awn 23–38 mm long, the column 7–12 mm long *S. crinita*
- 13*. Coma appressed, formed by hairs at the awn/lemma junction, the junction discernible. Awn 35–65 mm long, the column 15–25 mm long 14
14. Lower glume 11–15 mm long. Lemma 5.5–6.5 mm long *S. wakoocia*
- 14*. Lower glume 16–20 mm long. Lemma 7–8.2 mm long *S. metatoris*

Group J: Column of the awn plumose or long-pubescent. Lemma usually without a coma.

1. Distinct coma 1–3 mm long present at the apex of the lemma in addition to the hairs on the column *S. stuposa*
- 1*. No coma present 2
2. Column hairs 0.3–1 mm long, spreading, evenly distributed around the column and therefore not appearing to spiral 4
- 2*. Column hairs 1–4 mm long, slightly appressed, distributed mainly along the ribs and thereby appearing to spiral with the spiralling column 3
- 3ⁱ. Upper glume 9–10 mm long, floret 3.5–5 mm long. Central Australian Ranges *S. aquarii*
- 3ⁱⁱ. Upper glume 10–15 mm long, floret 5–7 mm long *S. hemipogon*
- 3ⁱⁱⁱ. Upper glume 15–20 mm long, floret 7.5–8.5 mm long *S. mollis*
4. Glumes glabrous except on the nerves. Awn 70–90 mm long. Leaves scabrous or glabrous *S. semibarbata*
- 4*. Glumes pubescent. Awn less than 60 mm long. Leaves hirsute 5
5. Floret 8–9 mm long, awn 50–70 mm long *S. campylachne*
- 5*. Floret 5.5–7 mm long, awn 35–45 mm long *S. densiflora*

Group K: Lemma glabrous for varying lengths below the apex, the surface rough. Glumes strongly ridged.

1. Lemma glabrous except on the nerves, strongly crystalline-tuberculate overall, pale until advanced in maturity *S. oligostachya*
- 1*. Lemma with hairs not restricted to the nerves, tuberculate mainly towards the apex, light brown early in maturity 2
2. Culms spreading and decumbent. Leaf blades 1 mm long or deciduous. Panicle reduced to 1–3 spikelets *S. muelleri*
- 2*. Culms caespitose and erect or geniculate. Leaf blades more than 20 mm long (deciduous in *S. aphylla*). Panicle of more than 8 spikelets 3
3. Spikelets 8–12 per panicle. Column of the awn 55–70 mm long. Subalpine grass *S. nivicola*
- 3*. Spikelets more than 12 per panicle. Column of the awn less than 55 mm long 4
4. Almost all blades deciduous before flowering. Glumes tapering to a fine acuminate or dentate tip *S. aphylla*
- 4*. Blades not deciduous. Glumes truncate, broadly acute or obtuse 5
5. Lower glume 15 mm long or less *S. rudis*
- 5*. Lower glume 17 mm long or more 6
6. Ligule truncate, 0.4–1 mm long. Glumes truncate. Lemma surface strongly tuberculate at the apex. Palea 50–70% the length of the lemma, obtuse *S. pubescens*
- 6*. Ligule obtuse, 1–3 mm long. Glume tips broadly obtuse and membranous. Lemma surface granular. Palea equal in length to the lemma, acute *S. pubinodis*

Group L: Awn falcate. Lemma narrow and needle-like.

1. Inflorescence short, very dense and spike-like, to 14 cm long, 1 cm wide (excluding awns). Ligule 3–7 mm long. Shoots extravaginal from a short rhizome *S. pycnostachya*
- 1*. Inflorescence to 55 cm long, variably contracted or expanded but not spike-like. Ligule usually less than 3 mm long (occasionally to 4 mm in *S. scabra*). Shoots intravaginal or extravaginal but with no rhizome 2
2. Awns long-pubescent or plumose with spreading hairs, most of which are 0.25–0.8 (–1.5) mm long 5
- 2*. Awns scabrous or puberulous with appressed hairs, most of which are 0.2 mm long or less 3
3. Leaves very fine: sheaths 2–5 mm wide; blades 0.6–1.2 mm wide, inrolled, usually flexuose 4
- 3*. Leaves coarse: sheaths (3–) 4.5–9 mm wide; blades 1–3 mm wide, inrolled and erect or expanded and flexuose 5
4. Leaf sheaths softly pilose; blades with dense, long (≥ 0.5 mm) spreading hairs *S. trichophylla*
- 4*. Leaf sheaths glabrous, scabrous or puberulous; blades glabrous, scabrous or shortly pubescent with most hairs less than 0.5 mm long *S. scabra*
5. Panicle contracted, usually dense. Innovations mostly intravaginal. Nodes mostly concealed by the sheaths *S. nitida*
- 5*. Panicle spreading, usually sparse. Innovations mostly extravaginal. Nodes exerted and conspicuous *S. nodosa*
6. Spikelet small in most parts: lower glume 8–14 mm long, upper glume 6–12.5 mm long; floret 4–6.5 (–7) mm long; awn 38–90 mm long, delicate (0.2–0.3 (–0.4) mm wide near the base), gently falcate 8
- 6*. Spikelet large in most parts: lower glume 14–20 mm long, upper glume 11.5–18 mm long; floret 7–8 mm long; awn 70–100 mm long, sturdy (0.3–0.4 mm wide near the base), very strongly falcate 7
7. Auricles glabrous or with few short hairs *S. blakei*
- 7*. Auricles hirsute with a dense line of long white hairs *S. tenuifolia*
8. Leaf blades broad, 2–6 mm wide (0.8–2 mm diameter if inrolled), erect 9
- 8*. Leaf blades fine (0.3–0.6 mm diameter, usually inrolled), usually slightly flexuose 10
9. Leaves pungent, sheaths narrow and tightly enveloping the culm. Nodes exerted. Panicle contracted. Awn 40–50 mm long *S. pilata*
- 9*. Leaves acute but not pungent, sheaths broad and loose around the culm. Nodes rarely exerted. Panicle expanded. Awn (40–) 60–90 mm long *S. drummondii*
10. Leaf blades densely hirsute. Column of the awn to 10 mm long. Glumes unequal *S. trichophylla*
- 10*. Leaf blades mostly glabrous or scabrous (occasionally the very basal blades hirsute). Column of the awn 11–14 mm long. Glumes subequal *S. variabilis*

Key 2, Multiple-entry

Part 1: Species with straight or geniculate awns

sc. = scabrous

Taxon	Species group(s)	Upper glume mm	Lower glume mm	Floret mm	Lemma lobe(s) mm	Lemma coma (or Corona*) mm	Column length mm	Awn hairs mm	Awn length mm	Other distinguishing features
leucotricha	A	10-16	10-17	6.5-9	—	1.5-2.5*	20-30	<0.8	50-60	corona
megapotamia	A	9-9.5	8-10	5.5-6	0.1-0.2	0.6-0.8*	30	0.1-0.5	50	corona
neesiana	A	10-18	14-18	6-10	—	1.5*	25-55	0.1-0.5	45-85	corona
caudata	B	6-9.5	6-9	4-6	0.3-0.4	0.2-1	6-9	<0.2	12-18	
hyalina	A	7-8	9	4	—	0.7*	15	sc.	35-40	corona
ramosissima	C	2.4-2.8	2.3-4	1.8-2.5	—	—	4-7	sc.	14-30	cane-like stems, whorled branches
verticillata	C	3-5	3-5	2.7-4	—	—	7-30	0.05-0.1	33-53	cane-like stems, whorled branches
breviglumis	C	4.5-6	5.5-6.5	3-4.5	—	0.2	10-15	sc.	20-35	
nultarboensis	C	4-5.5	4-5.5	3-4	0.1	—	6-13	0.1	14-30	
acrociliata	C	5-7	6-10	4.5-6.5	0.2-0.5	0.3-0.6	12-17	0.2-0.5	30-90	ligule 3-6 mm
platychaeta	C	6-12	7.5-15	4.5-6	0.1-0.2	—	10-15	<0.2	60-90	flattened bristle
elegantissima	C	7-11	7-12	4.5-10	0-0.8	—	8-20	0.1-0.2	20-50	long-hairy (1.5-3 mm) pedicels and branches
tuckeri	C	5-9	6-9	4-5	—	0.1-0.25	10	0.05-0.1	30-35	pedicels and branches hairy (0.3-0.6 mm)
compressa	E	9-14	13-21	6.5-8.5	0.25	—	20-40	0.05-0.2	80-140	± annual
macalpinci	E	8-14	13-22	7-8	0.1-0.4	—	14-40	0.05	60-200	± annual
vickeryana	E	9-14	14-18	6-7	—	1-1.5	26-32	0.2-0.3	80-125	lemma ± glabrous
nullanulla	E	8-10	9-11	5-6	—	1-1.5	18-25	0.2	50-70	lemma ± glabrous
lanata	E	14-19	19-26	6.5-8	—	1.5	22-30	0.3	65-80	lemma glabrous, palca exposed
eremophila	I	10-18	15-25	6-9.5	0.2-0.75	0.4-0.7	15-38	0.2-0.5	50-110	lemma apex appearing shorn or glabrous
plumigera	I	12-15	18-23	7.5-8.5	<0.1	0.5-0.8	20-26	0.5-1	70-110	bristle with hairs 1 mm long
metatoris	I	12-15	16-20	7-8	0.2-0.5	2.5-3.5	20-25	0.2-0.3	55-65	
puberula	I	6-12	8-14	4-6.5	<0.1	0.4-0.7	15-20	0.05-0.1	25-65	lemma apex appearing shorn or glabrous
wakoolica	I	9-11	11-15	5.5-6.5	<0.2	2-2.5	15-25	<0.15	35-60	
centralis	I	12-16	13-18	7-9	0-0.3	0-0.3	19-25	0.25-0.4	50-60	Central Australian ranges
mundula	I	8-14	12-17	6.5-8	0.1-0.5	0.5-1.5	22-30	0.35-0.7	50-80	blades ± smooth and glabrous
exilis	I	7-8	8-12	4.5-5.5	0-0.25	0.6-0.8	15-21	0.2	35-55	blades and sheaths hairy
petraea	G	11-13	11-15	7-9.5	1.5-2.5	2.5	20-25	0.3	40-55	lemma with orange hairs; S.A. gorges
juncifolia	G	9-10	10-12	6.5-9	2-2.5	2-2.5	10-20	0.1-0.2	25-50	
stipoides	G	12-18	12-20	8-13	0.5-3	<3.5	10-15	0.05-0.25	20-40	blades pungent; coastal
oligostachya	H, K	10-15	11-17	7-9	0.1-0.6	—	18-25	0.25-0.8	55-70	lemma glistening, ± glabrous upwards
aristiglumis	H	6-12	8-14	4-7.5	—	0.4-1.5	10-17	0.1-0.2	25-40	very short callus (0.4-1.5 mm)
curticoma	H	9-14	12-18	5.8-8	0.1-0.5	0.5-1	18-25	0.25-0.5	45-65	
gibbosa	H	8-13	11-17	4.5-6	—	0.8-1.3	12-20	<0.2	25-50	
bigeniculata	H	9-15	12-20	6-9.5	—	1.2-2	12-26	<0.2	30-60	
blackii	H	8-15	10-20	5-8	—	2-5	13-20	<0.1	28-50	blades and sheaths hairy
dongicola	H	8-11	7-12	5-6.5	—	0.7	15	0.5-1.5	30-40	
setacea	H	7-10	9-16	5.5-7	—	0.8	10-15	<0.1	25-40	furrow on palca, ligule 2-9 mm
feresetacea	H	4-6	4-7	3-4.5	—	0.2-0.9	7-10	<0.1	12-18	furrow on palca, ligule 3.5-8 mm
echinata	I	14-18	21-23	8-10	0.2-0.7	0.6-1.2	30-35	0.2-0.8	90-110	blades pungent
flavescens	I	9-14	9-16	5.5-9	0.1-0.5	0.3-1.2	18-30	0.2-0.4	40-70	mainly coastal
crinita	I	7.5-11.5	9-15	5-6.5	—	2	7-12	<0.1	23-38	W.A. west coast
velutina	I	6.5-10	9-12	5-6.5	0.1-0.2	0.1-0.5	10-25	0.1-0.3	30-45	blades and sheaths velvety-hairy; Great Australian Bight
multispiculis	I	6.5-9	8.5-10	4.5-6	0.1	0.2-0.8	15-20	0.25-0.5	25-40	
densiflora	J	12-16	13-18	5.5-7	—	—	13-20	0.5-1	35-45	glumes hairy
stuposa	I, J	12-19	15-23	7-12	0.1-0.2	1-3	20-25	0.5-1	45-70	

Taxon	Species group(s)	Upper glume mm	Lower glume mm	Floret mm	Lemma lobe(s) mm	Lemma coma (or Corona*) mm	Column length mm	Awn hairs mm	Awn length mm	Other distinguishing features
<i>mollis</i>	J	15-20	16-20	7.5-9	—	—	20-35	0.6-2	60-100	column hairs in a spiral
<i>hemipogon</i>	J	10-16	15-20	5-7.5	—	—	10-20	0.5-4	30-60	column hairs in a spiral
<i>aquarii</i>	J	9-10	10-12	3.5-5	—	—	10-15	0.8-1.3	40-50	column hairs in a spiral; Central Australian ranges
<i>semibarbata</i>	J	15-25	18-27	9-11.5	—	—	30-40	0.3-1	70-110	blades and sheaths scabrous
<i>campylachne</i>	J	14-18	15-23	8-9	—	—	30	0.3-1.6	50-70	blades and sheaths pubescent to hirsute
<i>muelleri</i>	G, K	15-30	18-30	13-20	3	—	40-55	0.02-0.2	50-100	scrambler, few-flowered inflorescence
<i>nivicola</i>	K	15-20	20-25	12-15	—	—	55-70	0.05-0.5	85-130	alpine and subalpine areas
<i>aphylla</i>	K	14	16	8.5-10	0.5	0.4-0.8	35-50	0.1-0.25	60-85	blades deciduous
<i>pubinodis</i>	K	15-20	18-29	10-13	—	—	30-60	0.1-0.2	55-95	palca full-length, acute
<i>pubescens</i>	K	15-20	17-24	9.5-15	—	—	45-70	0.05-0.15	60-100	palca short, obtuse
<i>rudis</i>	K									
<i>ssp. rudis</i>		9-12.5	10-15	7.2-10	0.05-0.25	—	20-25	0.05-0.3	35-65	lemma apex tuberculate above
<i>ssp. nervosa</i>		7-10	8-12	5-8.5	0.05-0.25	<1	8-20	0.05-0.3	20-45	lemma apex tuberculate above
<i>ssp. australis</i>		11-14.5	12-15	8.6-11.5	—	—	32-45	0.05-0.3	60-90	lemma apex tuberculate above

Part 2: Species with falcate awns

Taxon	Species group(s)	Upper glume mm	Lower glume mm	Floret mm	Lemma lobe(s) mm	Lemma coma (or Corona*) mm	Column length mm	Awn hairs mm	Awn length mm	Other distinguishing features
<i>pynostachya</i>	L	10-14	11-15	4-6	<0.2	—	8-15	0.05	35-50	short, dense inflorescence, ligule 3-7 mm
<i>drummondii</i>	L	6-11	7-12	4-7	0-0.2	0-0.5	11-21	0.3-1.5	40-90	blades and sheaths broad, hairy
<i>nitida</i>	L	8-13	8-13	4-6	<0.15	0.2-0.8	10-13	0.1-0.3	45-70	mostly intravaginal, infl. ± contracted
<i>nodosa</i>	L	7-14	10-15	4-7	0.1-0.4	0.4-1	7-15	<0.4	45-100	mostly extravaginal, nodes prominent, infl. open
<i>scabra</i>	L									
<i>ssp. scabra</i>		6-13	8-15	4-6.5	0.2-0.5	0.1-0.6	5.5-15	0.1-0.2	30-70	ligules long, leaves fine, infl. contracted
<i>ssp. falcata</i>		8-13	10-15	4-6.5	0.2-0.5	0.1-0.6	5.5-15	0.1-0.2	55-65	ligules short, leaves fine, infl. open
<i>trichophylla</i>	L	8-11.5	9.5-14	3.8-6.5	<0.3	<1.5	6-10	0.15-0.4	38-75	leaves fine, hairy
<i>pilata</i>	L	7-9	8-10	4-5	—	1	7-11	0.2-0.5	40-50	blades pungent, hairy
<i>variabilis</i>	L	8.5-12.5	10-15	4.5-7	<0.25	<1	11-14	0.2-0.5	50-90	
<i>tenuifolia</i>	L	12-18	13-20	7-9	<0.4	1.5	11-20	0.2-0.6	70-120	auricles hairy, W.A. and S.A.
<i>blakci</i>	L	13-17	14-18	7-8	0.1-0.2	—	9-13	0.2-0.3	70-100	auricles ± glabrous, Old.

Stipa acrociliata *Reader*, Victorian Naturalist 13: 167 (1897), *ibid.* 15: 145 (1899); Hughes, Kew Bull. 1921: 28 (1921), *ibid.* 1922: 19 (1922); Black, Fl. S. Austral. 1: 65 (1922), edn 2: 91 (1943); Ewart, Fl. Victoria: 182 (1931); Gardner, Fl. W. Austral. 1, Gram.: 178 (1952); Vickery, Contrib. N.S.W. Natl. Herb. 2: 78 (1953); Willis, Handb. Pl. Victoria 1: 183 (1962), edn 2: 183 (1970).

HOLOTYPE: VICTORIA: Sandy desert, Lowan Shire, *F. Reader*, 1895 (MEL 59867!; apparent isotypes MEL 59869 with panicle, 59868 foliage only).

SYNONYM: *S. readeri* F. Muell. ex *Reader*, Victorian Naturalist 13: 168 (1897), in syn.

Shortly rhizomatous or caespitose perennial to 1.5 metres high, often with several branches at the nodes, with or without a basal tuft of leaves to about one third the height. Culms erect or slightly geniculate at the base, to 3 mm wide, scarcely compressible, moderately to strongly ribbed, glabrous or just below the nodes very shortly puberulous; nodes 2–3, exserted, glabrous, to 50% wider than adjacent internodes. Leaf sheaths usually inflated, to 10 mm wide, strongly to moderately ribbed, glabrous to scaberulous with minute stiff hairs or pubescent; margins glabrous. Ligule truncate, obtuse, or lacinate, membranous, 2.5–6 mm long, glabrous; auricles thickened, 1–2 mm long, glabrous. Leaf blade expanded or loosely inrolled, 3–10 mm wide, to 40 cm long; abaxial surface strongly ribbed, glabrous to scaberulous with minute stiff hairs; adaxial surface strongly ribbed, glabrous to scaberulous with minute stiff hairs; margins glabrous. Panicle to 50 cm long, expanded, 4–12 cm wide (excluding awns), exserted, with distant fascicles of unequal few-flowered branches; branches 4.5–10 cm long, slightly angular, scabrous along the edges; pedicels 1–10 mm long, angular, minutely scabrous along the edges. Spikelets 6–10 mm long (excluding awn), gaping. Glumes unequal, green, straw-coloured or purplish, scabrous on the nerves; lower glume 6–10 mm long, acuminate to acute, often ciliate at the tip, lower 40–50% 3-nerved; upper glume 5–7 mm long, obtuse to broadly acute, usually ciliate at the tip, the lower 30–50% 5-nerved, the next 20–40% 3-nerved. Floret elliptical, with no definite neck, 4.5–5.5 (–6.5) mm long (including callus). Lemma surface brown and finely tuberculate with erect, spreading white hairs up to the apex; lobes 2, 0.2–0.5 mm long, or absent; coma obscure, 0.3–0.6 mm long. Callus 1.0–1.5 mm long, fine and straight, the tip sharp. Awn 3–7 (–9) cm long with 1–2 slight bend(s), 0.1–0.2 mm wide near the base; column 12–17 mm long, 6–10 mm to the first bend, pubescent with hairs 0.2–0.5 mm long; bristle occasionally slightly curved, scaberulous, often darker than the column. Palea equal in length to the lemma, acute, densely pubescent down the centre, glabrous on the margin; apex ciliate. Lodicules 2, abaxial, membranous, 1–1.7 mm long, obtuse. Anthers 1.5–1.8 mm long, not or minutely penicillate. Caryopsis 3–3.5 mm long; embryo 20–25% the length; hilum 60–65% the length.

DISTRIBUTION: Sandy areas of the western plains of New South Wales and Victoria; arid areas of South Australia and on limestone of the Nullarbor Plain.

SELECTED SPECIMENS: NEW SOUTH WALES: **North Western Plains:** West Bogan–Nyngan, *Butcher* NSW 116147, 26.11.1934 (NSW). **South Far Western Plains:** 7 km N. of highway on Arumpo road E. of Euston, *Cunningham* 4022 & *Milthorpe*, 13.10.1975 (NSW); 60 miles [96 km] N. of Balranald, *Leigh* NSW 116146, 20.10.1964 (NSW); 20 km W. of Balranald, *Mulham* NSW 116674, 11.1974 (NSW).

VICTORIA: **Region A:** Red Cliffs, *Henshall*, 16.3.1969 (NT 43331). **Region B:** Timberoo Forest Reserve, 10 miles [16 km] SW. of Ouyen, *Beaulehole* 40396, 19.9.1972 (NSW, MEL); 4 miles [6 km] N. of Tempy, *Henshall* NSW 116675, 20.9.1969 (NSW); Wyperfeld National Park, W. of Moorong Rise, *Beaulehole* 29519 & *Finck*, 12.11.1968 (NSW, MEL). **Region C:** Little Desert, *Reader* 18.11.1896 (MEL 59871, AD); Lowanshire, *no collector*, 1895 (MEL 59874). **Region F:**

Annuello, c. 23 km NNW. of Manangatang, *Beaglehole* 55841, 29.4.1977 (MEL). **Region G:** 5 km SW. of Chinkapook, c. 18 km S. of Manangatang, *Beaglehole* 55495, 17.4.1977 (MEL); 5 km W. of Gama, *Beaglehole* 56907, 22.10.1977 (MEL, NSW).

SOUTH AUSTRALIA: **Nullarbor:** 3 miles [5 km] inland from the cliff tops at 'Koonalda' Station, *Symon* 4589, 17.2.1967 (ADW, CANB); 9 km W. of Yalata, *Beaglehole* 49510, 31.8.1974 (CANB); WA/SA border on Eyre Highway, *Phillips CBG* 005337, 8.9.1962 (CBG). **Eyre Peninsula:** 'Colona' Homestead, *Willis*, 27.2.1947 (MEL 60866); c. 15 km W. of Nundroo, *Spooner* 2189, 1.9.1972 (AD); Bookabie Mallee, *Hilton*, 21.8.1955 (ADW 19784, 20593); Wirrulla to Penong Road, *Cleland*, 17.9.1957 (AD); Ceduna, *Canning CBG* 039220, 1.9.1968 (CBG, NSW); 8 miles [13 km] from Streaky Bay towards Ceduna, *Phillips NSW* 116144, 30.8.1968 (CBG, NSW); 63 miles [100 km] from Port Lincoln towards Whyalla, *Phillips CBG* 054383, 3.9.1962 (CBG); 40 km NW. of Kimba, *Rohrlach* 685, 18.10.1959 (AD); 12 miles [19 km] E. of Kimba, *Cleland*, 14.10.1953 (AD); Mangaloo area, *Turner NSW* 116150, 12.1954 (NSW, ADW); between Lock and Cleve, *French*, 9.1954 (ADW 28158); Hambridge Reserve, NW. & NNW. from Prominent Hill, *Symon* 4180, 8.10.1966 (ADW); Verran Hill, Hincks National Park, *Alcock* 2176, 6.10.1968 (AD); Yeelanna, 10 miles [16 km] N. of Cummins, *Hilton*, 20.12.1945 (ADW 43830); Boston I. near Port Lincoln, *Wilson* 303, 8.10.1958 (AD). **Northern Lofty:** Halbury, *Cleland*, 31.8.1963 (AD); Owen, c. 35 km E. of Port Wakefield, *Cleland*, 16.11.1955 (AD). **Murray:** Waikerie, *Cleland*, 29.8.1946 (AD); c. 13 km SW. of Waikerie, *Crisp* 630, 7.10.1973 (CBG); Monarto City Centre, *Symon* 9751, 3.12.1974 (NSW, ADW); Karoonda (Trans-Murray Scrub), *Black*, 12.11.1915 (MEL 60928); Naturi near Victorian border, *Black*, 15.10.1925 (AD). **Yorke Peninsula:** 10 miles [16 km] from Edithburgh towards Moorowie Point, *Phillips* 1247, 3.10.1965 (CBG). **Southern Lofty:** between Reeves Plains & Kangaroo Flat, *Harris* 33, 1.10.1959 (AD); Roseworthy Agricultural College, *Symon*, 1946 (ADW 25095); Hindmarsh I., Goolwa, *Hilton*, 10.10.1945 (ADW 43829); Hundred of Wiltunga, *Copley* 276, 12.5.1966 (NSW). **South-eastern:** 10 miles [16 km] E. of Mannum, *Blake* 16843, 24.8.1946 (BRI); near Goolwa, 11 miles [17 km] ENE. of Victor Harbour, *Hilton*, 23.11.1935 (ADW 43828); Cape Jervis, *Carroll* 1386, 6.10.1965 (CBG); 4 miles [6 km] E. of Tintinara, 63 miles [100 km] SE. of Tailm Bend, *Hilton* (ADW 44075); Tintinara, *Phillips CBG* 037668, 21.10.1966 (CBG, AD).

WESTERN AUSTRALIA: **Eucla:** c. 5 km E. of Eucla Pass, *Parsons* 30, 26.11.1967 (AD); Mundrabilla Station, *Aplin* 1701, 2.9.1962 (PERTH); Eyre Highway, 8 miles [13 km] W. of Madura Pass, *George* 10573, 16.10.1966 (PERTH); 46 km WSW. of Madura, *Beaglehole* 49402, 30.8.1974 (CANB); 27 km W. of Madura Hotel, Eyre Highway, *Chinnock* 1176, 20.9.1973 (AD); Twilight Cove, Great Australian Bight, *George* 8568, 16.10.1966 (PERTH). **Coolgardie:** Westonia, *Moffat*, 10.1924 (PERTH); 14 miles [22 km] N. of Norseman on Coolgardie road, *Beaglehole* 11343, 21.9.1965 (CANB, PERTH); 7 km NNE. of Norseman, *Crisp* 5950, 19.7.1979 (CBG); c. 160 km E. of Balladonia, *Jackson* 1469, 24.10.1968 (PERTH); 32 miles [51 km] E. of Balladonia, *Main*, 29.8.1955 (PERTH). **Darling:** Perth district, *per Dept. Agric. W.A., NSW* 116149, 10.1907 (NSW). **Eyre:** 1.5 km N. of Baanga Hill, *Saffrey* 448, 11.8.1968 (PERTH); Israelite Bay, *Jackson* 1306, 1.10.1968 (PERTH); Lovers Cove, Esperance, *Cleland*, 11.10.1950 (AD); East Barren Range, 4 miles [6 km] W. of Hopetoun, *Beaglehole* 13343, 21.9.1965 (CANB; PERTH); between Esperance Bay & Frasers Range, *Dempster*, 1876 (MEL 60927); Fitzgerald River National Park, *George* 10573, 19.12.1970 (PERTH).

***Stipa aphylla* (Rodway) Townrow**, Pap. & Proc. Roy. Soc. Tasmania 104: 85, 96 (1970), *ibid.* 112: 232, 235 (1978). Based on *S. pubescens* var. *aphylla* Rodway, Tasmanian Fl.: 262 (1903).

TYPIIFICATION: Rodway cites 'Dry hills in Southern Tasmania' without specifying a particular locality. Townrow (on p. 96) provides an amended description in Latin and English and singles out a 'Syntype': 'Huon Road (Hobart), Rodway, November 1897, Sheet No. 995, Rodway Collection' (HO, not seen) which we here designate as **Lectotype**, as doubtless was intended by Townrow.

Caespitose perennial to 0.5–0.6 metres high, shortly rhizomatous without a basal tuft of leaves. Culms erect, 1–2 mm wide near the base, not compressible, very slightly to moderately ribbed, scabrous with minute tubercles; nodes 3–4, exserted, sericeous with hairs 0.2–0.4 mm long, c. 25% wider than the adjacent internodes. Leaf sheath margins glabrous; basal sheath tightly enveloping the culm, 4–8 mm wide, moderately ribbed, scabrous with minute tubercles, sometimes also with hairs; upper sheath slightly inflated, 3.5–4 mm wide,

strongly ribbed, glabrous. Ligule membranous, 0.25–0.4 mm long, with 2–3 obtuse lobes, glabrous; auricles absent. Leaf blade linear, stiff, loosely rolled, c. 1.5 mm wide, 2–3.5 cm long, withering before flowering; abaxial surface glabrous to scabrous with minute tubercles, weakly to strongly ribbed; adaxial surface pubescent with hairs 0.1–0.3 mm long, strongly ribbed. Panicle sparse, c. 11 (–25) cm long, exerted, with distant fascicles of unequal, few-flowered, compound branches, c. 2 cm wide (excluding awns); axis terete, scabrous with minute hairs and tubercles; branches c. 6 cm long, slightly angled, scabrous with hairs 0.05 mm long; pedicels 0.5–1.5 cm long, angled, scabrous with hairs 0.1–0.5 (–1) mm long. Spikelets 16 mm long, gaping. Glumes subequal, acute to acuminate, hyaline with chlorenchyma bands associated with the nerves; lower glume 16 mm long, scabrous with hairs 0.05 (–1) mm long, lower 25% 3-nerved; upper glume c. 14 mm long, scabrous with hairs c. 0.05 mm long, lower 50% 5-nerved, upper 50% 4–1-nerved. Floret cylindrical, without a neck, 8.5–10 mm long. Lemma surface scabrous, sericeous with hairs 0.3–0.6 mm long; coma 0.4–0.8 mm long; lobes c. 0.5 mm long or absent. Callus (1.5–) 2 mm long, weakly bent at the tip, sericeous with dense white hairs 0.2–1 mm long, tip glabrous. Awn 6–8.5 cm long, twice bent, 0.25–0.4 mm wide near the base; column 3.5–5 cm long, 2.5–3.5 cm to the first bend, straw-coloured, pubescent with hairs 0.1–0.25 mm long; bristle straw-coloured, scabrous with hairs 0.05–0.15 mm long. Palea sub-equal to the lemma, obtuse or often erose, surface smooth, sericeous along the centre back with hairs c. 0.5 mm long, margins glabrous. Lodicules 3; 2 abaxial, 1–1.5 mm long, obtuse, brown, brittle; paleal c. 1 mm long, acute, white. Anthers 3.5–5 mm long, penicillate. Caryopsis not seen.

DISTRIBUTION: South-eastern Tasmania.

SELECTED SPECIMENS: TASMANIA: 2 miles [3 km] N. of Bicheno, *Townrow*, 13.1.1965 (MEL 58875); Copping, *Blake 18277*, 15.1.1949 (BRI, NSW); near Hobart, common on dry hills, *Rodway*, 2.1894 (MEL); University of Tasmania, Hobart, *Townrow 77*, 29.11.1967 (JEST); Ferntree, Lower Pipe track, *Townrow 7.3.1965* (JEST); Kingston, *Rodway NSW 116237* 1.1893 (NSW); Huonville, *Martin*, n.d. (CANB 13186); Barnes Bay, Bruny Is, *Townrow 147*, 1.2.1968 (JEST); S. Tasmania, *Rodway*, 1894 (MEL 60850).

S. aphylla is superficially similar to *S. muelleri*, especially because of the reduction and deciduous nature of the leaf blades, but *S. aphylla* differs markedly in that the margins of the lemma are not or scarcely continued as distinct membranous lobes and the lemma has a minute crown of hairs. Hence *S. aphylla* does not belong to the group Aphyllae of Hughes, which was described before the name *S. aphylla* was published.

***Stipa aquarii* J. Vickery, S.W.L. Jacobs & J. Everett, sp. nov.**

S. hemipogoni affinis sed spicula minore, lemmate anguste fusiformi, arista gracili, differt.

HOLOTYPE: NORTHERN TERRITORY: Waterhouse Range, 24° 02'S, 133° 36'E, P.K. *Latz 6349*, 3 February 1976. Erect perennial. Rare in skeletal soil, walls of gully, sandstone hill (NT).

Caespitose perennial to c. 1 metre high, with basal shoots to three quarters the height, and very short rhizomes. Culms c. 1.5 mm wide near the base, not easily compressed, terete, finely ribbed, glabrous, finely scabrous to densely pubescent 1 cm below the nodes; nodes 5–6, c. 40% broader than adjacent internodes, shortly retrorsely sericeous, scarcely or only the uppermost exerted.

Leaf sheaths c. 2 mm wide, scabrous to sparsely hirsute and scabrous on the basal sheaths; outer margin sparsely ciliate to glabrous; inner margin glabrous. Ligule obtuse, coriaceous, 1–2 mm long, 0.5 mm long on basal leaves, densely long-ciliate, sericeous on the abaxial surface; auricles slightly thickened, tufted with sparse straight hairs. Leaf blades loosely rolled, to 60 cm long, 1–2 mm wide; abaxial surface scabrous with dense, short, antrorsely hooked tubercles; adaxial surface long-pubescent, ribbed. Panicle dense, contracted, with closely spaced fascicles of unequal compound branches, exerted, c. 14–20 cm long, 1 cm wide (excluding awns); axis terete, finely scaberulous; branches slightly flattened, to 3 cm long, scaberulous; pedicels slightly flattened, 1–4 mm long, scaberulous. Spikelets scarcely gaping, 10–12 mm long (excluding awn). Glumes subequal, acuminate, transparent, glabrous except for a scaberulous midrib; lower glume 10–12 mm long, lower 30% 3-nerved; upper glume 9–10 mm long, lower 20% 3-nerved. Floret 3.5–5 mm long (including callus), narrowly fusiform, brown at maturity, the midrib pale. Lemma with sparse spreading yellow hairs, sparser upwards, the upper 1 mm glabrous; surface granular and with antrorsely hooked tubercles on the upper half; coma absent; lobes absent. Callus short and curved, c. 1 mm long, sericeous with yellowish hairs. Awn 40–50 mm long, 0.2 mm wide near the base, pale brown, twice bent; column 10–15 mm long, 7–9 mm to the first bend, villous with hairs 0.8–1.3 mm long, continuing halfway along the bristle, the remaining half of the bristle scaberulous. Palea acute, shorter than the lemma by 0.5 mm, coriaceous, granular and sparsely hairy to glabrous down the midline. Lodicules 2, spatulate, membranous, 0.7 mm long. Anthers 0.8 mm long (chasmogamous), cilia not observed. Caryopsis 2–2.5 mm long; embryo 25–30% the length.

DISTRIBUTION: Central Australian Ranges, on hillsides.

SPECIMENS EXAMINED: NORTHERN TERRITORY: **Central Australia:** Gosses Bluff, 23° 49'S, 132° 18'E, *Latz 9035*, 11.4.1982 (NSW); Waterhouse Range, 24° 02'S, 133° 36'E, *Latz 6349*, 3.2.1976 (NT, NSW, CANB); 13 km NE. Kings Canyon, 24° 13'S, 131° 41'E, *Latz 8853*, 21.7.1981 (NT).

The specific epithet is from the Latin “of the water man”, having a similar derivation to the surname ‘Waterhouse’, after which the Range in which the Type was collected was named.

The ms. name “*S. aquavilla*” appears on some of our early determinavit slips on specimens of this species.

Similar to *S. hemipogon* but differing in the smaller spikelet with narrow-fusiform lemma (turbinate in *S. hemipogon*) and slender awn.

***Stipa aristiglumis* F. Muell.**, Trans. & Proc. Victorian Inst. Advancem. Sci.: 43 (1855), Fragm. Phytogr. Austral. 8: 103 (1873); Bentham, Fl. Austral. 7: 570 (1878); Bailey, Syn. Queensland Fl.: 650 (1883); Moore & Betche, Handb. Fl. N.S.W.: 484 (1893); Hughes, Kew Bull. 1921: 25 (1921), *ibid.* 1922: 19 (1922); Willis, Handb. Pl. Victoria 1: 185 (1962), edn 2: 185 (1970).

HOLOTYPE: VICTORIA: cited as ‘In bushy parts of the Murray Desert, F. Mueller’. Two sheets at MEL (MEL 59879! and (vegetative only) MEL 59878!) marked respectively ‘Murray’ and ‘Ad flumen Murray’ by Mueller appear jointly to be the Holotype. As Hughes (1922) notes, the glumes on MEL 59879 are torn between the nerves so that the nerves project as teeth.

SYNONYM: *S. fusiformis* Hughes, Kew Bull. 1921: 25 (1921). See also Hughes, Kew Bull. 1922: 19 (1922). HOLOTYPE: VICTORIA: Murray River, *Mueller 19277* (K). Hughes also cited the following specimens: NEW SOUTH WALES: Cassilis, *Leichhardt* (K) (not seen definitely); VICTORIA: Avoca River, *F. Mueller* (K) (NSW 116069 from Herb. Hooker is probably a duplicate).

Caespitose perennial to 2 metres high with a sparse basal tuft c. one third the height. Culms erect or slightly geniculate near the base, terete, not compressible, c. (1.5-) 2.5 (-5) mm wide near the base, ribbed, glabrous to puberulous. Nodes 3, exserted, 35-45% broader than adjacent internodes, pubescent with slightly spreading short hairs or occasionally glabrous. Leaf sheaths at first tightly enveloping the culms, soon becoming loose, 3-6 mm wide, ribbed, glabrous or between the ribs scaberulous; inner margin glabrous; outer margin long-ciliate, or the basal part glabrous. Ligule thinly coriaceous to chartaceous, scarcely ciliate, glabrous except for a small tuft of hairs each side, truncate to obliquely truncate, 0.8-1.5 mm long or obtuse and to 3 mm long when continuous with one or both sheath margins; auricles thickened, glabrous. Leaf blades flat or convolute (most tightly in leaves of the basal tuft), to 40 cm long, 3-6 mm wide; abaxial surface scabrous with minute hairs or glabrous, occasionally with widely scattered strong or weak hairs, especially on the basal leaves; adaxial surface minutely scaberulous, occasionally with scattered weak hairs; margins similar to adjacent surface or with sparse long strong hairs. Panicle to 40 (-55) cm long, exserted at length, moderately sparse with distant fascicles of many, unequal, few-flowered compound branches, usually spreading, (2-) 6-10 cm wide (excluding awns); axis terete and glabrous at the base, upwards flattened and scabrous with dense minute hairs mostly on the edges; branches to 20 cm long, flattened, scabrous with minute hairs mostly on the edges; pedicels to 12 mm long, flattened, scabrous, with minute hairs mostly on the edges. Spikelets 8-14 mm long (excluding awn), gaping widely at floret disarticulation, otherwise tightly closed. Glumes unequal, firm and green for most of the length, the tip membranous and transparent between the nerves and often eroded, acuminate with long fine tips often reduced to the midrib, moderately broad and inflated at the middle, glabrous or the nerves scabrous, or scabrous with dense minute hairs overall; chlorenchyma bands associated with the nerves; lower glume 8-14 mm long, lower 75-90% 3-nerved; upper glume 6-12 mm long, lower 60-50% 5-nerved, 3-nerved up to 90% of the length. Floret (4-) 5-7.5 mm long (including callus), fusiform, tapering gradually to the base of the awn. Lemma gold-brown to dark red-brown at maturity, sericeous with appressed white to yellow hairs becoming gold at late maturity and sparse to absent at the apex, central nerve thickened; lobes minute or absent; coma of very sparse, appressed hairs of varying lengths to 0.4-1.5 mm long, or occasionally absent. Callus short and broad, 0.4-1 (-1.5) mm long, scarcely differentiated from the lemma, with hairs similar to those of the lemma, the naked point very short, 0.1-0.15 (-0.2) mm long, and rounded. Awn 25-40 mm long, twice bent, 0.2 (-0.3) mm wide near the base; column 10-17 mm long, 4-9 mm to the first bend, scabrous with sparse appressed hairs less than 0.1 (-0.2) mm long; bristle scaberulous. Palea \pm equal to the lemma, coriaceous, slightly thinner at the margins, granular down the centre, acuminate, glabrous or with a few hairs down the centre. Lodicules 3, membranous; 2 abaxial 1.1-1.8 mm long, broadly cuneate; paleal 0.5-1.2 mm long, oblong. Anthers 2-3 mm long, usually penicillate. Caryopsis 3-4.5 mm long; embryo 30-50% the length; hilum 75-90% the length.

DISTRIBUTION: On heavy soils west of the Great Dividing Range from southern Queensland to Victoria.

SELECTED SPECIMENS: QUEENSLAND: **Darling Downs:** Jondaryan, *Blake* 7740, 22.2.1935 (NSW); Oakey, *Donges*, 1930 (BRI); nr. Kingsthorpe, *Blake* 13248, 12.2.1938 (NSW); Toowoomba, *Pollock*, 9.12.1938 (BRI); Pittsworth, *Roe*, 5.12.1938 (BRI); Cambooya, *White* 12679, 19.10.1944 (BRI); Tummaville, *White* 12586, 19.11.1944 (BRI); Clifton, *White*, 12.1912 (BRI); Talgai, *Bailey* (BRI); between Toowoomba & Warwick, *White* 13099, 6.3.1944 (BRI); Allora, *Bailey* (BRI). **Moreton:** Brisbane River, *Bailey* 57, 3.1873 (MEL).

NEW SOUTH WALES: **North Coast:** Singleton, *Boorman* NSW 116067, 11.1914 (NSW). **Central Coast:** Hawkesbury River, *Cleland*, 4.1912 (AD 98100091). **Northern Tablelands:** New England, *McFarland*, 1890 (MEL); between Tamworth & Glen Innes, *White* 10412, 29.12.1935 (BRI). **Central Tablelands:** Bathurst Experiment Farm, *May*, 26.3.1941 (NSW). **North Western Slopes:** Wallangra, *Rodway* NSW 116083, 28.9.1929 (NSW); Warialda, *Vickery* NSW 116087, 1.1932 (NSW); Gravesend, *Breakwell* NSW 116088, 16.1.1913 (NSW); Glendon nr. Gravesend, *Carne* NSW 116089, 5.1914 (NSW); 3 miles [5 km] N. of Stannifer on Elsmore road, *Jessup & Gray* 2794, 10.3.1954 (CANB); "Derra Derra", 16 miles [26 km] W. of Bingara, *Hindwood* NSW 116092, 7.10.1950 (NSW); Barraba, *Rupp* NSW 116093, 26.2.1914 (NSW); Boggabri, *Cabbage* NSW 116094, 11.1909 (NSW); Gunnedah, *Gardiner* NSW 116095, 29.11.1939 (NSW); Piallaway district, between Currabubula & Carroll, *Goode* 95, 8.11.1954 (NSW); Tamworth, *McKie* NSW 116096, 15.4.1947 (NSW); nr. Tamworth, *Phillips & Vickery* CBG 001275, 21.2.1961 (AD, CANB); Liverpool Plains, NSW 116098, 2.1850 (NSW); Quirindi, *Rowntree* NSW 116100, 11.1917 (N.S.W.); c. 3 miles [5 km] N. of Wallabadah, *Goode* NSW 116103, 11.11.1954 (NSW); nr. Bundella, (c. 41 miles [65.5 km] WSW. of Quirindi), *Pickard & Coveny* 1172, 6.6.1969 (NSW). **Central Western Slopes:** Scott Creek near Blandford, *Reiner* 292, 21.1.1960 (CANB); "Belltrees" via Scone, *White* NSW 116053, 2.1920 (NSW); Cassilis, *Leichhardt*, (MEL); Yangambil Plains, *Trangie*, *Hutchings* 59, 22.10.1948 (CANB); 1 mile [1.6 km] E. of Bunnan (16 miles [26 km] W. of Scone), *Story* 6947, 27.11.1959 (CANB, BRI); Scone Experimental Station, *Story* 7059, 15.3.1960 (AD, CANB, PERTH); Bow, 7 miles [11 km] W. of Merriwa, *Story* 6989, 1.12.1959 (CANB); Narromine, *Helms* NSW 116054, 12.1892 (NSW); Eulomogo, *Blakely* NSW 116056, 10.1912 (NSW); 6 miles [10 km] W. of Wellington, *Henderson* NSW 116050, 31.12.1946 (NSW); Mudgee, *Betche* NSW 116058, c. 1885 (NSW); Alectown, *Bradford* NSW 116059, 25.11.1949 (NSW); 13 km E. of Condobolin, *Cunningham & Milthorpe* 1546, 19.11.1973 (NSW); Bedgerebong, *Henderson* NSW 116049, 31.12.1946 (NSW); Forbes, *Cashmore*, 2.3.1935 (ADW 250); 'Allandale', Cowra road, Forbes, *Tretheway* NSW 116060, 23.11.1942 (NSW); between Grenfell & Forbes, *Martensz* 4128, 8.12.1968 (CANB); Marsden, *Hill* NSW 116062, 6.11.1962 (NSW); West Wyalong, *Ballantine* NSW 116063, 6.3.1939 (NSW). **South Western Slopes:** between Wagga & Lockhart (19 miles [30 km] from Lockhart), *Moore* 1081, 21.11.1948 (CANB); Burrumbuttock-Howlong Road, *McBarron* 4371 (*in part*), 3.8.1950 (NSW). **North Western Plains:** Moree to Bullarah, *Waterhouse* NSW 116075, 4.11.1956 (NSW); Narrabri, *Vickery* NSW 116077, 10.12.1928 (NSW); Condobolin, *Cunningham & Milthorpe* NSW 117006, 6.3.1978 (NSW). **South Western Plains:** Euabalong, *Doyle* NSW 116080, 11.1963 (NSW); Deniliquin, *Leigh* NSW 116081, 25.10.1963 (NSW); between Oaklands & Berrigan (8 miles [13 km] from Berrigan), *Moore*, 22.11.1948 (CANB 32524).

VICTORIA: **Region C:** Shire of Dimboola, *Reader*, 10.2.1895 (MEL); Horsham, *Willis & Beauglehole* 7870, 17.10.1960 (NSW); Wimmera, *Pye*, 1889 (MEL 60659). **Region G:** nr. Kerang, *Baldwin*, 11.1937 (MEL, ADW 43834). **Region H:** Minyip, *Eckert*, 12.5.1899 (MEL); Avoca River, *Hooker* NSW 116069, (NSW). **Region M:** 4 miles [6.4 km] from Rochester, *Phillips* CBG 046200, 8.11.1965 (CBG); Mooroopna, *Black*, 12.11.1942 (MEL); Tatura, *Gauba* CBG 003585, 20.12.1945 (CBG). **Region N:** 1 mile [1.6 km] south of Laverton, *Cullinore* 125, 28.11.1967 (CANB, BRI). **Region R:** Rutherglen, *Dreven*, 12.1886 (MEL).

Stipa bigeniculata *Hughes*, Kew Bull. 1922: 20 (1922); *Vickery*, Contrib. N.S.W. Natl. Herb. 2: 78 (1953).

HOLOTYPE: NEW SOUTH WALES: Cooma, *R.T. Baker*, Jan. 1887 (K!). The sheet at K consists of a drawing made from a specimen in the U.S. National Herbarium (US), No. 993695(!), together with a packet containing a portion of a panicle with attached glumes and florets. NSW 116547 from Cooma, but without indication of collector's name or date, is perhaps part of the Type collection and matches the Holotype well.

Caespitose perennial to 1 metre high with a basal tuft of leaves to one third the height. Culms erect or geniculate at the base, terete, c. 2 mm wide near the base, scarcely compressible, not or only slightly ribbed, puberulous at the base, glabrous upwards except just below the nodes; nodes 2-3, exerted, sericeous,

20–50% wider than adjacent internodes. Leaf sheaths enveloping the culm, 4–5 mm wide, minutely scaberulous but upper sheaths glabrous; cataphylls and very basal sheaths pubescent; outer margin ciliate to long and woolly near the orifice, although upper-sheath margins glabrous. Ligule truncate, coriaceous, 0.3–0.5 mm long although occasionally the outer sheath-margin extended 1 mm past the orifice, ciliate, abaxial surface sericeous; auricles usually with tufts of stiff hairs to 1 mm long. Leaf blade weakly rolled (those of the basal tuft more tightly so), c. 3 mm wide, to 25 cm long; abaxial surface slightly ribbed, shortly and strongly scabrous on lower blades, upper blades glabrous; adaxial surface strongly ribbed, densely minutely scaberulous, with occasional longer hairs; margins glabrous or strongly scabrous. Panicle 25–45 cm long, exerted with distant fascicles of unequal, few-flowered, compound branches, contracted and 2–3 cm wide (excluding awns), or expanded and to 15 cm wide (excluding awns); axis terete, strongly scabrous; branches flattened or angular, 3–16 cm long, scabrous; pedicels flattened or angular, scabrous, 6–20 mm long. Spikelets 12–18 (–20) mm long (excluding awn), gaping widely after floret disarticulation, otherwise tightly closed. Glumes unequal, firm throughout, glabrous or minutely scabrous especially at the tip, usually purple-tinged at the base, white at the tip, broad and inflated at the middle, narrowed abruptly at the tip; chlorenchyma bands associated with the nerves; lower glume 12–18 (–20) mm long, lower 75% 3-nerved; upper glume 9–12 (–15) mm long, the lower 35% 5-nerved, the next 30% 3-nerved. Floret oblong-cylindrical to oblanceolate-cylindrical, with a well-defined neck, 6–8.5 (–9.5) mm long (including callus). Lemma reddish brown at maturity, the surface tuberculate, scabrous with antrorse hooks at the apex, the central nerve thickened, usually prominent, with spreading white hairs becoming yellow at maturity; lobes minute; coma (1.2–) 1.4–2.0 mm long. Callus strong, curved, (1.2–) 1.4–2.5 mm long, sericeous with hairs slightly darker than those of the lemma. Awn 30–60 mm long, strongly twice bent, 0.2–0.35 mm wide near the base; column 12–22 (–26) mm long, 6–11 mm to the first bend, scaberulous with hairs less than 0.2 mm long; bristle scaberulous. Palea ± equal to the lemma, acuminate, granular down the centre, coriaceous but hyaline on the margins, very sparsely hairy down the centre. Lodicules 3, membranous; 2 abaxial, 1.3–2.0 mm long, broadly oblong to cuneate; paleal 0.9–1.2 mm long, narrow-oblong. Anthers 3.0–4.5 mm long (occasionally 1.5 mm), penicillate. Caryopsis 3.5–4.5 mm long; embryo 30% the length; hilum 90% the length.

DISTRIBUTION: Wooded areas of the Central and Southern Tablelands and Slopes of New South Wales, and scattered through Victoria.

SELECTED SPECIMENS: NEW SOUTH WALES: **Central Tablelands:** Bathurst district, *Ingram* NSW 116584, 28.2.1943 (NSW). **Southern Tablelands:** Crookwell district, *Grantham* NSW 116560, 3.1.1956 (NSW); Goulburn, *Dwyer* NSW 116558, 2.1915 (NSW); 18 miles [29 km] SW. of Goulburn, *Daniel* NSW 116561, 12.1955 (NSW); lower east slopes of Black Mt, Canberra, *Pullen* 3735, 12.12.1962 (NSW, CANB, MEL, AD); nr. Lake Burley Griffin, *Solling* 49, 2.2.1972 (NSW); Canberra, Queanbeyan, *Cabbage* NSW 116553, 8.11.1911 (NSW, CANB); Stromlo Forest, *Boden* CBG 044555, 7.1.1970 (CBG); near Tharwa, *Blake* 7526, 2.2.1935 (NSW); Bredbo, *Murray* NSW 116568, 12.1913 (NSW); near Slacks Creek, between Cooma & Jindabyne, *Vickery & Phillips* NSW 116551, 11.1.1956 (NSW); Maffra (Cooma district), *Vickery* NSW 116557, 14.1.1940 (NSW); 4 miles [6 km] N. of Bombala, *Pullen* 4466, 21.1.1972 (CANB). **Central Western Slopes:** Wellington district, *Taylor* NSW 116571, 11.1956 (NSW); Cowra district, *Daniel* NSW 116573, 6.3.1950 (NSW). **South Western Slopes:** Yass district, *Grubor* NSW 116556, 16.2.1939 (NSW); Gerogery, *McBarron* 2660, 24.11.1948 (NSW); Howell Reserve, 4 miles [6 km] W. of Burrumbuttock, *McBarron* 4735, 3.8.1950 (NSW); Albury, *McBarron* 1186, 21.10.1947 (NSW). **South Western Plains:** Binya State Forest, c. 17 km E. of Griffith, *Crisp* 1638, 20.11.1975 (CBG).

VICTORIA: **Region A:** Mildura, *Williamson* (MEL 60883). **Region C:** 5 km NW. of Dimboola, 36° 25', 141° 57', *Everett* 191 & *Jacobs*, 30.11.1980 (NSW). **Region H:** Inglewood, *Sonnenberg*,

13.11.1929 (MEL 60661). **Region N:** Bacchus Marsh, *Meebold 21813*, 12.1936 (NSW); Newstead, *Black*, 18.11.1931 (CANB 9759). **Region P:** Geelong, *Williamson NSW 116572*, 7.1905 (NSW). **Region R:** Barnawartha, *Black*, 13.11.1939 (CANB 9766).

TASMANIA: Queens Domain, *Curtis* (BRI).

Stipa blackii *C.E. Hubbard*, *Kew Bull.* 1925: 431 (1925); *Black*, *Fl. S. Austral.* edn 2: 92 (1943); *Vickery*, *Contrib. N.S.W. Natl. Herb.* 2: 78 (1953); *Willis*, *Handb. Pl. Victoria* 1: 185 (1962), edn 2: 185 (1970), perhaps in part.

HOLOTYPE: SOUTH AUSTRALIA: Jamestown, *J.M. Black 2* (K!; see also CANB photo 237009; isotype AD; probable isotype MEL 59881).

SYNONYMS: *S. aristiglumis* var. *cana* *Reader*, *Victorian Naturalist* 17: 156 (1901). HOLOTYPE: VICTORIA: Sandy Desert, Lowan, *F.M. Reader* 9.10.1898 (MEL 59880!). Another sheet annotated 'Lowan, *F.M. Reader*, 9.10.1898' (MEL 69892) is probably a duplicate. The leaves of these specimens are more strongly hairy than in most specimens of *S. blackii* but appear to us to fall within the range of variation of the species.

S. pubescens var. *comosa* *J. Black*, *Fl. S. Austral.* 1: 66 (1922), *Trans. & Proc. Roy. Soc. S. Austral.* 46: 565 (1922). TYPIIFICATION: *Black* cites four specimens from South Australia: 'Marino; Jamestown; Melrose; Moolooloo'. All are in *Black's* herbarium at AD on sheets AD 97424107!, 97424108!, 9724090!, 97424106!, 97422279!, and have been annotated by him as *S. pubescens* var. *comosa* and, presumably later, as *S. blackii* *C.E. Hubbard* or, in the case of the specimen from 'Moolooloo' and one from Jamestown, as *S. clelandii*. The specimen from Jamestown, No. 2 (the type number of *S. blackii*) at AD (AD 97424106) is now devoid of florets except for one lemma partially obscured by adhesive tape, but a probable duplicate of it (though not marked No. 2) in good condition is at MEL (MEL 59881).

S. clelandii *Summerhayes & Hubbard*, *Kew Bull.* 1927: 362 (1927); *Black*, *Fl. S. Austral.* edn 2: 92 (1943). HOLOTYPE: SOUTH AUSTRALIA: Kinchina, *J.B. Cleland S. 40*, Nov. 1924, (K, 2 sheets!; see also CANB photo 236996). After repeated examination of a wide range of specimens we are convinced that there is no justification for recognizing *S. clelandii* as a species distinct from *S. blackii*. As described, *S. clelandii* had a narrow inflorescence (*blackii*: open), lower glume 18–20 mm (*blackii*: 12–13 mm), upper glume 11–16 mm (*blackii*: 8–9 mm), lemma 7–8 mm (*blackii*: 5.5–6 mm) and the awn 50 mm (*blackii*: 25–30 mm). The respective type specimens undoubtedly display some discrepancies in dimensions but the various individual characters may be found distributed within a population.

Caespitose perennial c. 1 metre high with a basal tuft of leaves c. half the height. Culms erect or geniculate at the base, 1.5–2.5 mm wide near the base, scarcely compressible, slightly ribbed, densely sericeous to scaberulous or glabrous upwards, hairs longer just below the nodes; nodes c. 3–4, exserted, sericeous, 30–50% wider than adjacent internodes. Leaf sheaths at first tightly enveloping the culm, later becoming free, 5–6 mm wide, $\frac{2}{3}$ the length of the internodes, densely pubescent, scaberulous and hirsute, upper sheaths pubescent or glabrous; outer margins long-woolly to ciliate on upper-sheath margins. Ligule truncate to shortly lacinate, coriaceous, 0.3–1.5 mm long, ciliate; abaxial surface sericeous; auricles usually thickened and spreading, pubescent. Leaf blade expanded or weakly rolled (those of the basal tuft more tightly so), 2–5 mm wide, to 20 cm long; abaxial surface slightly ribbed, densely pubescent or scabrous with short hairs and sparsely hirsute or scabrous with longer hairs, lower blades more scabrous than upper; adaxial surface ribbed, densely minutely scaberulous; margins similar to abaxial surface or with occasional long, rigid hairs. Panicle 10–30 cm long, exserted, with distant fascicles of unequal, few-flowered, compound branches, \pm contracted (although spreading at anthesis), 2–6 cm wide (excluding awns); axis slightly angular, moderately to sparsely scabrous; branches 2–8 cm long, \pm terete or triquetrous, scabrous on the edges; pedicels 5–13 mm long, \pm terete or triquetrous, scabrous on the edges. Spikelets

10–17 (–19) mm long (excluding awn), gaping after floret disarticulation, otherwise tightly closed. Glumes unequal, acuminate, broad and inflated at the middle, narrowed abruptly at the tip, firm and green at the base, purple-tinged across the centre, hyaline and often torn at the tip, densely minutely scabrous to almost glabrous; chlorenchyma bands associated with the nerves; lower glume 10–17 (–20) mm long, lower 80% 3-nerved, margins often ciliate; upper glume 8–15 mm long, lower 30% 4–5-nerved, the next 50% 3-nerved. Floret turbinate to oblanceolate-cylindrical with a weakly defined neck, 5–7 (–8) mm long (including callus). Lemma slightly gibbous at maturity, reddish brown, the surface tuberculate, scabrous with antrorse hooks at the apex, the central nerves slightly thickened, with white spreading hairs becoming yellow to orange at maturity; lobes minute; coma 2–3 (–5) mm long. Callus 1.2–2.3 mm long, sharp, sturdy and curved, with hairs slightly darker than those of the lemma. Awn 28–40 (–50) mm long, strongly twice bent, 0.2–0.4 mm wide near the base; column 13–20 mm long, 6–10 mm to the first bend, scaberulous with hairs less than 0.1 mm long; bristle delicate, often darker than the column, scaberulous. Palea ± equal to the lemma, broadly acuminate, granular down the centre, coriaceous but hyaline on the margins, very sparsely hairy down the centre or glabrous. Lodicules 3; 2 abaxial membranous, 1.2–2 mm long, narrow-cuneate to oblong; paleal membranous to slightly coriaceous, narrow-triangular. Anthers 2.5–3.5 mm long, penicillate. Caryopsis 3.4–3.8 mm long, slightly gibbous above; embryo 50–30% the length; hilum 90% the length to ± equal in length.

DISTRIBUTION: Widespread on heavier soils in New South Wales, Victoria and South Australia with a few records from Western Australia.

SELECTED SPECIMENS: NEW SOUTH WALES: **Northern Tablelands:** between Brushwood & Currawarua, *Moore 1085*, 17.11.1948 (CANB). **Southern Tablelands:** near Jindabyne, *Vickery NSW 116826*, 5.1.1956 (NSW). **Central Western Slopes:** Minore, *Blakely NSW 116117*, 10.1912 (NSW); Alectown South, *Constable NSW 17466*, 3.10.1951 (NSW); Bogan Gate, *Boorman NSW 116131*, 11.1906 (NSW); Forbes district, *Curtin NSW 116124*, 12.12.1952 (NSW); Morangarell, *per Esplin Pty. Ltd. NSW 116128*, 1938 (NSW); Young, *Patterson NSW 116125*, 12.1917 (NSW); Temora, *Dwyer NSW 116136*, 10.1916 (NSW). **South Western Slopes:** between Illabo & Eurongilly, *Moore 1106*, 18.11.1948 (CANB); Wagga Experimental Farm, Bonen, *McKeown NSW 116130*, 3.12.1906 (NSW); 7 miles [11 km] N. of Wagga Wagga, *Phillips CBG 025123*, 20.10.1965 (CBG); near Mangoplah, *Moore 1121*, 30.11.1948 (CANB); 4 miles [6 km] N. of Pleasant Hills, *McBarron 4569*, 14.6.1950 (NSW); Alma Park near Culcairn, *McBarron 4696*, 14.7.1950 (NSW); 8 miles [13 km] N. of Burrumbuttock, *McBarron 4661*, 26.6.1950 (NSW); Balldale, *McBarron 4730*, 2.8.1950 (NSW). **North Western Plains:** West Bogan, Nyngan, *Butchee NSW 116109*, *116131*, 20.11.1934 (NSW, K). **South Western Plains:** Trida district, *Stannard NSW 116822*, 8.10.1956 (NSW); 8 km S. of Lake Cargellico, 33°23'S, 146°22'E, *Everett 218 & Jacobs*, 2.12.1980 (NSW); Monia Gap, *Constable NSW 4605*, 29.10.1947 (NSW); Griffith, *Vickery NSW 10183*, 18.10.1949 (NSW); Benerembah, Griffith, *McKie NSW 2520*, 27.10.1938 (NSW); Jerilderie district, *Dykes NSW 116113*, c. 1880 (NSW); Wakool Reserve, *Henderson 125*, 10.11.1945 (NSW); Myall Plains, Berrigan, *O'Niell NSW 116121*, 20.10.1935 (NSW); 4 miles [6 km] NE. of Henty, *Flynn NSW 116115*, 23.10.1969 (NSW); Deniliquin, *Williams 41*, 10.1947 (CANB); Gerogery, *McBarron 2462*, 1.11.1948 (NSW). **Far South Western Plains:** 'Milton Grove', c. 60 miles [96 km] SW. of Ivanhoe on Mildura road, *De Nardi 1105*, 24.10.1972 (NSW).

VICTORIA: **Region C:** Jung, near Horsham, *Beaglehole NSW 116126*, 26.10.1963 (NSW, CANB); Mt Arapiles, *Beaglehole 30679*, 15.5.1969 (MEL). **Region G:** 15 miles [24 km] SSW. of Kerang, *Beaglehole 40671*, 1.11.1972 (MEL, NSW). **Region H:** 5 miles [8 km] from Wedderburn, *Phillips CBG 003138*, 31.10.1963 (CBG). **Region M:** Tatura, *Gauba CBG 047569*, 30.10.1945 (CBG); near Kamarooka, *Robins 7975*, 26.10.1947 (NSW); between Murchison & Nagambie, *Corrick 3414*, 24.9.1973 (Corrick Herb); Bendigo, *Robins 7968*, 1.11.1948 (NSW). **Region N:** Studley Park, Melbourne, *Muir 24*, 28.9.1956 (MEL). **Region R:** Yarrawonga to Benalla road, 4 miles [6 km] from Hume Highway, *Muir 1760*, 2.11.1960 (MEL). **Region V:** Sawpit Creek, *Wakefield s.n.*, 19.5.1969 (MEL 1509948). **Region W:** between Swifts Creek & Omeo, *Hewitt (MEL 60667)*; S. of Lauries Track, East Gippsland, *Beaglehole 37217*, 5.3.1971 (NSW).

SOUTH AUSTRALIA: **Flinders Ranges:** Fergusons Gorge, 'Moolooloo' Station, *Ising* 707, 9.10.1918 (AD); Wilpena Pound, *Crisp* 919, 22.10.1974 (NSW, CBG); Alligator Gorge, *Hilton*, 5.8.1952 (ADW 44090); Mt Remarkable, *Mueller* (MEL 60664, 60665); 5 miles [8 km] from Melrose, *Hilton*, 12.9.1951 (ADW 43838, 44048, 44050); Melrose Showground, *Copley* 3207, 12.10.1970 (AD). **Eastern:** Morialta Reserve, *Spooner* 672, 2.11.1969 (AD). **Northern Lofty:** Barunga Range, Bute to Snowtown road c. 40 km NNW. of Port Wakefield, *Copley* 739, 20.10.1966 (AD); 1.5 km E. of Barunga Gap Siding, *Copley* 762, 15.10.1966 (NSW, AD); South Hummocks Range, *Copley* 3227, 25.10.1970 (AD); Tothill Range, *Kraehenbuehl* 1098, 27.10.1963 (AD); Saddleworth, *Symon* 789, 27.10.1960 (ADW); Balaklava, 42 miles [67 km] NNW. of Gawler, *Hilton* NSW 116812, 1.10.1944 (ADW, NSW); c. 1 km S. of Freeling, *Kraehenbuehl* 1450, 18.9.1965 (AD). **Murray:** 1 mile [2 km] E. of Kanmantoo, *Hilton*, 7.12.1954 (ADW 44136). **Yorke Peninsula:** Port Germain Pass, *Hilton*, 12.9.1951 (ADW 43842 to 43846). **Southern Lofty:** Roseworthy College, *Hilton*, 23.8.1941 (ADW 43840); c. 1 km W. of Angle Vale road and western side of Parafield aerodrome, *Kraehenbuehl* 1451, 18.9.1965 (AD); Modbury, *Spooner* 1273, 24.10.1970 (AD); Torrens Gorge, *Spooner* 525, 4.10.1969 (AD); Black Hill near Athelstone Oval, *Spooner* 344, 30.10.1968 (AD); Marino Rocks, *Smith* 693, 10.9.1967 (AD); Mt Barker, *Liebelt*, summer 1936–1937 (ADW 2670); Hallett Cove, *Cleland*, 24.9.1932 (AD). **South-eastern:** Greenhill Road E. of Adelaide, *Cleland*, 9.10.1948 (AD).

WESTERN AUSTRALIA: **Austin:** Ninghan, *Storr* 3301, 19.10.1959 (PERTH); between Kunnunoppin and Mt Marshall & Lake Barlee, *Fitzgerald Fraser* NSW 116813, winter–spring 1919 (NSW). **Coolgardie:** Merredin, *Maiden* NSW 116814, 10.1909 (NSW).

S. blackii is at times difficult to distinguish from *S. aristiglumis*. The coma of *S. aristiglumis* is usually much shorter and less regular. In *S. blackii* the young leaves are shortly pubescent with scattered stiff hairs amongst the pubescence. In *S. aristiglumis* the leaves, sheaths and culms are mostly glabrous and smooth.

***Stipa blakei* J. Vickery, S.W.L. Jacobs & J. Everett, sp. nov.**

S. tenuifoliae affinis sed auriculis glabris vel vix pilosis, nodis plerumque tumidis, panícula plerumque sparsiore differt.

HOLOTYPE: QUEENSLAND: **Warrego:** Charleville, *S.T. Blake* 11024, 4.4.1936. Open places on sand ca. 950 ft. Tufted, erect, 2–3 ft., dark green, spikelets paler (BRI 250581).

Caespitose perennial 0.3 to c. 1 metre high with a contracted rootstock. Culms robust, narrow, 1–2 mm wide near the base, terete, smooth or slightly ribbed, glabrous or minutely retrorsely puberulous especially just below the nodes; nodes 2–4, glabrous, usually conspicuously thickened (to 60% broader than adjacent internodes), exserted. Leaf sheaths narrow, tight around the culms (except that subtending the panicle slightly broader and looser), slightly ribbed, sparsely to densely retrorsely puberulous between the ribs, the very basal sheaths pubescent; outer margin glabrous to ciliate just below the orifice; inner margin glabrous. Ligule truncate to broad-ovate, 1–2.5 mm long, lightly ciliate, otherwise glabrous; auricles glabrous or with a few short hairs. Leaf blades linear, loosely rolled, to 28 cm long, 1.5–2 mm wide; abaxial surface glabrous and smooth, sparsely but strongly scabrous with short rigid hairs, or pubescent (especially between the nerves and at the back of the orifice); adaxial surface very strongly ribbed, ribs densely pubescent. Panicle 20–35 cm long, 2–3 cm wide (excluding awns) sparse and spreading, with distant fascicles of unequal compound branches, the base exserted; axis terete, ribbed, glabrous, scaberulous or finely pubescent; branches very fine, 3–6 cm long, pedicels very fine, flattened, especially near the apex, 7–25 mm long, minutely scaberulous on the edges. Spikelets scarcely gaping, 14–18 mm long (excluding awn). Glumes subequal, long-acute to acuminate, firm at the base but mostly hyaline, glabrous; lower glume 14–18 mm long, lower 60% 3-nerved; upper glume 13–17 mm long, lower 50% 5-nerved. Floret narrow-cylindrical, 7–8 mm long (including callus). Lemma only loosely enclosing the palea and caryopsis,

visually tuberculate (but so minutely as to feel smooth), dark brown at maturity, with sparse, short, dull white to yellowing hairs, sparsest at the apex, densest on the margins; lobes 2, c. 0.1–0.2 mm long, coma absent. Callus straight, 2.5–3 mm long, with hairs similar to those on the lemma. Awn robust, 0.3–0.4 mm wide near the base, 7–10 cm long, strongly falcate; column 9–13 mm long, pubescent with spreading antrorse hairs 0.2–0.3 mm long; bristle scabrous, much paler than the column at maturity. Palea very broadly obtuse, firm but the margins more delicate, subequal to the lemma, with similar hairs scattered down the back. Lodicules 2, abaxial, long-cuneate c. 2 mm long. Anthers c. 3 mm long, lightly penicillate. Caryopsis c. 4.5 mm long.

DISTRIBUTION: Mainly on sandy soils in western Queensland.

SPECIMENS EXAMINED: QUEENSLAND: **Leichhardt**: Cairdbeign via Springsure, *Norton*, 2.1903 (BRI 228952); from the Dawson, [? *Leichhardt*] 322, 16.1.1847 (MEL 60005). **Mitchell**: Williwin, 12 miles [19 km] W. of Yalleroi, *Everist 1837*, 23.6.1939 (BRI). **Warrego**: Chesterton, c. 25°20'S, 147°20'E. *Blake 11104*, 7.4.1936 (BRI, NSW); Charleville, *Blake 11024*, 4.4.1936 (BRI, NSW); 10 km ENE of "Maryvale" homestead, 26°34'S, 146°58'E, *Purdie 368D*, 17.6.1976 (BRI, 2 sheets). **Maranoa**: Mitchell, *Blake 5690*, 4.4.1934 (BRI, NSW); 'Amby Downs', *Scortechini*, 12.1883 (NSW); Wycanna, 134 km W. of Goondiwindi, 28°02'S, 149°01'E, *C.H.P. Y1644*, 30.5.1974 (BRI, CANB); Nindigully, *Willoughby 17*, 4.1940 (BRI).

This species is named after Dr S.T. Blake, a Queensland botanist who, over many years, advanced our knowledge of the taxonomy of Australian grasses.

It differs from *S. tenuifolia* in the glabrous or very sparsely hairy auricles, the usually swollen nodes and in the usually sparser panicle. It differs from *S. nodosa* in the glabrous or very sparsely haired auricles and the stronger awn.

Stipa breviglumis *J. Black*, Trans. & Proc. Roy. Soc. S. Austral. 65: 333 (1941); Willis, Handb. Pl. Victoria 1: 181 (1962), edn 2: 181 (1970).

SYNTYPES: SOUTH AUSTRALIA: cited as 'Lyndoch, Oct. 1927, *J.B. Cleland*; Mount Brown, Nov. 1881 (in Tate Herb.)'. At AD there is a sheet from Cleland's herbarium labelled 'Lyndoch 8.10.27' in J.B. Cleland's handwriting, and the initials "J. M. B." (associated with an unpublished epithet) in Black's handwriting; Black has not written the epithet 'breviglumis' on it, but it is evident that he saw and examined it. This sheet bears a satisfactory specimen and we designate it as the **Lectotype**. A small duplicate of this specimen is at MEL (MEL 59884) and bears the name 'breviglumis' and collecting data in Black's handwriting. In AD there is also a sheet from the Tate herbarium bearing a single panicle surmounting a portion of a culm, alongside which Black has written the name *Stipa breviglumis*; the sheet also bears three other panicles, two of which are *S. platychaeta* and the third a species of the Falcatae. In describing this species as a robust rigid grass, Black must have had in mind the Cleland specimen that clearly shows this character, whereas the Tate herb. specimen is inadequate to support his statement.

Caespitose or very shortly rhizomatous perennial c. 1.5 metres high, often with several branches at the nodes, without a basal tuft of leaves. Culms erect or slightly geniculate at the base, terete, c. 2.5 (–4) mm wide near the base, not compressible, slightly to moderately ribbed, glabrous; nodes 2–4, exserted, glabrous, to 50% wider than the adjacent internodes. Leaf sheaths ± inflated, minutely puberulous or scaberulous with minute tubercles, glabrous; basal sheath to 1 cm wide, slightly to strongly ribbed; upper sheath 3.5–4 mm wide, moderately ribbed. Ligule truncate, membranous, 1–7 mm long, glabrous; auricles ± thickened, c. 1 mm long. Leaf blade expanded or loosely inrolled, 2–2.5 mm wide, to 20 cm long; adaxial surface strongly ribbed, minutely puberulous or scabrous with minute tubercles; abaxial surface strongly ribbed, glabrous; margins glabrous. Panicle 20–40 cm long, exserted, with distant fascicles of unequal, few-flowered, branches, contracted, 2–4 cm wide (excluding

awns); axis slightly angular or terete and strongly ribbed, glabrous to minutely puberulous; branches 5–10 cm long, slightly angled or terete and moderately ribbed, minutely sericeous along the ribs or edges; pedicels 2–6 mm long, slightly angled, minutely sericeous. Spikelets 5–6.5 mm long (excluding awn), gaping. Glumes subequal, acute-acuminate, hyaline with chlorenchyma bands associated with the nerves, sericeous with hairs minute–0.3 (–0.5) mm long; lower glume 5.5–6.5 mm long, lower 30–65% 5–3-nerved, upper 35–70% 3–1-nerved; upper glume 4.5–6 mm long, lower 75–95% 3-nerved, upper 25–5% 1-nerved. Floret narrowly cylindrical tapering to a slender neck, 3–4.5 mm long (including callus). Lemma slightly granular, with white hairs 0.2–0.4 mm long; lobes absent; coma sparse, c. 0.2 mm long. Callus c. 0.5 mm long, slightly curved, the tip blunt, sericeous with white hairs minute–0.5 mm long. Awn 2–3.5 cm long with 1–2 bends, 0.1–0.2 mm wide near the base; column 1–1.5 cm long, 5–6.5 mm to the first bend, straw-coloured to brown with 2 chlorenchyma bands, minutely scabrous; bristle often darker than the column, minutely scabrous. Palea 50–60% the length of the lemma, obtuse, sparsely sericeous along the centre back with white hairs 0.1–0.4 mm long. Lodicules 3; 2 abaxial, membranous, c. 0.25 mm long, obtuse; paleal membranous, c. 0.25 mm long, lacinate. Anthers c. 1.25 mm long, minutely penicillate. Mature caryopsis not seen.

DISTRIBUTION: Central and southern Victoria and into the Lofty Regions of South Australia.

SELECTED SPECIMENS: VICTORIA: **Region H:** St Arnaud, *Rouell*, s.d. (BRI). **Region M:** Kamarooka, N. of Bendigo, *Morris*, 10.1947 (MEL 5985); Kamarooka Forest, 30 km NNE. of Bendigo, *Beaglehole 55242 & Kellam*, 17.10.1976 (ACB, NSW); Rushworth State Forest (Forest Park N. of Graytown), *Corrick 3578*, 3.11.1973 (Herb Corrick). **Region N:** Lerderberg Gorge, *Kenna*, 3.6.1956 (MEL 59886); Coimadai Lane, off Bacchus Marsh Road, c. 28 miles [45 km] from Melbourne, *no collector*, 1935 (MEL 59888).

SOUTH AUSTRALIA: **Flinders Ranges:** Alligator Gorge, Wilmington, *Cooper*, 14.8.1954 (AD 966071541); Alligator Creek, *Ising NSW 116024*, 23.10.1928 (NSW, ADW). **Northern Lofty:** Northern Tothill Range, Niblet Gap, c. 30 km NE. of Marrabel, *Kraehenbuehl 2177*, 29.10.1967 (AD). **Southern Lofty:** Lyndoch, *Cleland*, 8.10.1927 (BRI, fragment from Lectotype); Finnis, *Cleland*, 10.8.1963 (AD 97210220); Goolwa, Railway line to Currency Creek, *Cleland*, 17.8.1940 (AD 96323293).

S. breviglumis differs from *S. verticillata* in having firmer, not hyaline, rather broader and more scabrous glumes, and a relatively longer (60–70% of lemma length) and more hairy palea. *S. breviglumis* is widespread but uncommon and tends to grow under trees or scrub and on rocky areas whereas *S. verticillata* tends to grow in open grasslands. Black, *Fl. S. Austral.* edn 2: 92 (1943), and Eichler, *Suppl. to Black's Fl. S. Austral.*: 49 (1965), incorrectly identified specimens of *S. breviglumis* as *S. verticillata*.

***Stipa campylachne* Nees in Lehmann, Pl. Preiss. 2: 99 (1846).**

S. semibarbata var. *campylachne* (Nees) Benth., *Fl. Austral.* 7: 569 (1878); Gardner, *Fl. W. Austral.* 1, Gram.: 179 (1952). Based on *S. campylachne*.

TIPIFICATION: Nees cites: 'In solo sublimoso jugi montium Darling's-range, Perth. Herb. Preiss No. 1848. Ad flumen Cygnorum. Drummond'. Nees' herbarium was in B and has been destroyed. Preiss' herbarium is now at LD with a substantial set of duplicates at MEL. There is one specimen of *Preiss 1848* at LD; this specimen is *S. tenuifolia* and it is not a good match for the original description as it lacks both a white-pubescent column and hairy sheaths. There is no annotation by Nees on the specimen and, presumably, he did not see it. In MEL there are two sheets of *Preiss No.*

1848 which have been annotated *S. campylachne* Nees but which manifestly represent two entirely different species. One of these sheets, MEL 59990, bears a complete, rather robust culm with panicle bearing glumes and an imperfect floret, a packet containing other more or less imperfect florets, and a fascicle of strongly hirsute-pubescent leaves with the lower part of a culm. This specimen is a good match for the protologue despite the absence of mature florets. In many ways the specimen strongly resembles *S. semibarbata* R. Br., but differs in its shorter lemma, column and bristle. The other sheet, MEL 59950, bears a plant with a strongly curved falcate bristle above the more or less straight, erectly pubescent culm and is *S. tenuifolia* Steud. The florets could not, in any respect, be said to resemble either *S. pubescens* or *S. semibarbata* with which *S. campylachne* was associated by Nees, and later with *S. semibarbata* by Bentham and Hughes. This specimen is presumably a true duplicate of *Preiss 1848* at LD. We have therefore based the following concept of *S. campylachne* on the sheet MEL 59990 and we here designate this as the **Lectotype**. There is a duplicate of this specimen in S but it has only one immature fruit remaining.

Caespitose perennial c. 0.8 metres high, not rhizomatous, with a basal tuft of leaves c. half the height. Culms erect or geniculate at the base, 1–2 mm wide near the base, \pm compressible, terete, slightly ribbed to smooth; basal culms pubescent with hairs 0.1–0.4 mm long to 0.8 mm near the nodes; upper culms glabrous to pubescent with hairs minute to 0.4 mm long; nodes 2–4, exserted, densely sericeous with hairs 0.2–0.6 mm long, c. 50% wider than the adjacent internodes. Leaf sheaths tightly enveloping the culm, basal sheath 5–8 mm wide, pubescent to hirsute with hairs to 1 mm long, slightly to moderately ribbed, inner margin glabrous, outer margin ciliate with hairs 0.1–0.4 mm long; upper sheath 4–5 mm wide, pubescent to hirsute with hairs to 1 mm long, also with hairs 1.5 mm long around the collar, strongly ribbed, inner margin glabrous, outer margin ciliate with hairs similar to those on the abaxial surface. Ligule truncate, membranous, 0.3–0.6 mm long, minutely ciliate; auricle sometimes present to 1.5 mm long, glabrous. Leaf blade weakly rolled, 1.5–2 mm wide, up to 35 cm long; abaxial surface strongly ribbed, the surface slightly scabrous with minute tubercles, pubescent to hirsute with hairs (0.1–) 0.3–0.9 mm long; adaxial surface strongly ribbed, pubescent to hirsute with hairs (minute–) 0.2–0.4 mm long; margins sparsely ciliate with hairs 0.5–0.7 (–1.5) mm long. Panicle 10–20 cm long, exserted, with distant fascicles of unequal, few-flowered, compound branches, contracted (but spreading at anthesis), 2–3 cm wide (excluding awns); axis slightly flattened to terete, scabrous with stiff hairs 0.05–0.3 mm long; branches angular to slightly flattened, 2–3 cm long, scabrous along the edges with stiff hairs 0.1–0.3 mm long; pedicels angular, 0.2–1 cm long, scabrous with stiff hairs 0.05–0.3 mm long. Spikelets 14–23 mm long (excluding awn) gaping. Glumes subequal to equal, acuminate, scabrous along the nerves with hairs 0.05–0.25 mm long, sparsely scabrous between the nerves with hairs minute–0.15 mm long, hyaline, chrenchyma bands associated with the nerves; lower glume 15–23 mm long, lower 40–55% 3-nerved, upper 45–60% 2–1-nerved; upper glume 14–18 mm long, lower 35% 5-nerved, upper 65% 4–1-nerved. Floret cylindrical, without a neck, 8–9 mm long (including callus). Lemma surface smooth to scabrous upwards, with sparse hairs 0.3–1 mm long; lobes absent; coma absent. Callus 2–2.5 mm long, densely sericeous with hairs 0.2–0.8 mm long, tip glabrous and weakly bent. Awn 5–7 cm long, twice bent, 0.4 mm wide near the base; column c. 30 mm long, c. 20 mm to the first bend, straw-coloured, pubescent to plumose with hairs (0.3–) 0.5–1 (–1.6) mm; bristle straw-coloured, scabrous with hairs c. 0.1 mm long. Palea equal to the lemma, acute, surface smooth, with sparse hairs 0.5–0.8 mm long down the centre, margins hyaline. Lodicules 2, abaxial, membranous, (1.2–) 1.6–1.8 (–2.4) mm long, obtuse. Anthers 2.5–3.5 mm long \pm penicillate. Caryopsis 4–5 mm long; embryo 20% the length; hilum 80–100% the length.

DISTRIBUTION: The south-west of Western Australia.

SELECTED SPECIMENS: WESTERN AUSTRALIA: **Darling:** Smiths Mill, *Morrison*, 13.11.1897 (BRI); Mundaring, *Helms*, 25.7.1897 (PERTH); Welshpool to Kalamunda, *Maiden*, 9.1909 (NSW 116932); Armadale, *Symon*, 9.1954 (ADW 28146); Wungong Gorge near Armadale, *Blake 18019*, 24.8.1947 (BRI, PERTH); Araluen, Darling Range, in Jarrah forest, *Burbidge 3641*, 9.12.1951 (CANB); Darling Range, *Morris*, 9.1947 (MEL 60829, 60830); Pinjarra, *Helms*, 27.9.1897 (PERTH); Harvey, *no collector*, 1911 (PERTH); Hamel near Drakesbrook, *Blake 18045*, 31.8.1947 (BRI); Upper Blackwood R. on wooded ridges, *Mueller*, 10.12.1877 (MEL 60831); banks of Blackwood R., *Oldfield 675* (MEL 60687); 39.4 miles [63 km] from Collie towards Williams, *Canning CBG 039953*, 1.10.1968 (CBG); Capel, *Royce 2684*, 24.9.1948 (PERTH). **Warren:** 3 miles [5 km] W. of Mayanup, *Burbidge 2551*, 9.12.1951 (CANB); Mt Barker, *Mueller*, 10.1867 (MEL 60820); King Georges Sound, *Muir, s.d.* (MEL 60810).

S. campylachne is close to *S. semibarbata* but the distinctive hirsute-pubescent of its foliage in many specimens, the usually narrower, more delicate glumes and shorter lemma, column and bristle, appear to make it worthy of separate recognition in specific rank.

**Stipa caudata* Trin., Mém. Acad. Imp.Sci.- St. Pétersbourg Sér. 6, Sci. Math 1: 75 (1830); Rosengurtt, de Maffei & de Artucio, Gramineas Uruguayas: 73 (1970); Caro & Sanchez, Darwiniana 16: 643 (1971).

HOLOTYPE: "V. spp. chilens" (LE, not seen), said to be a Lindley collection from Chile, *s.n., s.d.*

Caespitose perennial 0.75–1 metre high with a basal tuft half to three quarters the height, without rhizomes. Culms erect, terete to slightly angled, not compressible, slightly ribbed at the base to smooth or strongly ribbed upwards, glabrous; nodes 2–4, \pm exserted, glabrous, not swollen. Leaf sheaths tightly enveloping the culm, sometimes becoming loose upwards, glabrous; basal sheaths 6.5–7 mm wide, slightly ribbed, margins glabrous; upper sheaths 3–3.5 mm wide, strongly ribbed, inner margin with hairs 0.4–0.6 mm long to glabrous, outer margin with hairs 0.5–1.5 mm long to glabrous. Ligule truncate to obtuse, membranous, 0.1–0.5 mm long, ciliate with hairs 0.2–1.5 mm long, also with a tuft of hairs present at the sides; auricles, if present, thickened, c. 0.8 mm long, glabrous. Leaf blade expanded to tightly rolled, 1–2.5 mm wide, to 50 cm long; abaxial surface strongly ribbed, glabrous; adaxial surface strongly ribbed, minutely scabrous along the ribs; margin with hairs 0.2–1 mm long to minutely scabrous. Panicle 15–25 cm long, exserted, with distant fascicles of unequal, few-flowered, compound branches, contracted, c. 2.5 cm wide (excluding awns); axis terete to slightly flattened, strongly ribbed, scaberulous with sparse minute hairs; branches 1.5–6 cm long, angled, scaberulous along the edges with hairs minute–0.2 mm long; pedicels 0.1–1 cm long, slightly angled, scaberulous along the edges with hairs minute–0.3 mm long. Spikelets 6–9 mm long (excluding awn), gaping. Glumes subequal, hyaline with chlorenchyma bands associated with the nerves, acuminate; lower glume 6–9 mm long, glabrous or scaberulous along the midrib with hairs minute–0.2 mm long, the margins with sparse hairs 0.05–0.1 mm long, lower 40–65% 3-nerved; upper glume 6–9.5 mm long, scaberulous along the midrib with hairs 0.1–0.2 mm long to glabrous, lower 50–60% 3-nerved, upper 40–50% 1-nerved. Floret cylindrical, 4–6 mm long (including callus), without a neck. Lemma surface scaberulous with minute tubercles, with hairs 0.2–1 mm long along the midrib and margins; lobes 0.3–0.4 mm long, coma of hairs 0.2–1 mm long. Callus c. 0.6 mm long, straight, blunt, densely sericeous with white hairs 0.1–1 mm long. Awn 1.2–1.8 cm long, twice bent, 0.1–0.2 mm wide near the base; column 6–9 mm long, 3–4 mm to

the first bend, straw-coloured, scaberulous with hairs minute–0.2 mm long; bristle straw-coloured, scaberulous with hairs minute–0.2 mm long. Palea \pm equal to the lemma, acute, the surface smooth to granular, sericeous along the centre back with hairs 0.2–0.8 mm long, margins glabrous. Lodicules 3; 2 abaxial, membranous, oblong, 1–1.3 mm long; paleal membranous, acute, c. 0.5 mm long. Anthers 3–3.5 mm long, penicillate. Only immature caryopsis seen, obovate, c. 3 mm long, embryo 30% the length, hilum c. 80% the length, the stylar appendage eccentric.

DISTRIBUTION: An introduction from South America, uncommon on roadsides on the Western Slopes of New South Wales; also scattered on Flinders I. in Bass Strait.

SELECTED SPECIMENS: NEW SOUTH WALES: **Central Western Slopes:** Merriwa district, *Henderson NSW 117377*, 15.11.1955 (NSW), *Merriwa Shire Council NSW 117378*, 1.1956 (NSW). **South Western Slopes:** Cootamundra district, *Christenson NSW 117379*, 5.11.1959 (NSW).

TASMANIA: Flinders Island: Emita, *Warren NSW 117376*, 4.12.1979 (NSW).

S. caudata has been known in Australia as *S. brachychaeta* Godron, Mém. Sect. Sci. Acad. Sci. Montpellier 1: 450 (1853). (The latter name appears on some of our determinavit labels.) These two South American species are difficult to distinguish. They are generally said to be distinguished by: (i) *S. caudata* having hairs on the margins and midrib of the lemma, and a broader caryopsis with an eccentric stylar appendage; (ii) *S. brachychaeta* having hairs all over the lemma surface, and a narrower caryopsis with a centric stylar appendage. The type of *S. brachychaeta* (Godron (NYC!)) has lemmas showing both character states on the one inflorescence. In Australian specimens, the only caryopses we have found are immature and in a glasshouse-grown specimen (*Morris*, 19.1.1981 (HO)); and these match the description of *S. caudata*. We have as yet been unable to find caryopses of either *S. brachychaeta* or *S. caudata* for comparison. We are using the earlier name *S. caudata* although we are not yet convinced the situation is fully understood.

***Stipa centralis* J. Vickery, S.W.L. Jacobs & J. Everett, sp. nov.**

S. eremophilam aemulans sed cataphyllis et vaginis foliorum basaliis lanatis, pilis lemmatis pallidioribus sparsioribusque, differt.

HOLOTYPE: NORTHERN TERRITORY: Mt Riddock 23°06'S, 134°38'E. Erect perennial. Common in skeletal soil, southern slope of metamorphic hill. *P.K. Latz 4305*, 13 Sept. 1973 (NT 41138).

Caespitose perennial to c. 0.8 metres high, with a short rhizome. Shoots conspicuously extravaginal, the basal leaves at least as long as the culms. Culms numerous, terete, very tough, c. 1 mm wide near the base, glabrous, smooth; nodes 4–5, glabrous, exserted. Leaf sheaths tight around the culms, minutely puberulous to glabrous, but the cataphylls and most basal sheaths densely woolly with long, soft, slightly spreading hairs. Ligule acute, coriaceous, 0.6–1 mm long, densely sericeous on the back. Leaf blades linear, to 25 cm long, c. 1.5 mm wide, loosely inrolled; abaxial surface slightly ribbed, smooth, glabrous; adaxial surface very strongly ribbed, minutely scabrous; margins glabrous to scabrous. Panicle, with distant fascicles of few-flowered branches, very sparse, with less than 30 spikelets, 10–20 cm long, 1–2.5 cm wide (excluding awns), exserted but not exceeding basal leaves; axis, pedicels and branches angular, scaberulous with sparse, short, stiff hairs; branches 15–40 mm long; pedicels slender, 3–25 mm long. Spikelets gaping, 13–18 mm long (excluding awn). Glumes slightly unequal, broad, acuminate, hyaline, the tips easily torn; densely

short-scabrous to pubescent to glabrous at the tips; lower 13–18 mm long, 3-nerved; upper 12–16 mm long, 5-nerved to the middle. Floret 7–9 mm long (including callus), narrow-turbinate. Lemma pale to dark brown at maturity but the central nerve very pale and visible; with sparse white hairs at the base; becoming glabrous upwards between the nerves; surface finely granular to finely retrorsely hooked-tuberculate upwards; lobes 2, c. 0.3 mm long or minute or absent; coma absent or a few hairs to 0.3 mm long present. Callus straight, 1.5–2.5 mm long, sericeous with dense yellowish hairs. Awn c. 0.3 mm wide, 50–60 mm long, twice bent; column 19–25 mm long, 12–13 mm to the first bend, pubescent with slightly spreading hairs 0.25–0.4 mm long; bristle scabrous. Palea to 0.8 mm shorter than the lemma, acute, ciliate-tipped, granular, sparsely hairy down the middle of the back. Lodicules 2–3, c. 1 mm long; 2 abaxial, linear to slightly spatulate; paleal acute or absent. Anthers 0.8–1.5 mm long, penicillate. Mature caryopsis not seen, apparently c. 2.5 mm long.

DISTRIBUTION: Slopes of the Central Australian Ranges.

SELECTED SPECIMENS: NORTHERN TERRITORY: **Central Australia:** Mt Palmer, Harts Range, 23°06'S, 134°57'E, *Beaglehole* 44747, 28.5.1974 (NSW); Mt Riddock, 23°06'S, 134°38'E, *Latz* 4305, 13.9.1973 (NT, NSW, BRI); Valley of the Eagles, 23°37'S, 134°27'E, *Beaglehole* 44945, 2.6.1974 (NT, NSW); 5 km SE. of Reedy Rockhole, 24°19'S, 131°38'E, *Latz* 8997, 18.8.1982 (NSW, duplicate from NT).

The specific epithet refers to the Central Australian distribution of this species.

Similar in appearance to *S. eremophila* but differing in the woolly cataphylls and basal leaf sheaths, and in the lighter-coloured and sparser hairs on the lemma.

***Stipa compressa* R. Br.**, Prodr.: 175 (1810); Bentham, Fl. Austral. 7: 567 (1878); Hughes, Kew Bull. 1921: 26 (1921); Gardner, Fl. W. Austral. 1, Gram.: 176 (1952).

HOLOTYPE: WESTERN AUSTRALIA: King Georges Sound, *A. Menzies* (BM!).

SYNONYM: *S. longearistata* Steudel, Syn. Pl. Glum. 1: 127 (1854). HOLOTYPE: Cited as 'Urville legit ad Port George, N. Holl.' (not seen). Steudel's descriptions could only apply, as indeed he himself suggests, to a plant of *S. compressa* R. Br.

Caespitose annual (to short-lived perennial?) to 0.7 metres high, without rhizomes and with a basal tuft of slender shoots c. a quarter the height. Culms erect, mostly terete, \pm compressible, to 3.5 mm wide, slightly ribbed to smooth upwards, glabrous; nodes 2–5, glabrous, concealed by the sheaths or at length exerted, to 25% wider than the adjacent internodes. Leaf sheaths usually inflated, glabrous to minutely scaberulous; basal sheaths broad, to 12 mm wide, slightly to strongly ribbed, inner margin glabrous, outer margin ciliate with hairs c. 1 mm long; upper sheaths 5–5.5 mm wide, strongly ribbed, inner margin sparsely ciliate with glistening hairs c. 0.5 mm long, outer margin ciliate with hairs 0.6–0.8 mm long. Ligule membranous, obtuse, entire to laciniate, longest on upper leaves, 4–11 mm long, minutely scaberulous on the abaxial surface, continuous on the upper sheaths with acute auricle lobes, the lobes glabrous or minutely scaberulous on the abaxial surface; auricles thickened, 0.5 mm long, with hairs at the base. Leaf blades triangular to linear, either as broad and expanded at the base as the sheaths or to half the width, upwards loosely convolute, to 20 cm long; abaxial surface strongly ribbed, glabrous and smooth to scaberulous with minute hairs; adaxial surface strongly ribbed, densely and

minutely scabrous to pubescent with hairs c. 0.2 mm long; margins glabrous or scabrous. Panicle contracted or at length narrowly spreading, with distant fascicles of many unequal simple or compound branches, 10–30 cm long (excluding awns), 1–4 cm wide; axis smooth and glabrous to minutely scabrous, \pm angled; branches to 10 cm long, glistening, scabrous with minute hairs; pedicels 0.5–2 cm long, angled, scabrous with hairs minute–0.1 mm long. Spikelets 13–21 mm long (excluding awn), gaping. Glumes green to straw-coloured, translucent, glabrous to scabrous at the tips, very unequal; lower glume 13–21 mm long, acute to acuminate, lower (40–) 66% 3-nerved, scabrous, glabrous at the base; upper glume 9–14 mm long, acute, lower 50 (–66)% 5-nerved, upper 50 (–33)% 3–1-nerved, glabrous to minutely scabrous at the tip. Floret narrow-cylindrical, 6.5–8.5 mm long (including callus). Lemma with 1 or 2 lobes to 0.25 mm long, smooth, white to pale yellow at maturity, at least the central nerve visible externally, shortly and stiffly pubescent with hairs white to grey at maturity 0.2–0.3 mm long; coma absent. Callus straight, 2.5–3.5 mm long, densely sericeous with hairs 0.2–0.5 mm long. Awn 8–14 cm long, 0.25–0.4 mm wide near the base, slightly twice bent; column dark brown at maturity, 2–4 cm long, 1.4–3 cm to the first more gradual but stronger bend, scabrous with hairs 0.05–0.2 mm long; bristle pale yellow, much paler than the column, scaberulous with hairs 0.05–0.1 mm long. Palea acute, subequal to the lemma, with hairs 0.2–0.3 mm long down the centre, the surface smooth, margins glabrous. Lodicules 2 or 3, membranous; 2 abaxial oblong, 1–1.5 mm long; paleal absent or acute and c. 0.2 mm long. Anthers 1.5–2.5 mm long, not penicillate. Caryopsis 3–3.5 mm long; embryo 15–25% the length; hilum 80–90% the length.

DISTRIBUTION: Mainly sandy areas near the coast of south-western Western Australia.

SELECTED SPECIMENS: WESTERN AUSTRALIA: **Darling:** Yanchep, *Aplin 2979*, 12.10.1965 (PERTH); Middle Swan River, *Sewell*, 1894 (MEL 60920); Kings Park, Perth, *Roe*, 4.10.1934 (CANB 1233); South Perth, *Carne*, 11.11.1923 (PERTH); Cottesloe near mouth of Swan R., *A.M. [?]*, 21.10.1899 (BRI); Claremont, *Andrews*, 10.1902 (PERTH); Helena Valley, *Seabrook 435*, 22.10.1977 (PERTH); S. of Jandakot, *Aplin 1061*, 10.1961 (PERTH); Armadale, *Symon*, 9.1954 (ADW 28127); Jandakot Marsupial Breeding Station, Lake Banganup, *Western 9805*, 2.11.1974 (PERTH); Forrestdale, c. 15 miles [24 km] SSE. of Perth, *Man & George 11*, 7.11.1969 (PERTH); Pinjarra, Murray R., *Helms*, 22.9.1897 (PERTH); Harvey, *Stoward NSW 116594*, 10.1911 (NSW, K); Jindong, *Royce 2864*, 18.10.1948 (PERTH); nr. NW. side of Lake Unicup, S. of Tonebridge, *Pullen 9975*, 11.12.1874 (CANB, NSW); nr. Lake Muir, *Christensen 181*, 10.11.1970 (PERTH); Bow River, *Jackson NSW 116596*, 11.1912 (NSW); between Irwins Inlet & Brookes Inlet, *Jackson NSW 116597*, 12.1912 (NSW). **Eyre:** Cape Arid National Park, E. of Esperance, *Royce 9934*, 1.12.1971 (PERTH).

***Stipa crinita* Gaudich.** in Freycinet, *Voy. Uranie Bot.*: 407 (1830).

HOLOTYPE: WESTERN AUSTRALIA: 'Novae-Hollandiae ora occidentalis (baie des Chiens Marins)' [Shark Bay] collected by Labillardière (P!; isotypes G, FI-W). This specimen had been regarded as lost for some time (Hughes, *Kew Bull.* 1922: 21), causing much confusion in the use of the name. Fortunately, the specimen was found in P after having been misfiled some time ago. The specimen referred to by Hughes (*ibid.*) as *S. flavescens* is a specimen of *S. pubescens*.

Caespitose perennial to 1 metre high with very short rhizomes. Shoots conspicuously extravaginal. Culms erect, terete, (1.5–) 2–2.5 (–3.5) mm wide, finely to strongly ribbed, glabrous but minutely puberulous between the ribs on the lower parts and just below the nodes; nodes 2–4, sericeous, exserted. Leaf sheaths tight around the culms and shoots, glabrous, lower sheaths sometimes puberulous; outer margin glabrous but sparsely long-ciliate on the basal sheaths; inner margin glabrous. Ligule broadly obovate to ovate, 0.5–2 mm long, short- to long-ciliate, puberulous on the back; auricles with several to many hairs c.

1 mm long in a tuft. Leaf blades flat or weakly rolled, to 30 cm long, 1.5–4 mm wide; abaxial surface ribbed, glabrous to sparsely pubescent on the ribs, densely puberulous to scaberulous between the ribs; adaxial surface ribbed, short- to long-pubescent and, in addition, antrorsely scabrous between the ribs; margins glabrous. Panicle linear, contracted, 15–30 cm long, densely flowered with close fascicles of unequal, many-flowered compound branches, base enclosed by the sheath until late maturity; axis sparsely scaberulous; branches 15–40 mm long, glabrous to scaberulous, slightly ribbed; pedicels slightly angular, 2–8 mm long, puberulous to scaberulous. Spikelet 9–15 mm long (excluding awn), not or only slightly gaping. Glumes acute or shortly acuminate, evenly textured from base to tip, green or bleached, rarely evenly purple-tinged, unequal, puberulous to scaberulous, sometimes glabrous between the nerves; lower glume 9–15 mm long, the lower 65–75% 3-nerved; upper glume 7.5–11.5 mm long, lower 30% 4–5-nerved, the next 35–45% 3-nerved. Floret very narrow elliptic, 5–6.5 mm long (including callus). Lemma smooth, white to tawny at maturity, with long, soft, slightly spreading, white to yellow hairs, the upper overlapping the base of the awn, appearing to form a 2 mm coma, lobes absent. Callus straight, 1.3–1.4 mm long, sericeous with similar hairs to the lemma. Awn very slender, 0.15 mm wide near the base, 23–38 mm long, twice bent; column 7–12 mm long, 3–7 mm to the first bend, antrorsely scaberulous with hairs less than 0.1 mm long; bristle antrorsely scabrous. Palea acute, c. 0.5 mm shorter than the lemma, sericeous with long, soft hairs. Lodicules 2, membranous, abaxial, oblong, 1.5 mm long. Anthers not observed. Caryopsis not observed.

DISTRIBUTION: Islands and coast around the Shark Bay area of Western Australia.

The ms. name “*S. peronensis*” appears on some of our early determinavit slips on specimens of this species.

SELECTED SPECIMENS: WESTERN AUSTRALIA: **Carnarvon:** W. of White Beach, Dorre Island, *Weston 10484*, 13.8.1977 (PERTH); Dorre Island, Shark Bay, *Royce 5909*, 15.7.1959 (PERTH); Sandy Point, Dirk Hartog Island, 25°42'S, 113°03'E, *George 11536*, 5.9.1972 (PERTH); Cape Ransonnet, Dirk Hartog Island, 26°09'S, 113°13'E, *George 11394*, 2.9.1972 (PERTH); nr. 'Peron Peninsula' Station, *Whitley NSW 135864*, 5.9.1972 (NSW); Peron Peninsula, *Blackall 4640* (in part), 9.1940 (PERTH); Mt Elliot, Carrarang, *Beard 7073*, 16.10.1974 (PERTH). **Irwin:** N. to Houtman Abrolhos, *Storr 2225*, 6.9.1959 (PERTH).

***Stipa curticomma* J. Vickery**, *Telopea* 2(1): 11 (1980).

HOLOTYPE: SOUTH AUSTRALIA: Mt Lofty Ranges, 3 km S. of Mt Barker, *M.D. Crisp 884*, 13.10.1974 (CBG 058899).

Caespitose perennial to 1.2 metres high with a basal tuft of leaves c. one third the height. Culms usually geniculate at the base, terete, 2–3 mm wide near the base, scarcely compressible, slightly ribbed, glabrous except puberulous at the very base and just below the nodes; nodes 3–4, exserted, sericeous, 25–40% broader than adjacent internodes. Leaf sheaths at first tightly enveloping the culm, later becoming free, 4–6 mm wide, $\frac{1}{2}$ – $\frac{2}{3}$ the length of the internodes; basal sheaths puberulous, especially just below the orifice, to almost glabrous; upper sheaths minutely scaberulous or glabrous, occasionally puberulous near the margins; outer margin ciliate or, on upper sheaths, glabrous. Ligule truncate, coriaceous, 0.5–1.5 mm long, ciliate, abaxial surface puberulous; auricles usually thickened and spreading, with hair tufts to 1 mm long. Leaf blade flat or weakly rolled (those of the basal tuft more tightly so), 3–5 mm wide, to 30 cm long; abaxial surface slightly ribbed, glabrous or densely scabrous with minute hairs, with occasional, scattered, moderately long, rigid, straight

hairs or strong hooks; adaxial surface ribbed, minutely scaberulous, sometimes with scattered longer hairs; margins similar to abaxial surface or with occasional long, stiff, scabrous hairs. Panicle 15–30 cm long, exerted, with distant fascicles of unequal, few- to many-flowered, compound branches, usually spreading, 5–7 cm wide (excluding awns); axis terete to flattened upwards, glabrous to scabrous with glistening hairs upwards; branches to 10 cm long, flattened to angular, the edges scabrous with glistening hairs; pedicels 4–16 mm long, flattened to angular, scabrous with glistening hairs on the edges. Spikelets 12–16 (–18) mm long (excluding awn), gaping slightly at first, but widely after floret disarticulation. Glumes unequal, acuminate to acute-oblong, firm and green at the base, membranous and purple-tinged across the centre, hyaline and occasionally torn at the tip, scaberulous on the nerves only, or overall, slender chlorenchyma bands associated with the nerves; lower glume 12–16 (–18) mm long, the lower 60–75% 3-nerved; upper glume 9–14 mm long, lower 30% 5-nerved, next 30–45% 3-nerved. Floret oblong-cylindrical with a well defined neck, (5.8–) 6.5–8 mm long (including callus). Lemma very slightly gibbous at maturity, reddish brown to almost black at maturity, the central nerve slightly thickened, the surface granular, with sparse spreading white hairs glistening at maturity, sparser towards the apex; lobes 2, 0.1 (–0.5) mm long; coma 0.5–1.0 mm long but usually with a few hairs to 0.5 mm longer. Callus 1.5–2.5 mm long, sharp, sturdy and curved, sericeous with hairs yellowing at maturity. Awn 45–65 mm long, twice bent, 0.25–0.35 mm wide near the base; column 18–25 mm long, 9–11 mm to the first and stronger bend, densely pubescent with spreading glistening hairs 0.25–0.5 mm long; bristle scabrous. Palea ± equal to the lemma to shorter by 0.3 mm, broadly acute to acuminate, finely granular down the back, hyaline on the margins to membranous at the tip with sparse hairs down the centre and occasionally at the tip. Lodicules 3, membranous; 2 abaxial 1.3–2.0 mm long, oblong to narrow-cuneate; paleal 1–1.3 mm long, oblong to narrow-triangular. Anthers 3–3.5 mm long, penicillate. Caryopsis c. 4 mm long; embryo 30% the length; hilum 90% the length.

DISTRIBUTION: Heavier soils of the Lofty regions of southern South Australia, Kangaroo Island and extending into the Grampians, Victoria.

SELECTED SPECIMENS: VICTORIA: **Region C:** 4.7 km from Dimboola, Nhill road, *Canning* 2972, 11.11.1969 (NSW); Grampians, Mt. Arapiles, *Beaglehole* 29667, 20.11.1968 (ACB). **Region N:** Melbourne, *Smith* 69/43, 30.10.1969 (MEL).

SOUTH AUSTRALIA: **Eyre Peninsula:** Claremont Hill, *no collector*, 11.1925 (ADW 278 in part). **Northern Lofty:** Clare, *Black*, 8.11.1920 (AD 97420231). **Yorke Peninsula:** Point Davenport, *Symon* 11885, 4.11.1979 (ADW). **Southern Lofty:** Black Hill, c. 12 km ENE. of Adelaide, *Czornij* 253, 21.11.1968 (AD); Modbury, c. 15 km NE. of Adelaide, *Spooner* 1274, 24.10.1970 (AD); Beefacres, between Hope Valley Reservoir & Torrens Creek, *Spooner* 2718, 21.12.1973 (AD); Hope Valley, c. 10 km NE. of Adelaide, *Cleland*, 15.11.1947 (AD); near Highbury Hotel, c. 13 km NE. of Adelaide, *Kraehenbuehl* 824, 22.10.1942 (AD); Highbury, Sassafras Drive, c. 15 km NE. of Adelaide, *Spooner* 1318, 12.10.1970 (AD); National Park, c. 6 km SE. of Adelaide, *Cleland*, 17.12.1939 (AD); Adelaide Hills Belair, *Hilton*, 13.10.1944 (ADW 44019); Adelaide Plains near Plympton, c. 5 km SW. of Adelaide, *Smith* 1224, 19.10.1968 (AD); Waite Institute, *Eardley*, 10.11.1931 (ADW 251); Adelaide foothills, Netherby, *Hilton*, 19.9.1944 (ADW 44105); Coxs Scrub National Park, c. 55 km SSE. of Adelaide, *Crisp* 121, 30.10.1971 (AD). **Kangaroo Island:** Kingscote, *Cleland*, 23.11.1945 (AD). **South-eastern:** Encounter Bay, Halls Creek, c. 5 km W. of Victor Harbour, *Cleland*, 5.1.1940 (AD).

In habit and general appearance *S. curticomma* resembles some South Australian specimens of *S. blackii* but differs in that the coma of hairs at the apex of the lemma is very short. It differs from *S. eremophila* in its taller habit, essentially flat leaf blades, mostly white (only tardily fulvous) hairs on the

lemma, much shorter bristle and usually broader glumes; from *S. flavescens* in its broader glumes, stouter awn with the column stiffly scabrous-pubescent (not very finely pubescent to pilose), and shows no particular preference for maritime or estuarine habitats; from *S. aristiglumis* in its longer glumes, longer lemma with a longer and almost straight callus, and appears to occur in quite different edaphic and geographic situations; from *S. gibbosa* in its longer and more or less evenly fusiform lemma, usually longer awn, and usually narrower palea with a band of hairs down the middle of the back.

***Stipa densiflora* Hughes**, Kew Bull. 1921: 18, fig. 20, (1921); *non* Smirn. (1929); Vickery, Contrib. N.S.W. Natl. Herb. 2: 78 (1953); Burbidge & Gray, Fl. Austral. Cap. Terr.: 53 (1970).

HOLOTYPE: Central Victoria, *Etheridge* 1865 (K!). The Type sheet consists of a packet containing a small fragment of panicle with spikelets, and a small drawing by Hughes of a spikelet and a lemma; also a drawing of a panicle subtended by two uppermost leaves with no indication of what specimen it represents.

SYNONYM: *S. congesta* Summerhayes & Hubbard, Kew Bull. 1927: 362 (1927). HOLOTYPE: SOUTH AUSTRALIA: Morialta, *Cleland* 33, 2.10.1925 (K!, isotype at AD and fragment at MEL).

Caespitose perennial c. 0.5–1.5 metres high, not rhizomatous, with a basal tuft of leaves one third to half the height. Culms erect, slightly geniculate at the base, terete, not compressible, slightly ribbed, pubescent with hairs 0.1–0.7 mm long becoming minute upwards; nodes 2–4, exserted, densely sericeous with hairs to 0.5 mm long, to 50% wider than the adjacent internodes. Leaf sheaths not inflated; basal sheath 0.5–1.5 cm wide, slightly ribbed, pubescent with hairs to 0.4 mm long to glabrous; inner margin glabrous; outer margin ciliate with hairs minute–0.6 mm long; upper sheath 5–10 mm wide, moderately ribbed, pubescent down the centre with hairs minute–0.5 mm long; margins scaberulous with hairs minute–0.1 mm long or scabrous with minute tubercles; inner margin glabrous or ciliate with hairs 0.1–0.2 mm long, outer margin ciliate with hairs 0.2–0.7 mm long; collar with hairs 0.1–0.7 mm long. Ligule truncate to shortly lacinate, (0.1–) 1–4 mm long, ciliate with hairs 0.1–0.5 mm long; abaxial surface sericeous with hairs 0.1–0.5 mm long; auricles, when present, thickened, 5–15 mm long, glabrous. Leaf blade weakly rolled, linear, 1.5–4.5 mm wide, 15–45 cm long; abaxial surface moderately ribbed, the surface scabrous with minute tubercles, or sparsely pubescent with hairs to 0.5 mm long; adaxial surface strongly ribbed, pubescent with hairs 0.1–0.2 (–0.5) mm long; margins glabrous or similar to adaxial surface. Panicle 10–30 cm long, exserted, moderately dense with distant fascicles of unequal, few-flowered, compound or simple branches, contracted (although spreading at anthesis), 2–5 cm wide (excluding awns); axis terete (or angled), scabrous with hairs minute–0.1 mm long; branches 2–8 cm long, angled, pubescent to scabrous with hairs minute–0.2 mm long. Spikelets 13–18 mm long (excluding awn), gaping. Glumes unequal to equal, acuminate; lower glume 13–18 mm long, sericeous with hairs minute–0.5 mm long, lower (35–) 40–55% (5–) 3-nerved, upper 45–60 (–65)% (3–) 2–1-nerved; upper glume 12–16 mm long, sericeous with hairs minute–0.1 mm long, lower 15–35 (–45)% (5–) 3-nerved, upper 45–60 (–65)% (3–) 2–1-nerved. Floret cylindrical, 5.5–7 mm long (including callus), without a neck. Lemma surface scabrous, especially at the apex, sericeous with white hairs 0.3–0.6 mm long; lobes and coma absent. Callus 1.2–1.8 mm long, weakly bent at the tip, densely sericeous with hairs 0.2–1 mm long. Awn 3.5–4.5 cm long, strongly twice bent, 0.2–0.3 mm wide near the base; column 13–20 mm long,

10–13 mm to the first bend, pubescent to plumose with hairs 0.5–1 mm long; bristle scabrous with hairs minute–0.2 mm long. Palea \pm equal to the lemma, acute, scabrous, glabrous and smooth on the edges, sericeous with hairs 0.3–0.6 mm long. Lodicules 3; 2 abaxial, membranous, obtuse, 1.5–2 mm long; paleal acute, 1.6–1.8 mm long. Anthers 2–3 mm long, not penicillate. Caryopsis 3–3.5 mm long; embryo 20–25% the length; hilum 70–85% the length.

DISTRIBUTION: Tablelands and western slopes of the Great Dividing Range, from southern Queensland into Victoria and higher areas of southern South Australia, usually on low fertility soils.

SELECTED SPECIMENS: QUEENSLAND: **Darling Downs:** Wallangarra, *Hilton* NSW 116904, 14.1.1945 (AD, NSW); Wyberba, *Blake* 4632, 23.1.1933 (NSW).

NEW SOUTH WALES: **Central Coast:** The Oaks, Orangeville road, *McBarron* 13704, 12.1966 (NSW, CANB). **South Coast:** Cobargo, *District Agronomist Bega*, NSW 115837, 10.1970 (NSW); Wolumba, *Blake* NSW 116248, 23.10.1974 (NSW). **Northern Tablelands:** head of the Gwydir (River), *no collector* (MEL 60916); Parlour Mountains, Booralong, c. 18 miles [29 km] SW. of Guyra, *McKie* 2407, 27.12.1943 (BRI); 5.5 miles [9 km] N. of Armidale on road to Guyra, *Jessup & Gray* NSW 115838, 1.1953 (NSW). **Central Tablelands:** Ilford, *Suttor* NSW 115839, 12.1963 (NSW); Sodwalls, *Dellow* NSW 115840, 11.1971 (NSW); Joadja Valley, 12 miles [19 km] W. of Bowral, *Rodway* NSW 115841, 3.1956 (NSW); Berrima, *Calvert* (MEL). **Southern Tablelands:** Goulburn, *Vickery* NSW 18038, 11.1931 (NSW); Cullerin Range, 4.2 km N. of Cullerin, *Crisp* 2319 & *Telford*, 19.11.1976 (CBG); Yass district, *Pastures Protection Board* NSW 15847, 12.1942 (NSW); Bungonia Gorge, S. of Marulan, *Pullen* 4163, 11.1966 (NSW, CANB); c. 4 miles [22 km] from Tarago towards Braidwood, *Wheeler* 16, 23.11.1972 (CBG); 8 miles [13 km] NE. of Bungendore, Gunning Shire, *Story* 7888, 16.4.1967 (CANB); Black Mt, Canberra (A.C.T.), *Pullen* 19, 12.1956 (NSW, CANB, AD); near Doughboy Creek, Goulburn to Braidwood road, *Pullen* 2059, 8.12.1959 (CANB); Mt Majura (A.C.T.), *Burbidge* 1804, 6.1.1948 (CANB); 6 miles [10 km] from Canberra on Federal Highway to Goulburn, *Burbidge* 1803, 6.1.1948 (CANB); Canberra Botanic Gardens, *Beeton* CBG 044493, 1.1972 (CBG); near Tharwa (A.C.T.), *Blake* 7547, 2.1935 (NSW); Cooma, *Mueller* NSW 115845, 12.1952 (NSW). **North Western Slopes:** c. 20 miles [32 km] NNE. of Ashford on road to Emmaville, *Morrow* 96, 22.3.1968 (NSW); Inverell, *Thomas* NSW 115868, 1.1912 (NSW); Barraba, *Rupp* NSW 115866, 11.1913 (NSW); Tamworth district, *Boyle* NSW 115865, 11.1947 (NSW); Coonabarabran, *McDonald* NSW 115867, 10.1903 (NSW). **Central Western Slopes:** Cobbora, *MacCulloch* NSW 15869, 11.1969 (NSW); 8 miles [13 km] NE. of Dubbo towards Mendooran, *Coveny* 2483, 26.11.1969 (NSW); Mudgee, *Wools*, s.d. (MEL 60923); Reefton, *Nixon* NSW 115879 (NSW); Harvey Ranges, Peak Hill, *no collector*, 11.1905 (NSW 115880); Parkes, *Perry* NSW 115876, 11.1962 (NSW); Rankin Springs, *Wallin* NSW 115877, 10.1956 (NSW); Grenfell, *Hill* NSW 115875, 11.1962 (NSW); Ariaah to Coolamon road, *Southwood* NSW 115871, 10.1963 (NSW); Ardlethan, *Cambage* NSW 115885, 10.1916 (NSW, CANB); Temora, *Dwyer* NSW 115872, 11.1916 (NSW); 20 km W. of Temora, *Crisp* 1658, 20.11.1975 (NSW, CBG); Narraburra–Trungle Hills, Temora, *Dwyer* NSW 115883, 10.1915 (NSW). **South Western Slopes:** Wagga, *Crisp* 1825, 27.11.1975 (CBG); The Rock, *Constable* 5174, 21.10.1964 (NSW, CANB, BRI); Milbrulong, *Newman* NSW 115870, 11.1955 (NSW); Tumut–Tumbarumba–Holbrook district, *Morland* NSW 115874, 1.1948 (NSW); Walbundry–Albury, *Moore* M492, 7.12.1946 (CANB). **North Western Plains:** Coolabah, *Maiden & Boorman* NSW 115888, 8.1910 (NSW). **South Western Plains:** Monia Gap, *Constable* NSW 4604, 10.1947 (NSW); Milby Hill, Condobolin, *Cunningham* NSW 115886, 11.1972 (NSW); Boppy Mt, *Boorman* NSW 115887, 7.1903 (NSW); Mt Binya, c. 25 km ENE. of Griffith, *Crisp* 1466, 12.11.1975 (NSW, CBG); Griffith, *McKie* NSW 116905, 27.10.1939 (NSW).

VICTORIA: **Region J:** Mt Hamilton, Wulgulmerang, East Gippsland, *Beaglehole* 36115, 16.1.1971 (NSW). **Region K:** Brisbane Range, Staughton Vale (c. 50 km SE. of Ballarat), *Cleland*, 11.1923 (AD). **Region M:** Eaglehawk, *Canning* 3010, 14.11.1969 (CBG); Longwood, *Stewart*, 10.1950 (BRI); Mt McIvor, *Stuart*, s.d. (MEL.). **Region N:** Bairnsdale district, *Hart* (MEL); Kew (River Yarra), *Dakin*, 2.1934 (MEL). **Region R:** c. 1.25 miles [2 km] E. of Mt Pilot, c. 6 miles [10 km] N. of Beechworth, *Beaglehole* 43598, 23.11.1973 (NSW); Warby Range, near Wangaratta, *Canning* 3214, 29.11.1972 (CBG); Beechworth Gorge, *Canning* 392, 30.10.1967 (CBG); Mt Stanley, *McBarron* 2914, 3.1.1949 (NSW). **Region S:** Valencia Creek road, 15.5 miles [24.8 km] SE. of Mt Wellington, *Beaglehole* 43434, 30.10.1973 (NSW). **Region V:** Mitta Mitta, *Black*, 5.11.1939 (CANB 9777). **Region W:** Rocky Knob near Bridle Creek, *Suggan Buggan*, *Beaglehole* 33249, *Finck & Rogers*, 6.1.1970 (NSW). **Region Z:** Upper Genoa River, *Beaglehole* 35010 and *Rogers*, 30.11.1970 (NSW).

SOUTH AUSTRALIA: **Flinders Ranges:** Alligator Creek, *Ising*, 23.10.1928 (AD 966090382). **Eastern:** Morialpa [as Morialta], *Vickery* NSW 116246, 116247, 11.1938 (NSW). **Southern Lofty:** Barossa

Valley, *Hilton 195* (ADW); Torrens Gorge, East, *Spooner 420*, 22.10.1969 (AD); Mt Barker, *Cleland*, 4.12.1943 (AD).

S. densiflora has been included in *S. semibarbata* by many authors including Maiden, *Manual Grasses N.S.W.*: 115 (1898); Willis, *Handb. Pl. Victoria* 1: 184 (1962), edn 2: 184 (1970).

***Stipa dongicola* J. Vickery, S. W. L. Jacobs & J. Everett, sp. nov.**

S. curticomae affinis sed columna villosa, spicula omnibus partibus minore, palea glabra, nodis conspicuis glabrisque differt.

HOLOTYPE: WESTERN AUSTRALIA: Blackoak Donga, 'Kanandah' Station, approx. 20 km N. of Naretha. Donga. *M. G. Brooker 160*, 16.9.1974 (CANB 249733; isotype NSW).

Caespitose perennial to c. 1 metre tall, with few, conspicuously extravaginal shoots, and a very short rhizome. Culms 1.3–2.3 mm wide, rigid, terete, finely ribbed, minutely retrorsely scaberulous–puberulous between the ribs, glabrous upwards; nodes 3–4, glabrous, usually thickened, to 60% broader than adjacent internodes, exserted. Leaf sheaths narrow, loose, smooth and glabrous, or the lowermost scaberulous and hirsute; the orifice and the collar hairier than the sheath; outer margin similar to adjacent surfaces. Ligule obtuse to truncate, coriaceous, 0.8–1.5 mm long, densely sericeous on the back. Leaf blades linear, to 35 cm long, c. 3–4 mm wide, usually expanded and flexuose or, if inrolled, then erect; abaxial surface sparsely hirsute to scabrous with dense short hairs; adaxial surface sparsely to densely pubescent, scaberulous with sparse minute hairs. Panicle with distant fascicles of unequal compound branches, contracted to spreading at length, exserted early, c. 14–30 cm long, 1–6 cm wide (excluding awns); axis flattened, scabrous to scaberulous with dense short hairs; branches 2–5 cm long, pedicels 2–11 mm long, both with similar indumentum to the axis. Spikelets only slightly gaping even after floret disarticulation, 7–12 mm long (excluding awn). Glumes subequal, broad, acuminate, firm and usually purple in the lower half, hyaline and easily eroded at the tips; lower glume 7–12 mm long, lower 75% 3-nerved; upper glume 8–11 mm long, lower 30% 5-nerved, the next 45% 3-nerved. Floret 5–6.5 mm long (including callus), oblong-cylindrical with a well defined neck showing 3 thickened nerves. Lemma scabrous, especially at the neck, with antrorsely hooked tubercles, reddish brown at maturity, with slightly spreading white to yellow-orange hairs sparser just below the apex, and with a sparse coma to 0.7 mm long mainly in two tufts; lobes absent or minute. Callus 1.5–2 mm long, slightly blunt, sericeous with hairs slightly darker than those on the lemma. Awn c. 0.3 mm wide, 30–40 mm long, twice bent, the first bend less developed; column c. 15 mm long, the first section c. 10 mm long, villous with hairs 0.5–1.5 mm long, the second section scaberulous; bristle scabrous with short dense hairs. Palea subequal to the lemma, broadly obtuse, glabrous, granular down the back, the margins hyaline. Lodicules 3, membranous; 2 abaxial broad-cuneate, c. 0.6 mm long; paleal acute, c. 0.4 mm long. Anthers c. 3.5 mm long with sparse tufts c. 0.25 mm long at the tip. Caryopsis slightly gibbous, 3–3.5 mm long; the hilum 75% the length, the embryo 35% the length.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: **Eucla**: 60 miles [96 km] N. of Loongana, *Mitchell 86*, 5.10.1974 (PERTH, NSW); 50 miles [80 km] NNE. of Rawlinna, *Brooker 170*, 5.9.1974 (CANB, NSW); 50 km N. of Rawlinna, *Brooker 3633*, 4.6.1971 (PERTH); Blackoak Donga, c. 20 km N. of Naretha, *Brooker 160*, 16.9.1974 (CANB, NSW); CSIRO property, Rawlinna, *Goodall 2980*, 20.6.1966 (PERTH); 30 km S. of Rawlinna, 125°28'E, 31°11'S, *Chinnock 1157*, 1.9.1973 (AD); 62 km S. of Rawlinna, Cocklebidly road, *George 11877*, 12.7.1974 (PERTH, NSW).

The specific epithet refers to the habitat common to most of the specimens on the Nullarbor Plain, i.e. dongas (or gilgais).

Like *S. curticoma* but differing in the villous column, the overall smaller dimensions of the spikelet, the glabrous palea and in the conspicuous, glabrous nodes. Differs from *S. blackii* in its shorter coma and villous column.

***Stipa drummondii* Steudel, Syn. Pl. Glum. 1: 128 (1854); Bentham, Fl. Austral. 7: 567 (1878); Hughes, Kew Bull. 1921: 16 (1921), *ibid.* 1922: 17 (1922); Black, Fl. S. Austral. edn 2: 88, fig. 108 (1974); Gardner, Fl. W. Austral. 1, Gram.: 176 (1952); Willis, Handb. Pl. Victoria 1: 186 (1962), edn 2: 186 (1970).**

HOLOTYPE: cited as 'Australasia. *Drummond, Coll. IV, nr. 578*'. Drummond's collecting number is believed to have been misunderstood by Steudel. A specimen in Steudel's herbarium (P!) bears Drummond's original collecting ticket numbered 378, and has a label in Steudel's handwriting 'Stipa Drummondii. Steud. quo ad descriptionem a *S. campylachne* Nees et omnibus (...) usque e N. Holl. descriptis speciebus diversa'. This we have taken as the Holotype; duplicates of the Type number at MEL (MEL 59909), PERTH and K (labelled *Drummond 378, 4th collection*, as cited by Bentham). An un-numbered Drummond specimen in NSW (NSW 16249) also matches the Type numbers at MEL and K.

SYNONYMS: *S. luehmannii* Reader, Victorian Naturalist 16: 158 (1900); Hughes, Kew Bull. 1921: 28 (1921). HOLOTYPE: VICTORIA: Sandy Desert, Lowan, 30.11.1898, *F.M. Reader* (MEL 59939).

S. horrifolia J. Black, Trans. & Proc. Roy. Soc. S. Austral. 44: 191 (1920). LECTOTYPE, here designated: Nullarbor Plain, *R.S. Rogers*, 4.1911 (AD 97424081; isolecotypes MEL 59940, NSW 116254).

POSSIBLE SYNONYMS: *S. scabra* var. *subtricha* Reader, Victorian Naturalist 17: 156 (1901). HOLOTYPE: cited as 'Jan. 1899. Sandy regions, Lowan, *F.M. Reader*'. We have not found this specimen in MEL, where Reader's collections are now housed. There are, however, two other specimens from the same area (MEL 60784 and 60885) named as such, MEL 60784 in Reader's handwriting. Both these specimens are *S. drummondii*.

S. scabra var. *auriculata* J. Black, Fl. S. Austral. 1: 67 (1922). HOLOTYPE: cited as 'Dry Districts'. We have not been able to find a specimen so labelled but in K there is a specimen from Laura, 8.10.1916, labelled as *S. scabra* var. *auriculata* in J.M. Black's handwriting. This specimen is *S. drummondii*.

Caespitose perennial to 1 metre high with a basal leaf tuft often less than one third the height. Culms erect or geniculate, compressible, terete, 2–3 mm wide near the base, slightly ribbed, densely puberulous or scaberulous to almost glabrous, or tomentose especially just below the nodes; nodes 2–3, rarely exserted, to 25% broader than adjacent internodes, almost glabrous or sericeous. Leaf sheaths inflated, slightly ribbed, scaberulous, hirsute, with longer hairs around the collar; uppermost sheaths glabrous; inner margin glabrous; outer margin glabrous or occasionally ciliate just below the orifice. Ligule thinly coriaceous, 0.4–0.8 mm long or continuous with the sheath margins and to 1.5 (–4) mm long, ovate to irregularly truncate, ciliate; abaxial surface sparsely pubescent; auricles tufted. Leaf blades to 20 cm long, 2–6 mm wide, mainly erect, occasionally flexuose, usually expanded with incurved margins or involute; abaxial surface scarcely ribbed, scabrous and hirsute; adaxial surface deeply ribbed, scabrous and pubescent or hirsute. Margins similar to abaxial surface. Panicle to 40 cm long, 4–10 (–16) cm wide (excluding awns), exserted, spreading, dense with moderately distant fascicles of numerous many-flowered branches; axis terete, pubescent and/or scaberulous; branches to 13 cm long ± terete, pubescent or scaberulous; pedicels to 20 mm long, ± terete, pubescent or scaberulous. Spikelets(7–) 8–12 mm long (excluding awn), gaping. Glumes

unequal, acuminate or acute, the tips easily torn, often purple-tinged, usually associated with diffuse chlorenchyma bands; lower glume (7-) 8-12 mm long, membranous and translucent, the lower 25% obscurely 3-5-nerved; upper glume (6-) 7-11 mm long, membranous and translucent at the tip, firm and chaffy at the base, the lower 40-60% 5-nerved, the next 25% 3-nerved. Floret linear to slightly turbinate to fusiform, 4-6 (-7) mm long (including callus). Lemma very finely granular, except tuberculate over the apex of the midvein, red to black-brown at maturity, the midvein slightly paler and thickened; hairs white, erect and slightly spreading, sparse especially at the apex; coma obscure, of few hairs to 0.5 mm long, or absent; 1-2 lobes to 0.2 mm long. Callus 1.5-2.5 mm long, fine and straight, sericeous with dense hairs similar to those of the lemma. Awn (40-) 60-90 mm long, 0.2-0.3 mm wide near the base, falcate; column (11-) 14-18 (-21) mm long, 10-19 mm to the end of the straight portion, densely pubescent or villous with spreading hairs 0.3-0.8 (-1.5) mm long; bristle scaberulous. Palea 0.3-0.5 mm shorter than the lemma, obtuse, coriaceous down the centre with few hairs at the base, margins membranous and glabrous, tip membranous, glabrous or ciliate. Lodicules 2, membranous, abaxial, 0.8-1.8 mm long, linear-spathulate. Anthers 1.8-3 mm long, often lightly pencillate. Caryopsis 3-5 mm long; embryo 40% the length; hilum 50-65% the length.

DISTRIBUTION: Sandy areas of the western plains of New South Wales and Victoria, extending across South Australia into the southern regions of Western Australia.

SELECTED SPECIMENS: NEW SOUTH WALES: **North Western Slopes:** Liverpool Plains, *no collector* NSW 16259, 2.1880 (NSW). **North Western Plains:** Bungunyah, *Henderson* 335, 27.10.1947 (NSW); Coolabah, *Peacock* NSW 116877, 10.1900 (NSW). **South Western Plains:** Griffith, *Vickery* NSW 10186, 19.10.1949 (NSW); W. of Balranald, *Henderson* 337/2, 5.10.1947 (NSW); 30 km NNW. of Balranald, *Crisp* 1760, 29.11.1975 (NSW, CBG); 5 miles [8 km] W. of Stony Crossing, *Henderson* 337/1, 13.10.1947 (NSW); S. of Tueloga, *Henderson* 337/4, 23.9.1947 (NSW); Cunninyeuk (S. of Balranald), *Henderson* 174, 8.10.1946 (NSW); Coobool Sandhill, *Henderson* 335/2, 6.10.1947 (NSW); Barham, *Vickery* NSW 10195, 13.10.1949 (NSW); Barooga, *Vickery* NSW 116268, 11.10.1949 (NSW). **North Far Western Plains:** c. 150 km NW. of Louth, *Moore* 5050, 25.4.1967 (CANB). **South Far Western Plains:** c. 10 km before Menindee, *Richley* M5, 5.9.1973 (AD); Ivanhoe, *Leigh* NSW 116293, 19.10.1964 (NSW); 60 miles [96 km] S. of Wilcannia, Cobar road, *Martensz* 1513, 2.1968 (CANB).

VICTORIA: **Region A:** Northern Plains, 30 km SSW. of Mildura, 9 km S. of Benetook along Meridian road, *Crisp* 3292, 9.10.1977 (CBG); Mildura, *Williamson*, 28.10.1928 (MEL); 41.5 miles [66.4 km] from Mildura towards Renmark (S.A.) along Sturt Highway, *Canning* NSW 116266, 27.8.1968 (NSW; BRI dupl. of CBG); Redcliffs, *Beaglehole* 7550, 18.9.1964 (NSW); Hattah Lakes National Park, *Phillips* CBG 027109, 14.11.1962 (CBG). **Region B:** Murrayville, *Williamson*, 28.10.1928 (MEL); 4 miles [6 km] N. of Tempy, *Henshall* NSW 116676, 20.9.1969 (NSW); Wyperfeld National Park, *Beaglehole* 29231, 29178 & Finck, 10.10.1968 (NSW, MEL). **Region C:** Little Desert, *Reader*, 19.11.1899 (MEL); Sandy Desert, *no collector* (MEL 59908). **Region G:** Wathe Wildlife Reserve, 13 km WNW. of Gama, *Beaglehole* 56943, 23.10.1977 (MEL). **Region H:** Boort, *Purdie*, 1894 (MEL 59893); Borung, *Reader*, 23.10.1904 (AD; MEL 59895). **Region L:** Gunbower, *Curtis*, (MEL 59896). **Region M:** Kamarooka, N. of Bendigo, *Morris*, 10.1947 (MEL). **Region Q:** Cobram, *Moore* M977, 20.10.1948 (CANB).

SOUTH AUSTRALIA: **Nullarbor:** Colona to Ooldea road, *Cleland*, 8.10.1954 (AD, ADW); Nullarbor Plain, 1.6 km W. of Ivy Tanks, *Beaglehole* 49476, 31.8.1974 (CANB); 'Nullarbor' Station, *Black* NSW 116255, 6.1911 (NSW); 5 km E. of 'Koonalda' Homestead, *Chinnock* 1191, 21.9.1973 (AD, NSW); Tallowan Tank, *Cleland*, 17.10.1953 (AD); 'Yalata' Homestead, *Cleland*, 18.10.1953 (AD). **Flinders Ranges:** Greenhill road, *Cleland*, 9.10.1948 (AD); Parachilna Gorge, *Everett* 298 & *Jacobs*, 18.9.1981 (NSW); Deep Creek, 5 miles [8 km] E. of Burra, *Cleland*, 24.8.1941 (ADW); Waterfall Creek near Baroota, *Kraehenbuehl* 195, 18.9.1960 (AD); Tarcowie Common, 16 km W. of Peterbrough, *Crisp* 590, 9.9.1973 (CBG). **Eastern:** 30 km N. of Yunta, *Crisp* 588, 9.9.1973 (CBG). **Eyre Peninsula:** 49 miles [78 km] from Nundroo towards 'Nullarbor' Homestead, *Canning* NSW 116265, 116267, 3.9.1968 (CBG, NSW, BRI); Kooniba, *Cleland*, 6.10.1954 (AD); Ceduna, *Canning*

CBG 042997, 1.9.1968 (CBG, NSW); near Yardea, *Cleland*, 14.10.1954 (ADW); 24.9 miles [40 km] from Iron Knob towards Port Augusta, *Canning CBG 043034*, 28.8.1968 (CBG, BRI); Minnipa, *Black*, 9.1940 (AD); Minnipa-Wudinna, *French 8*, 10.1954 (ADW, NSW); Kimba, *French 2*, 2.10.1954 (ADW); 9 miles [14 km] from Cleve towards Lock, *Phillips 463*, 20.9.1965 (CBG); near Midgee Rocks on road to Mitchelville, NE. of Cowell, *Pearce NSW 116956*, 2.1965 (NSW, dup. of ADW); nr. Wild Horse Plain, near Lorne, *Blake 16844*, 28.8.1946 (BRI); 5.5 km S. of Cowell towards Whyalla, *Tindale 450*, 12.9.1970 (NSW); Verran Hill, Hincks National Park, *Alcock 2177*, 6.10.1968 (AD); Yellanna, 10 miles [16 km] N. of Cummins, *Hilton NSW 116289*, 20.12.1945 (ADW, NSW). **Northern Lofty**: between Port Wakefield and Kulpara, *Blaylock 610*, 30.9.1967 (AD); c. 1 mile [1.6 km] S. of Freeling, *Kraehenbuehl 1541*, 18.9.1965 (AD); Gladstone, *Black*, 23.10.1915 (AD); 4 km S. of Kupunda on Adelaide road, *Monfries NSW 11364*, 20.10.1974 (ADW, NSW). **Murray**: 30 km N. of Yunta, *Crisp 588*, 9.9.1973 (CBG); Morgan, *Brummitt*, 28.8.1894 (AD); Markaranka, Morgan, *Symon 3561*, 7.10.1965 (K ex ADW); 1 km downstream from Overland Corner Hotel, River Murray, *Crisp 631*, 7.10.1973 (CBG); Gerrard, near Berri, *Cleland NSW 116274*, 28.8.1946 (AD, NSW); Loveday, *Gauba CBG 003953*, 14.12.1944 (CBG); between Renmark & Blanchtown, *Griffiths*, 18.9.1969 (CANB); Swan Reach, *Cleland*, 8.5.1946 (AD); Alawoona, *Cleland NSW 116256*, 3.12.1913 (NSW, AD); 10 miles [16 km] E. of Mannum, *Vickery NSW 2048*, 24.8.1946 (NSW); Mannum, *Blake 16842*, 24.8.1946 (BRI); Chauncys Line near Monarto, *Cleland SW 116273*, 12.10.1938 (NSW, AD); Monarto City Centre, *Symon 9068*, 26.11.1974 (ADW, NSW); Kinchina, *Cleland NSW 116261*, 23.9.1922 (NSW, AD); Murray Bridge, *Cleland*, 14.10.1949 (AD); 5 km W. of Tailem Bend, *Everett 300 & Jacobs*, 18.9.1981 (NSW); 45 miles [72 km] from Tailem Bend towards Lameroo, *Phillips NSW 116714*, 12.9.1973 (NSW, CBG); Cooke Plains, c. 40 km SSE. of Murray Bridge, *Sharrad 148*, 6.9.1959 (AD). **Yorke Peninsula**: South Kilkerran, *Beck*, 2.1942 (ADW); Port Broughton, *Morris*, 25.9.1947 (MEL); Tooligie district, *French*, 8.10.1954 (ADW); c. 8 km SSW. of Corny Point Lighthouse, *Blaylock 1061*, 13.10.1968 (AD); Corny Point, *no collector*, 10.12.1928 (ADW); 10 miles [16 km] from Edithburgh towards Moorie Point, *Phillips 1247*, 11.6.1971 (CBG). **Southern Lofty**: Roseworthy Agricultural College, *Hilton NSW 116294*, 30.9.1941 (ADW, NSW); 1 mile [1.5 km] past Kangaroo Flat on the Mallalla road, *Harris 34*, 1.10.1954 (AD); Middle Beach, *Noble 41*, 26.9.1972 (AD); Gawler Range near Artiming Dam N. of Yardea, *Symon 8155*, 3.10.1972 (ADW, NSW); Kambrai turnoff on Sedan road, *Cleland*, 14.9.1963 (AD); c. 1 km W. of Angle Vale road and western side of Parafield aerodrome, *Kraehenbuehl 1452*, 18.9.1965 (AD); Brougham Place, North Adelaide, *Black*, 10.12.1920 (AD); Seaton Golf Links (c. 9 km WNW. of Adelaide), *Smith 651*, 13.10.1967 (AD); Outer Harbour (c. 17km NW. of Adelaide), *Cleland*, 22.10.1932 (AD); Menningham (Adelaide), *Hilton NSW 116291*, 8.9.1946 (ADW, NSW); coastal cliffs at Marino Rocks, *Smith 692*, 10.9.1967 (AD); Marino, *Cleland*, 15.9.1934 (AD); Hallett Cove, *Cleland*, 5.11.1926 (AD); Whittons Bluff at Port Noarlunga, *Smith 438*, 27.11.1967 (AD); Pedlars Beach, *Cleland*, 15.10.1927 (AD); North Willunga, *Hilton NSW 116290*, 20.10.1946 (ADW, NSW); Port Willunga, *Cleland*, 30.10.1928 (AD); Sellicks Beach, *Black*, 25.10.1940 (AD); cliffs at Aldinga Bay, *Andrews*, 2.11.1941 (AD); Goolwa, near Murray Mouth, *Cleland*, 8.1.1940 (AD). **South-eastern**: well c. 11 km from Meningee, *Cleland*, 15.10.1955 (AD); 1 mile [1.5 km] E. of Tintinara, *Hilton*, 11.10.1963 (ADW); Kingston Park, *Eardley*, 20.9.1936 (ADW).

WESTERN AUSTRALIA: **Eucla**: 'Mundrabilla' Station, *Coles Bros.*, 28.7.1930 (ADW); 45 miles [72 km] W. of Eucla, *Phillips NSW 116250*, 8.9.1962 (NSW, dupl. of CBG); pediment of Hampton Range, Eucla, *Noble 13*, 8.8.1973 (NSW); Roe Plain S. of 'Mundrabilla', *Mitchell 35*, 6.8.1974 (PERTH). **Coolgardie**: Frasers Range, *no collector* (MEL 59907); 7 km NNE. of Norseman, *Crisp 5951*, *Taylor & Jackson*, 19.9.1979 (CBG). **Roe**: Western margin of Lake King, *Saffrey 1209*, 29.9.1970 (PERTH). **Eyre**: Israelite Bay, *Brookes NSW 116252*, 9.1915 (NSW); Desmond nr. Ravensthorpe, *Maiden NSW 116253*, 11.1909 (NSW); Esperance district, *Rose*, 11.1962 (PERTH); Fitzgerald R. Reserve, *Royce 9192*, 21.10.1970 (PERTH). **Avon**: Cowcowing, *Koch 1235*, 9.1904 (NSW). **Irwin**: Mullewa, *Cleland*, 26.8.1948 (AD 97234216); c. 4 miles [6 km] S. of Marchagee on Geraldton Hwy., *Maslin 1414*, 20.10.1970 (PERTH).

S. drummondii can become infected by the same type of nematode ("Cockle") as *S. nitida* (see note under the latter species). The following specimens are examples of this infection:

VICTORIA: 15 miles [24 km] SSW. of Kerang, *Beaughole 40672*, 1.11.1972 (NSW, IMI); Wyperfeld National Park, *Beaughole 28523*, 19.9.1968 (NSW, IMI) p.p.

***Stipa echinata* J. Vickery, S.W.L. Jacobs & J. Everett, sp. nov.**

S. stipoidem simulans, sed gluma inferiore longiore, lobis lemmatum brevioribus, callo longiore, et arista multo longiore, differt.

HOLOTYPE: SOUTH AUSTRALIA: Hindmarsh I., E. of Goolwa, F.M. Hilton NSW 117382, 10.10.1945 (NSW).

Caespitose perennial c. 0.5 metres high with a basal tuft of leaves to half the height. Culms erect, terete, 1.5–2 mm wide near the base, not compressible, glabrous, smooth to strongly ribbed upwards; nodes 3–4, \pm exserted, densely sericeous with white retrorse hairs 0.15–0.25 mm long, not swollen. Leaf sheaths tightly enveloping the culm, 3.5–7 mm wide, glabrous, sometimes minutely scaberulous between the ribs; basal sheath smooth to moderately ribbed, inner margin glabrous, outer margin ciliate with hairs 0.2–0.6 mm long, glabrous on the innovations; upper sheath strongly ribbed, inner margin glabrous, outer margin ciliate with hairs 0.3–1.3 mm long, minutely ciliate on the innovations. Ligule truncate to obtuse, membranous, 1.5–2.5 mm long, glabrous to ciliate with hairs 0.1–0.2 mm long; abaxial surface sericeous with hairs c. 0.1 mm long to glabrous; auricles, when present, thickened, c. 1 mm long, ciliate at the base with hairs to 1.2 mm long; auricular lobes glabrous, to 3.5 mm long. Leaf blade tightly rolled, 1–2 mm wide, to 15 cm long, pungent; abaxial surface smooth and glabrous; adaxial surface strongly ribbed, densely scaberulous with minute siliceous prickles, sometimes also with sparse villous hairs 0.2–0.5 mm long. Panicle 10–20 cm long, exserted, with distant fascicles of unequal, few-flowered, compound branches, \pm contracted, 1.5–3 cm wide (excluding awns); axis terete to slightly angled, glabrous to scabrous along the edges with hairs c. 0.1 mm long; branches 1.5–2.5 cm long, terete to slightly angled, scaberulous with hairs minute–0.2 mm long; pedicels 2–10 mm long, slightly flattened to flattened, scaberulous with hairs minute–0.1 mm long. Spikelets 21–23 mm long (excluding awn), gaping. Glumes unequal, acute–acuminate, straw-coloured, scaberulous to scabrous with hairs minute–0.3 mm long or glabrous; lower glume 21–23 mm long, lower 50–65% 3-nerved; upper glume 14–18 mm long, lower 40–60% 5 (–7) -nerved, upper 60–40% (5–) 3–1-nerved. Floret cylindrical, without a neck, 8–10 mm long (including callus). Lemma surface smooth to slightly granular, densely sericeous with white hairs turning gold at maturity, 0.4–0.7 mm long; lobes 0.2–0.7 mm long, ciliate with hairs minute–0.1 mm long; coma 0.6–1.2 mm long. Callus 2.6–3.2 mm long, weakly bent at the tip, densely sericeous with white hairs 0.1–1 mm long turning gold at maturity. Awn 9–11 cm long, with 3 weak bends, 0.3–0.5 mm wide near the base; column 3–3.5 cm long, 1–2 cm to the first bend, straw-coloured, densely pubescent with white hairs 0.2–0.8 mm long; bristle straw-coloured to brown, scabrous along the edges with hairs minute–0.2 mm long. Palea \pm equal to the lemma, obtuse, smooth to slightly granular, sericeous along the centre back with hairs 0.2–0.8 mm long. Lodicules 2 (?), abaxial, membranous, 1–1.5 mm long, oblong. Anthers 3.2–3.8 mm long, penicillate. Mature caryopsis not observed.

DISTRIBUTION: Coastal and near-coastal areas of South Australia.

SPECIMENS EXAMINED: SOUTH AUSTRALIA: **Eyre Peninsula:** Reserve S. of Mt Verran, Cleland, 9.11.1960 (AD 968061288); Lincoln National Park, 34°56'S, 135°55'E, Heyligers 79005, 6.11.1979 (CANB, AD). **Murray:** 2 miles [3 km] E. of Tintinara, Hilton, 11.10.1953 (ADW 44072). **Yorke Peninsula:** Point Davenport, nr. 35°12'S, 137°24'E, Symon 11890, 4.11.1979, (NSW, dupl. of ADW); Pondalowie Bay, Blaylock 48, 10.10.1965 (AD). **Southern Lofty:** Hindmarsh I, E. of Goolwa, Hilton NSW 117382, 10.10.1945 (NSW, dupl. of ADW).

Occurs mainly near the sea but follows the Murray River up at least a short distance. The tussocks are spiny-leaved (similar to *S. stipoides*) and give rise to

the specific epithet. *S. echinata* differs from *S. stipoides* in having a longer lower glume, shorter lemma lobes, longer callus and much longer awns. *S. echinata* can be distinguished from *S. flavescens* by the spiny leaves, longer glumes and much longer awns. All three species are basically coastal.

***Stipa elegantissima* Labill.**, Nov. Holl. Pl. 1: 23, t. 29 (1804); Brown, Prodr.: 175 (1810); Hook. f., Fl. Tasman. 2: 111 (1858); Bentham, Fl. Austral. 7: 565 (1878); Hughes, Kew Bull. 1921: 11 (1921); Moore & Betche, Handb. Fl. N.S.W.: 483 (1893); Ewart, Fl. Victoria: 179 (1931); Willis, Handb. Pl. Victoria 1: 181 (1962), edn 2, 1: 181 (1970); Black, Fl. S. Austral. 1: 65 (1922), edn 2: 86 (1943); Gardner, Fl. W. Austral. 1, Gram.: 172, pl. 50A (1952).

LECTOTYPE: There are two sheets at Florence (FI-W) annotated 'Nova Hollandia et Van Diemen'. One of these bears copious notes in Labillardière's handwriting and we here designate this specimen as **Lectotype** (isolectotypes G, B-W). *S. elegantissima* does not occur in Tasmania and it appears that Labillardière confused Western Australia and Tasmania on the labels as he has done elsewhere (see Willis, Muelleria 1: 136 (1967)). Bentham also points out that Labillardière's specimen from Captain Baudin in herb R. Brown is marked 'Nouv. Holl.', i.e. the more accurate locality information was probably added at a later date.

Caespitose perennial c. 0.5–1 metre high, shortly rhizomatous, without a basal tuft of leaves. Culms decumbent, to 2 metres long, terete, 0.8–1.3 mm wide near the base, \pm compressible, smooth to slightly ribbed upwards, glabrous; nodes (3–) 6 (–10), exserted, glabrous, 25–50% wider than the adjacent internodes. Leaf sheaths at first tightly enveloping the culm, later becoming slightly free, glabrous; lower sheath 2 (–4) mm wide, slightly ribbed; upper sheath (1.5–) 2–4 mm wide, slightly to moderately ribbed. Ligule obtuse, erose, membranous, 2–3 mm long, glabrous; auricles 2.3–3.6 mm long, not thickened, glabrous. Leaf blade tightly rolled, 1.5–2 mm wide, (3–) 5–7.5 cm long; abaxial surface very slightly ribbed, glabrous or scabrous; adaxial surface moderately ribbed, villous with hairs c. 1 mm long; margins glabrous or scabrous. Panicle 15–25 cm long, exserted, pyramidal, with whorls of long, few-flowered, compound branches, spreading widely, 8–15 cm wide when expanded (excluding awns), disarticulating at maturity; axis terete (to slightly angular), plumose with hairs 1.5–2.5 mm long (to glabrous); branches (2.5–) 4.5–5.5 (–8) cm long, terete, plumose with hairs 1.5–3 mm long; pedicels 2–3 cm long, terete, plumose with hairs (1.5–) 2 mm long. Spikelets (7–) 8–10 (–12) mm long (excluding awn), gaping at maturity. Glumes subequal (to unequal), rounded on the back, acute, purple with a straw-coloured tip, pilose on the nerves with hairs 0.25–1 mm long, scabrous between the nerves, margins glabrous; lower glume (7–) 8–10 (–12) mm long, lower 50–60 (–66)% 3-nerved; upper glume 7–9 (–11) mm long, lower 60–70% 3-nerved. Floret narrowly cylindrical tapering to the apex, 4.5–6.5 (–10) mm long (including callus). Lemma black at maturity, the surface tuberculate, mainly glabrous but with hairs 0.5–0.7 mm long along the lower half of the lemma margins; lobes minute–0.8 mm long; coma absent. Callus 0.5–0.8 mm long, almost straight, sericeous with white hairs 0.5–1.0 (–1.2) mm long. Awn 2–5 cm long, 0.1–0.2 mm wide near the base, strongly once bent, often with another weak bend; column 8–15 (–20) mm long, straw-coloured, scabrous with hairs (0.1–) 0.2 mm long; bristle darker than the column, scabrous with hairs 0.05 mm long. Palea c. 50% the length of the lemma, acute, surface granular, glabrous. Lodicules 2, abaxial, 0.5–0.7 mm long, oblong. Anthers 1.5–3 mm long, penicillate. Caryopsis 4–5 mm long; embryo 20% the length; hilum 60–80% the length.

DISTRIBUTION: Southern Western Slopes and Plains of New South Wales, extending into Victoria, across the mallee regions of South Australia and the southern regions of Western Australia.

SELECTED SPECIMENS: NEW SOUTH WALES: **Central Western Slopes:** Muswellbrook, *Blakely NSW 115786*, 10.1911 (NSW); Peak Hill, *Boorman NSW 115796*, 11.1905 (NSW); Cunninyeuk, *Henderson NSW 115948*, 9.1946 (NSW); 'Lake Cowral' Station, Marsden, *Wilson NSW 115789*, 12.1917 (NSW); Wyalong, *Boorman NSW 121577*, 11.1917 (NSW, CANB, BRI); Alleena via Barmedman, *Winter NSW 115798*, 6.1931 (NSW); Ashbridge via Matong, *Cahill NSW 115790*, 11.1907 (NSW). **South Western Slopes:** Coolamon, *Bridle NSW 115785*, 5.1940 (NSW); Milbrulong, *Dwyer NSW 115791*, 11.1926 (NSW). **North Western Plains:** Nyngan, *Blakely NSW 115792*, 10.1912 (NSW). **South Western Plains:** Tullamore district, Fishpool, *no collector NSW 115781*, 11.1966 (NSW); W. of Weethalle, *Gauba CBG 008951*, 15.12.1950 (CBG); 10 miles [16 km] N. of Oxley on Booligal road, *De Nardi 1002*, 10.1972 (NSW); near Griffith, *J.C.N. NSW 72702*, 11.1964 (NSW); W. of Griffith on Rankin Springs road, *Cunningham NSW 115780*, 10.1971 (NSW); 'Zara' via Hay, *Officer NSW 115797*, 11.1903 (NSW); 40 miles [64 km] N. of Balranald, *Alchin NSW 120329*, 7.1970 (NSW); 7.9 miles [12.8 km] W. of Balranald, *De Nardi 1017*, 10.1972 (NSW); Narrandera, *Warby*, 1895 (MEL); 30 miles [61 km] W. of Moulamein, *Moore 15.10.1971* (CANB); Hillston to Rankin Springs road, *Constable NSW 4595*, 10.1947 (NSW); Wanganella, *Mulham NSW 97805*, 8.1967 (NSW); Tulla, Barham district, *Henderson NSW 115787*, 1945 (NSW). **North Far Western Plains:** Barrier Range, *Woolfs NSW 115782*, s.d. (NSW); 'Mundi Mundi' Station near Broken Hill, *Constable NSW 4681*, 11.1947 (NSW). **South Far Western Plains:** Junction of the Murray & Darling Rivers, Wentworth, *Holding*, 1890 (MEL).

VICTORIA: **Region A:** 30 km SSW. of Mildura, 9 km S. of Benetock, along Meridian road, *Crisp 3287*, 9.10.1977 (CBG); Hattah Lakes National Park, *Anderson*, 9.12.1965 (MEL). **Region C:** Jeparit, *no collector*, 14.10.1912 (MEL); 3 miles [5 km] NW. of Kanwa, *Melville et al. 886*, 15.9.1952 (NSW); Shire of Dimboola, *Reader*, 23.10.1893 (MEL); Mt Arapiles, *Corrick 1358*, 24.11.1968 (NSW). **Region G:** Kulwin, *Baker*, 20.10.1926 (BRI); Swan Hill district, *French*, 10.1888 (MEL). **Region H:** mallee scrub, Borung, *Reader*, 8.1911 (MEL). **Region J:** Stawell, *Holt*, s.d. (MEL). **Region M:** Nathalia, *Black*, 11.11.1932 (CANB 9757); Bendigo, *Whipstick*, *Hart*, 11.1947 (MEL). **Region N:** Daylesford, *Wallace*, 1878 (MEL); nr. Bacchus Marsh, *Tovey & French*, 3.11.1910 (MEL, PERTH). **Region P:** Mornington Peninsula, Frankston, *Willis NSW 116706*, 8.1.1969 (NSW, MEL). **Region S:** Woods Point, *no collector*, 25.10.1931 (ADW).

SOUTH AUSTRALIA: **Nullarbor:** Barton (c. 345 km E. of the Western Australian border, on the railway), *Ising 386 & 1336*, 20.9.1920 (AD); 4 miles [6 km] inland from cliff tops, Koonalda, *Symon 4597*, 17.2.1967 (ADW). **Flinders Ranges:** Blinman Cemetery, *Frances*, 10.1971 (AD); Oraparinna National Park, *Symon 7573*, 16.9.1971 (ADW); between Wilson & Warren, *Crocker*, 2.10.1944 (CANB 11595); between Wilson & Gordon, Willochra Plain, *Burbidge*, 1.9.1946 (CANB 12811); Pichi Richi Pass, *Lothian 3057*, 7.11.1964 (AD); Mt Remarkable, Melrose, *Eardley*, 2.9.1946 (ADW 19772). **Eastern:** N. of Curnamona, *Symon 8033*, 18.9.1972 (ADW); Koonamore, *Crisp 635*, 22.10.1973 (CBG); Mutooroo, *Morris*, 12.8.1921 (ADW 15069). **Eyre Peninsula:** Coorabie, *Cleland*, 18.10.1953 (AD); 12 miles [19 km] N. of Koonibba siding, *Symon*, 30.9.1959 (ADW 21350); Yudnappina, *Douglas*, 9.1939 (ADW 18280, 22952); Gawler Ranges, 10 km N. of Yardea, *Symon 8155*, 8.10.1972 (ADW); Whyalla Knob, *Cleland*, 1.9.1944 (AD); c. 4 miles [6 km] S. of Mambray Creek, *Copley 1586*, 10.10.1967 (AD); Hambidge National Park (c. 140 km N. of Port Lincoln), *Kraehenbuehl 2071*, 9.10.1966 (AD); c. 11 miles [18 km] SSW. of Port Broughton, *Morris*, 28.8.1946 (MEL); 57 miles [91 km] from Port Lincoln towards Cowell, *Wrigley CBG 037424*, 21.11.1968 (CBG); 3 miles [5 km] N. of Cowell, *Tindale 454*, 12.11.1970 (CANB, BRI). **Northern Lofty:** Bundaleer, Monarto South, *Symon 3139*, 20.11.1964 (ADW); Hincks National Park, *Symon 6515*, 13.10.1968 (ADW); Barunga Gap Cemetery, *Copley 1502*, 4.10.1967 (AD); Northern Tothill Range, Niblet Gap, *Kraehenbuehl 2172*, 29.10.1967 (AD); South Hummocks Range, *Blaylock 723*, 1.10.1967 (AD); Saddleworth, *Symon*, 27.10.1960 (ADW 22951); Freeling, *Kraehenbuehl 1487*, 18.11.1965 (AD). **Murray:** 'Baldina' Station, *Jackson 379*, 9.10.1961 (BRI); 3 miles [5 km] W. of Bower, *Boehm 410*, 16.10.1963 (AD); Overland Corner, *Symon 3882*, 12.10.1965 (ADW); between Kingston & Waikerie, *Whibley 2651*, 28.9.1968 (AD); N. of Owen, *Hilton*, 11.9.1951 (ADW 43863); Loveday, *Gauba CBG 003982*, 12.8.1944 (CBG); Old Coach Road Block 73, County Hamely, *Symon 3803*, 11.10.1965 (ADW); 1 mile [1.6 km] E. of Truro, *Kraehenbuehl 690*, 22.9.1962 (BRI); Barossa Valley, *Wells*, 31.7.1952 (ADW 8004); Mannum, *Blake 16841*, 24.8.1946 (BRI). **Yorke Peninsula:** near Port Germein, *Phillips CBG 054565*, 14.9.1973 (CBG); Mona Railway Yard, *Copley 873*, 8.11.1966 (AD); 4 miles [6 km] from Moonta towards Maitland, *Phillips CBG 042829*, 2.10.1965 (CBG); Hardwicke Bay, *Smith 756*, 25.10.1967 (AD); Greenly Island, North Island, c. 100 km W. of Port Lincoln, *Adelaide Bushwalkers*, 4-17.12.1947 (AD); Innes National Park, *Symon 9545*, 6.10.1974 (ADW, NSW). **Southern Lofty:** Roseworthy Agricultural College, *Hilton*, 23.10.1939 (ADW 28137); 1 mile [1.5 km] W. of Willaston, *Belcher*, 31.10.1967 (MEL); 2.5 miles [4 km]

WNW. of Gawler, *Smith 958*, 23.10.1967 (AD); Highbury, *Smith 1565*, 28.11.1968 (AD); E. side of the Port River between Granger & Royal Park, *Smith 914*, 21.10.1967 (AD); Tea Tree Gully, Dillon Road, *Spooner 325*, 12.10.1968 (AD); Christies Beach, *Perry*, 9.1944 (CANB 18356); c. 1 km NE. of Finnis, *Whibley 3683*, 26.10.1971 (AD); near Milang, c. 65 km SSE. of Adelaide, nr. Lake Alexandrina, *Whibley 870*, 8.10.1962 (AD). **Kangaroo Island:** Kingscote, *Jackson 219*, 16.9.1920 (AD).

WESTERN AUSTRALIA: **Carnegie:** Barwidgee road, 11.5 miles [18 km] S. of Yelma turn off, *Speck 1347*, 7.9.1958 (CANB, PERTH). **Ashburton:** Upper Murchison River, *Tyson 90*, 1892 (MEL). **Austin:** 103 miles [165 km] SSE. of Carnarvon, *Beauglehole 11789*, 21.8.1965 (CANB, PERTH); Mt Narryer, Murchison River, *Tyson 33*, 1898 (PERTH); 65 km NE. of Laverton, *Beauglehole 59899 & Errey*, 16.9.1978 (PERTH, NSW). **Coolgardie:** Lake Moore, *Gardner*, 10.1939 (PERTH); Camp 61, c. 160 km ESE. of Kalgoorlie, Elder Expedition, *Helms*, 25.9.1891 (AD); NE. of Kalgoorlie, *Gauba CBG 003955*, 10.10.1955 (PERTH); c. 4 miles [6 km] from Kalgoorlie towards Coolgardie, *Phillips CBG 025825*, 15.9.1962 (CBG, AD); 8 miles [15 km] SE. of Boulder, SE. of Kalgoorlie, *Beauglehole 13266*, 20.9.1965 (PERTH); Kurrawang, *Kessel*, 9.1921 (PERTH); 48 km W. of Coonana near Cardonia Rocks, *Chinnock 1141*, 18.9.1973 (AD); c. 20 km E. of Southern Cross, *Kuchel 2121*, 23.9.1964 (AD); Pioneer Rock, N. of Lake Cowan, *Burbidge 2672*, 19.9.1947 (CANB); Fraser Range, *Aplin 1771*, 6.9.1962 (PERTH); 4 miles [6 km] N. of Norseman on Coolgardie road, *Beauglehole 13329*, 21.9.1965 (CANB, PERTH); Norseman, *Galbraith*, 18.10.1964 (MEL); 2 miles [3 km] S. of Lake Kirk, *Burbidge 2685*, 20.9.1947 (CANB); Lake Hope, *Beard 3796*, 23.10.1964 (PERTH); Dundas Rocks, 10 miles [16 km] S. of Norseman, *Beauglehole 13200*, 18.9.1965 (CANB, PERTH). **Roë:** 5 km NW. of Ongerup, *Newbey 4590*, 16.11.1974 (PERTH). **Avon:** 6 miles [8 km] E. of Ballidu, *Royce 2167*, 13.9.1947 (PERTH); Cowcowing, *Koch 1133a*, 8.1904 (PERTH); Yelbine [Yelben], *Carne*, 11.1925 (PERTH); Merredin, *Carne*, 10.1923 (PERTH); Muntadgin, *Bailey 177*, 9.1945 (PERTH); Wagin, *Gardner 485*, 25.10.1920 (PERTH). **Irwin:** Dirk Hartog Island, *George*, 9.1972 (PERTH); between Denham & Monkey Mia, *Beard 6770*, 9.10.1973 (NSW, PERTH); 1 mile [1.6 km] S. of Wannoo, *Phillips CBG 035348*, 16.9.1968 (MEL); Champion Bay, *Guerin*, 1871 (MEL); c. 70 km NE. of Geraldton, *Muir 82(FF)*, 12–16.10.1976 (PERTH); 7 miles [11 km] N. of Geraldton, *Burbidge 2048*, 2.9.1947 (CANB); Geraldton, *Carriage & Ollerenshaw CBG 062572*, 5.10.1975 (CBG, PERTH); between Geraldton & Northampton, *Blake 18083*, 2.9.1947 (PERTH, BRI); West Wallabi Island, Abrolhos Islands, *Storr*, 9.1959 (PERTH); East Wallabi Island, Abrolhos Islands, *Gilham*, 7.9.1959 (PERTH); 'Karara' Station, *Beard 7193*, 28.10.1974 (PERTH); Yandanooka, *Morrison*, 16.9.1904 (PERTH, BRI). **Darling:** Goomalling, *Pullen 9618*, 25.11.1974 (CANB, NSW); Woorooloo-Bailup road, S. of Toodyay road, *Burbidge 7992*, 4.1.1972 (CANB); Woorooloo, *Koch*, 11.1907 (MEL); Darlington, *Helms*, 9.1898 (PERTH); Cottlesloe, *Andrews*, 9.1903 (PERTH); Upper Swan River, *Sewel*, 1855 (MEL); Blackwood River, *Hester*, 1876 (MEL). **Eyre:** Pallarup Rocks, SE. of Lake King, *George 1547*, 13.10.1960 (PERTH); Oldfield River crossing on Ravensthorpe–Esperance road, *Jackson 1409*, 13.10.1968 (PERTH); nr. Culham Inlet, *George 605*, 31.1.1960 (PERTH).

Palatable to stock and now found growing chiefly in situations sheltered from grazing, e.g. under and through the branches of shrubs or fallen timber; it was probably at one time much more abundant.

Stipa eremophila *Reader*, Victorian Naturalist 17: 154 (1901); Black, Fl. S. Austral. 1: 65 (1922), edn 2: 90, fig. 110 (1943); Gardner, Fl. W. Austral. 1, Gram.: 180 (1952); Willis, Handb. Pl. Victoria 1: 186 (1962), edn 2, 1: 186 (1970).

HOLOTYPE: VICTORIA: Sandy Desert, Lowan, 1898, *F.M. Reader* (MEL 59873!).

SYNONYMS: *Stipa pubescens* var. *auricoma* *Reader*, Victorian Naturalist 17: 156 (1901). HOLOTYPE: VICTORIA: November, 1897, Desert, Lowan; *F.M. Reader* (not seen). We have seen a specimen in the Melbourne Herbarium (MEL 60695) labelled by *Reader* '*Stipa aristiglumis* F.v.M. var. *auricoma*, Little Desert, Lowan, 16.10.1898. Coll. F.M. Reader' which, in the absence of the Holotype, we are accepting as the basis for our concept of this variety. This specimen is *S. eremophila* with immature spikelets in which the hairs of the lemma have not yet attained the yellowish to reddish brown colour described by *Reader* for his variety and characteristic of more mature spikelets of *S. eremophila*.

S. fusca C.E. Hubbard, Kew Bull. 1925: 432 (1925). HOLOTYPE: SOUTH AUSTRALIA: Eyre Peninsula, Iron Knob, *Cleland 3*, 22.8.1921 (K!; isotypes AD 9723153 and NSW 9317). Populations

of *S. eremophila* show considerable variation in length of both callus and body of the lemma. *S. fusca* was described from specimens at the extreme of the range in elongation of the callus combined with brevity of the body of the lemma. This combination of characters results in a somewhat distinctive appearance compared with the average proportions of the callus and body of the lemma in *S. eremophila*. However, so many intermediate gradations may be found that we are convinced that this form is unworthy of recognition.

S. variegata Summerhayes & Hubbard, Kew Bull. 1927: 363 (1927); Black, Trans. & Proc. Roy. Soc. South Australia 63: 241 (1939). HOLOTYPE: SOUTH AUSTRALIA: Sandergrove near Lake Alexandrina, 21.10.1926 (K; isotype AD 96323303; CANB photo 237008). In the Type the hairs on the lemmas are white, not fulvous, although a slight yellowing can be detected in a lemma of the duplicate; we regard this difference in colour, together with the slenderness of the lemma, to be due to the immaturity of the specimen. This specimen can be matched with immature material of *S. eremophila*. We have been unable to recognise any populations that could justify recognition of *S. variegata* as distinct from *S. eremophila*.

S. dura J. Black, Trans. & Proc. Roy. Soc. S. Austral. 65: 333 (1941); Fl. S. Australia edn 2, 1: 86–87 (1943), in part. HOLOTYPE: SOUTH AUSTRALIA: Nullarbor Station (near Fowlers Bay), Black, 1911 (AD 97424089). The Holotype is very imperfect, but we have no doubt that the spikelets agree with *S. eremophila*. Mounted on the same sheet is a specimen from Cape Thevenard (cited by Black, Fl. South Australia) that, although also rather imperfect, appears to be *S. flavescens* Labill.

Caespitose perennial to c. 0.9 metres high, with a basal tuft of leaves at least half the total height. Culms erect or geniculate, 1–1.5 mm wide near the base, terete, slightly compressible, scarcely ribbed, glabrous and smooth to minutely scaberulous or puberulous; nodes 2–3, appressed-pubescent to almost glabrous, exserted, to 60% wider than adjacent internodes. Leaf sheaths tight around the culms, c. 4 mm wide (the uppermost inflated and to 8 mm wide), finely pubescent or hirsute or glabrous, especially upwards; inner margin glabrous; outer margin ciliate, more so just below the orifice. Ligule coriaceous, 0.5–1.5 mm long, truncate (although often torn), densely ciliate; abaxial surface glabrous to pubescent; auricles densely to sparsely ciliate with straight or crinkly hairs or glabrous. Leaf blades mostly rolled, 1.5–4 mm wide, to 30 cm long, abaxial surface scarcely ribbed, glabrous to hirsute; adaxial surface ribbed, scaberulous, densely pubescent or hirsute to almost glabrous; margins scabrous or similar to adjacent surface. Panicle spreading at maturity, 15–30 cm long, 2–7 cm wide (excluding awns), exserted; axis terete, glabrous to sparsely pubescent; branches 10–60 mm long, angular, scaberulous to scabrous-pubescent; pedicels 2–15 mm long, flattened, scaberulous to scabrous-pubescent. Spikelets 15–25 mm long (excluding awn), slightly gaping. Glumes unequal, at least the lower usually broad and inflated, rarely narrow, glabrous or scaberulous on the nerves; lower 15–25 mm long, long-acuminate, the lower 50–75% 3-nerved, pale or usually with a crescentic purple patch in the middle third; upper 10–18 mm long, acuminate, the lower 30–50% 5-nerved, 50–75% 3-nerved, pale or purple at the base. Floret turbinate to cylindrical, usually with a neck, 6–9.5 mm long (including callus). Lemma deep brown at maturity, the surface smooth, sericeous with dense fulvous hairs, but the upper 0.5–1.5 mm scabrous with much shorter but otherwise similar hairs; lobes 2, obtuse to broadly acute, 0.2–0.4 (–0.75) mm long (rarely to 1.5 mm long, and then acute); coma of sparse stiff hairs 0.4–0.7 mm long. Callus 2–4 mm long, straight or slightly curved when short, sericeous with dark fulvous hairs. Awn sturdy, 0.25–0.4 mm wide near the base, 5–9 (–11) cm long, twice bent; column pale, 15–38 mm long, 7–16 mm to the first bend, pubescent with hairs 0.2–0.4 (–0.5) mm long to almost glabrous with few hairs to 0.1 mm long; bristle pale or purple-tinged, scaberulous or pubescent with hairs to 0.25 (–0.5) mm long. Palea acute, from slightly shorter to slightly longer than the lemma, ciliate at the tip, granular, densely sericeous between the nerves, the margins membranous and

glabrous. Lodicules 3, membranous; 2 abaxial 1–1.5 mm long, obtuse to spatulate; paleal 0.5–1.5 mm long, obtuse to acute. Anthers 2.5–4 mm long, penicillate. Caryopsis 3.5–4.5 mm long; embryo 30% the length; hilum 80% the length.

DISTRIBUTION: Southern Slopes and Plains of New South Wales, north-western regions of Victoria, across the southern half of South Australia and the Nullarbor Plain into the south of Western Australia. Mainly in woodlands or mallee but not uncommon on the limestone areas of the Nullarbor Plain.

SELECTED SPECIMENS: NEW SOUTH WALES: **South Western Slopes:** Urana, W. of Wagga Wagga, *Libke*, 26.9.1968 (CANB). **South Western Plains:** Griffith, *Jacobs 4159 & Everett*, 24.9.1981 (NSW); Kyalite, *Everett 60 & Jacobs*, 22.11.1980 (NSW); Cunninyeuk near Wakool between Moulamein & Swan Hill, *Henderson 177*, 8.10.1946 (MEL; NSW); N. of Stony Crossing, *Everett 88 & Jacobs*, 23.11.1980 (NSW); 3 miles [5 km] W. of Stony Crossing, *Henderson 431*, 9.10.1947 (NSW); Trida district, *Stannard NSW 116344*, 8.10.1956 (NSW); W. of Tueloga Siding, *Henderson 430*, 14.10.1947 (NSW); Meran Creek, between Swan Hill & Moulamein, *Henderson 435*, 5.12.1947 (NSW); E. end of Pt Poon Boon, SE. of Stony Crossing, *Henderson 427*, 23.9.1947 (NSW); NE. of Lake Tooim, *Henderson 432*, 5.11.1947 (NSW). **North Far Western Plains:** 11 miles [18 km] S. of Broken Hill, *Jacobs 176*, 11.11.1971 (NSW); Broken Hill, *Morris NSW 9325*, 11.1920 (NSW, K). **South Far Western Plains:** 135 miles [216 km] S. of Broken Hill, *Richley 1464*, 2.9.1974 (NSW); near Thackaringa, *Morris 13925*, 6.11.1920 (ADW); 13 miles [21 km] E. of Darnick, *De Nardi 1095*, 22.10.1972 (NSW); 39 km from Wentworth, 'Nulla Nulla' road, *Everett 117 & Jacobs*, 25.11.1980 (NSW); 6 km NE. of Euston, Balranald road, *Everett 105 & Jacobs*, 24.11.1980 (NSW); ridge above Lake Benemee, near Euston, *Henderson 423*, 5.10.1947 (NSW).

VICTORIA: **Region A:** Sunny Cliffs, S. of Mildura, *Beaglehole 16033*, 20.9.1966 (NSW). **Region B:** Bronzewing Wildlife Reserve, 15 km SSE. of Ouyen, *Beaglehole 56965*, 25.10.1977 (MEL); Beulah, *Connor*, 10.1963 (MEL). **Region C:** Broughton, *no collector* (MEL); 18 km SW. of Warracknabeal, Dimboola road, *Everett 172 & Jacobs*, 29.11.1980 (NSW); Kaniva, *Watts NSW 9327*, 10.1917 (NSW). **Region F:** 14 km SSE. of Robinvale, *Beaglehole 56070*, 3.5.1977 (MEL). **Region G:** 5 km SW. of Chinkapook, c. 18 km S. of Manangatang, *Beaglehole 55493*, 17.4.1977 (MEL); 17 km SSW. of Swan Hill, *Beaglehole 56001 and Macfarlane*, 1.5.1977 (MEL). **Region H:** Borung, *Reader*, 28.10.1904 (MEL, AD).

SOUTH AUSTRALIA: **Nullarbor:** N. of Cook, *Hilton*, 22.8.1955 (ADW); vicinity of Koonalda Cave, *Symon 4490*, 16.2.1967 (ADW); 'Nullarbor' Station, *Black NSW 9321*, 6.1911 (NSW); W. of Wigunda, *Phillips CBG 016293*, 7.9.1962 (CBG). **Gairdner-Torrens Basin:** 5 km N. of 'Bon Bon', *Donner 1707*, 8.9.1966 (AD). **Flinders Ranges:** 10 miles [16 km] N. of Hawker, *Hilton*, 2.10.1954 (ADW); Waterfall Creek near Baroota, *Kraehenbuehl 194*, 18.9.1960 (AD); Waukaringa, between Yunta & 'Koonamore', *Symon*, 19.12.1954 (AD); Craddock, on Wilson road, *Hilton NSW 116343*, 1.10.1954 (NSW, ADW); Orroroo, *Black*, 6.10.1910 (AD). **Eastern:** Mt Victor, *Lay & Crisp 439*, 4.9.1971 (AD, CBG); 'Koonamore', *Everett 162 & Jacobs*, 28.11.1980 (NSW); Yunta, *Black, s.n., s.d.* (MEL). **Eyre Peninsula:** 65 km from Ceduna along Eyre Highway towards Poochera, *Crisp 5762, Taylor & Jackson*, 12.9.1979 (CBG); E. slope of Iron Knob, 50 miles [80 km] NW. of Whyalla, *Hilton*, 14.9.1951 (ADW); Kimba, *Cleland*, 8.10.1932 (ADW); Gawler Ranges, S. of Scrubby Peak, 24 km N. of Minnipa, *Wilson 527*, 16.10.1958 (AD, K); c. 11 miles [18 km] SSW. of Port Broughton, *Blake 16847*, 28.8.1946 (BRI); c. 35 km W. of Colona, *Cleland*, 9.11.1955 (AD). **Northern Lofty:** halfway between Wintinerta and Bute – Kadina bitumen, *Copley 658*, 24.9.1966 (AD); 1 mile [1.6 km] W. of Balaklava, *Clarke*, 13.10.1936 (ADW); Mallala, *Harris 31*, 1.10.1959 (AD); S. of Freeling, *Kraehenbuehl 1783*, 6.11.1966 (AD). **Murray:** 8 miles [13 km] from Morgan towards Burra, *Phillips CBC 018940*, 2.9.1962 (CBG); Hundred of Bower, *Joannov 52*, 5.4.1968 (AD); E. of Sutherlands township, *Bohem 314*, 9.1958 (AD); road to Walkers Flat, *Cleland*, 8.10.1966 (AD); Murray Bridge, *Cleland*, 7.3.1941 (AD). **Yorke Peninsula:** Mission Station, Pt. Victoria, *Beck*, 2.1942 (ADW); 26 miles [42 km] from Yorketown towards Foul Bay, *Phillips CBG 026876*, 19.10.1966 (CBG). **Southern Lofty:** 1 mile [1.6 km] past Kangaroo Flat on Mallala road, *Harris 45*, 11.1959 (AD); Marino, *Cleland*, 8.10.1932 (AD); Hallett Cove, *Cleland NSW 116969*, 28.10.1932 (AD, NSW); Balaklava, 42 miles [67 km] NNW. of Gawler, *Hilton NSW 116342*, 1.10.1944 (NSW, ADW); Echunga, *Parsons 163*, 27.10.1961 (AD). **South-eastern:** 1 km from Keith on Adelaide road, *Specht*, 9.1949 (AD); Millicent, *Cleland*, 14.10.1949 (AD).

WESTERN AUSTRALIA: **Eucla:** 3 miles [5 km] S. of Reid, *Aplin*, 1.9.1962 (PERTH); 1 mile [1.6 km] W. of Forrest, *Calaby*, 24.10.1947 (CANB, BRI); Loongana, *Mitchell 69*, 11.9.1974 (PERTH); 50 miles [80 km] NNE. of Rawlinna, *Brooker 171*, 5.9.1974 (CANB); 26 km E. of Rawlinna, *Goodall*

2698, 18.8.1966 (PERTH); Rawlinna, *Wilson 5799*, 15.5.1967 (PERTH); 50 km S. of Rawlinna on road to Cocklebiddy, *George 11886*, 13.7.1974 (PERTH); 12 miles [19 km] from Madura towards Cocklebiddy, Eyre Highway, *Phillips CBG 039214*, 1.9.1968 (CBG, BRI); 46 km WSW. of Madura, *Beaglehole 49403*, 30.8.1974 (CANB). **Coolgardie**: 5 km W. of Coolgardie, *Hacker 3*, 11.3.1971 (PERTH); 30 km E. of Kitchener on Trans-Australian Railway, *Wilson 7644*, 2.9.1968 (PERTH); 147 km E. of Zanthus, *Goodall 2723*, 24.9.1966 (PERTH); Cunderlee Mission, N. of Zanthus, *George 5893*, 22.9.1963 (PERTH); Fraser Range, *Helms NSW 9320*, 30.10.1891 (NSW); 14 miles [22 km] N. of Norseman on Coolgardie road, *Beaglehole 1335*, 21.9.1965 (NSW); c. 160 km E. of Balladonia, *Jackson 1470*, 24.10.1968 (PERTH). **Darling**: 5 km NW. of Wongan Hills town, *Crisp 6323*, *Taylor & Jackson*, 2.10.1979 (CBG).

S. eremophila has a greater range of variation than most of the other Australian species of *Stipa*. Several of the recently described species are related to *S. eremophila*; each of these forms uniform populations differing in one or more characters from true *S. eremophila*. It is not uncommon to find individual specimens of *S. eremophila* with characters different from those accepted here as being characteristic of the species. Where the variants occur in populations dominated by what we regard as true *S. eremophila* these variants are not being recognized as taxonomically distinct. The anomolous characters seem to be relatively uncommon and not correlated with either other characters or variations in habitat. Common variations include long lemma lobes, hairy bristles (approaching *S. plumigera*), hairy orifices and almost glabrous lemmas. Examples are cited here of specimens with (i) long lemma lobes and (ii) hairy bristles (see *S. lanata* for a discussion of the latter two variations):

(i) NEW SOUTH WALES: **South Western Plains**: 3 miles [5 km] W. of Stony Crossing, *Henderson 431*, 9.10.1947 (NSW); SE. of Stony Crossing, *Henderson 427*, 23.9.1947 (NSW); W. of Tueloga [as Tucloga] Siding, *Henderson 428*, 29.9.1947 (NSW). SOUTH AUSTRALIA: **Murray**: Oakbank Station, *Cleland*, 21.9.1968 (AD 97308293).

(ii) VICTORIA: **Region A**: Mildura, *Sonenberg 1937*, 4.11.1935 (K). SOUTH AUSTRALIA: **Nullarbor**: Between Eucla & Fowlers Bay, *Richards* (MEL 60925). WESTERN AUSTRALIA: **Eucla**: 3 km N. of Eucla, *Whibley 632*, 14.9.1960 (AD); c. 70 km W. of Madura, *Kuchel 1570*, 9.9.1964 (AD).

Stipa exilis J. Vickery, *Telopea* 2(1): 13 (1980).

HOLOTYPE: SOUTH AUSTRALIA: Northern Yorke Peninsula, section 155, Hundred of Willunga (about 140 km NNW. of Adelaide), *B. Copley 799*, 21.10.1966 (AD 9670326).

Densely caespitose perennial to 0.6 metres high with mostly intravaginal basal leaves to about half the height. Culms usually geniculate or erect, to 1 mm wide near the base, terete, compressible, ribbed, puberulous or scaberulous just below the nodes otherwise glabrous or puberulous; nodes 2, finely pubescent, usually exserted, up to 50% broader than adjacent internodes. Leaf sheaths tightly enclosing the culm although basal sheaths loose, c. 5 mm wide, ribbed, scaberulous and pubescent and/or hirsute; inner margin \pm glabrous; outer margin short- or long-ciliate or glabrous. Ligule firmly membranous, obtuse, 0.5–2.5 mm long, often continuous with the sheath margin; margin glabrous or ciliate; abaxial surface puberulous; auricle with a dense to sparse tuft of long, straight or woolly hairs. Leaf blades loosely convolute, flexuose, less than 0.5 mm in diameter, to 25 cm long; abaxial surface slightly ribbed, scaberulous and pubescent and/or hirsute; adaxial surface strongly ribbed, pubescent; margins scabrous with short hooks. Panicle loosely contracted or narrowly spreading, moderately sparse, to 20 cm long, to 3 cm wide (excluding awns), exserted at length, with fascicles of unequal, few-flowered branches; axis terete or slightly angular, scaberulous; branches to 7 cm long, slightly angular, scaberulous. Pedicels to 10 mm long, slightly angular, scaberulous. Spikelets

8–10 mm long (excluding awn), gaping narrowly. Glumes unequal, firm and green at the base, purple-tinged to hyaline at the tip, scaberulous on the nerves or scaberulous overall; lower glume 8–10 (–12) mm long, acuminate, the lower 50–60% 3-nerved; upper glume 7–8 mm long, acute or obscurely dentate, the lower 50–70% 5-nerved, the next 10% 3-nerved. Floret linear-cylindrical to fusiform, 4.5–5.5 mm long (including callus). Lemma black at maturity, the main nerve paler, very finely granular to coarsely granular at the apex, with sparse erect and spreading hairs, white to bright gold at maturity; coma obscure, 0.6–0.8 mm long; lobes 2, to 0.25 mm long. Callus 1–1.5 mm long, sturdy, straight, with hairs similar to those of the lemma. Awn 35–55(–60) mm long, 0.2 mm wide near the base, gently twice bent; column 15–21 mm long, 9–15 mm to the first bend, scaberulous with hairs to 0.2 mm long; bristle scaberulous. Palea broad-acute to obtuse, to 0.5 mm shorter than the lemma, coriaceous, smooth, sericeous down the centre, hyaline and glabrous on the margins, the tip ciliate. Lodicules 3, membranous; 2 abaxial c. 1 mm long, cuneate; paleal less than 0.5 mm long, triangular-acute. Anthers 1–2 mm long, penicillate. Caryopsis 3–3.5 mm long; embryo 25% the length; hilum 70–90% the length.

DISTRIBUTION: Heath and scrub on sandy soil in southern South Australia, barely extending into Victoria and Western Australia (although not on the Nullarbor Plain).

SELECTED SPECIMENS: VICTORIA: **Region D:** 10 miles [16 km] SW. of Dergholm, *Beaglehole* 38083, 18.12.1971 (NSW).

SOUTH AUSTRALIA: **Eyre Peninsula:** 15 miles [24 km] from Poochera towards Minnipa, Eyre Highway, *Canning* 2277, 30.8.1968 (CBG, NSW); Hambridge National Park, *Kraehenbuehl* 2070, 8.10.1966 (AD); between Prominent Hill & S. edge of Hambridge Reserve, *Symon* 4118, 8.10.1966 (ADW); c. 11 miles [18 km] SSW. of Port Broughton, *Blake* 16848, 28.8.1946 (BRI); Hincks National Park, *Symon* 6455, 11.10.1968 (ADW); Kirton Point Reserve, Port Lincoln, *Whibley* 360, 12.10.1958 (AD); Flora and Fauna Reserve, Hundred of Flinders, *Specht* 2636, 10.11.1960 (AD). **Northern Lofty:** c. 5 km W. of Bute (old Mona railway yard), *Copley* 494, 14.8.1966 (AD); South Hummocks Range, *Copley* 3228, 25.10.1970 (AD). **Murray:** 6 miles [10 km] W. of Murray Bridge, *Crocker*, 23.10.1943 (CANB); Kinchina, *Cleland* NSW 117042, 9.1922 (NSW). **Yorke Peninsula:** Point Davenport, *Symon* 11918, 4.11.1979 (ADW); between Arthurlton & Maitland, *Blaylock* 1046, 6.10.1968 (AD). **Southern Lofty:** Chaunceys Line Reserve, *Hilton* 1011, 9.10.1954 (ADW). **Kangaroo Island:** Kingscote, *Cleland*, 26.11.1945 (AD 96323204). **South-eastern:** Ki Ki, 30 miles [48 km] SE. of Tailem Bend, *Hilton*, 12.10.1953 (ADW).

WESTERN AUSTRALIA: **Roe:** 16 km from Gnowangerup, towards Albany, *Phillips* WA/622116, 10.10.1962 (NSW). **Eyre:** 4 km E. of Needilup, *Newby* 4919, 10.11.1975 (PERTH).

Differs from *S. mundula* in its intravaginal habit, rather finer, pubescent to hirsute leaves with the nerves manifest on the outer surface, its very obtuse rather than truncate ligule, more slender, capillary, and shorter awn, shorter glumes and lemma. The spikelets and lemmas of *S. exilis* resemble those of *S. multispiculis* but the short slender tufted habit of *S. exilis* is very different.

Although *S. exilis* and *S. mundula* as described are quite distinct, two specimens are difficult to place in one or the other of the taxa because of the combinations of the definitive characters: 'Kirton Point Reserve, Port Lincoln, *Whibley* 360, 12.10.1958 (AD)' has smooth and \pm glabrous foliage as in *S. mundula* but a short lemma, delicate awn and slender, mostly intravaginal shoots as in *S. exilis*. 'Hincks National Park, Blue Range, Oak Amphitheatre, *Alcock* 2224, 7.12.1968, in part (AD)' has a long lemma, sturdy and pubescent awn and \pm glabrous foliage as in *S. mundula* but ribbed, slender, mostly intravaginal shoots as in *S. exilis*.

Both these specimens are from the area of overlapping distributions of *S. mundula* and *S. exilis*; their existence as intermediates does not affect the basic taxa.

***Stipa feresetacea* J. Vickery, S.W.L. Jacobs & J. Everett, sp. nov.**

S. setaceae affinis, sed glumis brevioribus, flosculo calloque aristaque brevioribus differt.

HOLOTYPE: NORTHERN TERRITORY: Mount Giles, 23°39'S, 132°55'E, P.K. Latz 6605, 19.9.1976, Spreading perennial. Rare in skeletal soil, side of gully in shistose [schistose] hill. (NT 51100; isotype NSW).

Caespitose perennial 0.5–1 metre high, without rhizomes, with a basal tuft of leaves from half to the full height. Culms erect, terete, 0.4–1.2 mm wide near the base, ± compressible, smooth to strongly ribbed upwards, glabrous to minutely scabrous upwards; nodes c. 3, exserted, glabrous, to 75% wider than the adjacent internodes. Leaf sheaths not inflated, 2–4 mm wide, glabrous to minutely scabrous; basal sheath smooth to moderately ribbed, the innovations pubescent at the base; upper sheath moderately to strongly ribbed; margins glabrous. Ligule acute to acuminate, membranous, 3.5–8 mm long, not ciliate; abaxial surface glabrous to minutely scabrous; auricles ± thickened, glabrous. Leaf blade tightly rolled, 0.7–0.9 mm wide, to 30 cm long; abaxial surface smooth to moderately ribbed, minutely scabrous; adaxial surface strongly ribbed, puberulous with minute siliceous prickles; margin minutely scabrous. Panicle 6–12 cm long, exserted, contracted, 5–10 mm wide (excluding awns), with distant fascicles of unequal, few-flowered, compound branches; axis angled, minutely scabrous; branches 1–25 mm long, angled, minutely scabrous; pedicels 2–7 mm long, angled, minutely scabrous. Spikelets 4–7 mm long (excluding awn), gaping at maturity. Glumes subequal to unequal, acute, straw-coloured, glabrous to minutely scaberulous; lower glume 4–7 mm long, lower 40–50% 3-nerved, upper 50–60% 2–1-nerved; upper glume 4–6 mm long, lower 40–70% 5–3-nerved, upper 30–60% 3–1-nerved. Floret turbinate, 3–4.5 mm long (including callus). Lemma surface granular to smooth, with hairs 0.5–1 mm long, without a neck; indefinite coma of hairs 0.2–0.9 mm long; lobes absent. Callus 0.7–1.4 mm long, weakly bent at the tip, densely sericeous with hairs 0.1–1 mm long. Awn 12–18 mm long, twice bent, 0.2 mm wide near the base; column 7–10 mm long, 3.5–6 mm to the first bend, brown, scabrous with hairs minute–0.1 mm long; bristle delicate, minutely scabrous. Palea equal to the lemma, obtuse, densely sericeous in the central groove with hairs 0.5–1 mm long, surface smooth to granular along the central groove. Lodicules 3; 2 abaxial membranous, c. 0.8 mm long, acute; paleal membranous, c. 0.5 mm long, acute. Anthers 1.4–1.8 mm long, not penicillate. Caryopsis 2–2.5 mm long; embryo 30–40% the length; hilum 80–100% the length.

Similar to *S. setacea* but differing in all the spikelet parts being smaller. See notes under *S. setacea* concerning similarities with species of *Piptochaetium*.

The specific epithet is derived from the Latin for 'nearly' or 'almost' (*ferē*) and from the specific epithet of *S. setacea*.

DISTRIBUTION: Rocky hillsides of the Central Australian Ranges.

SPECIMENS EXAMINED: NORTHERN TERRITORY: Chewing Range, 23°39'S, 132°58'E, Latz 6647, 22.9.1976 (NT); Mt Giles, 23°39'S, 132°55'E, Latz 6605, 19.9.1976 (NT, NSW); N. face of Mt Gillen, Latz 1808, 14.10.1971 (NT, CANB).

Stipa flavescens Labill., Nov. Holl. Pl. 1: 24, pl. 30 (1804); non Nees in Lehm. (1846); Brown, Prodr.: 175 (1810), at least in part; Bentham, Fl. Austral. 7: 566 (1878); Hughes, Kew Bull. 1921: 11 (1921); Black, Fl. S. Austral. 1: 66 (1922).

HOLOTYPE: 'Stipa flavescens billard n. Holl' (FI-W!), dupl. G (poor specimen); probable isotype K).

SYNONYMS: *S. scabra* var. *elatior* Benth., Fl. Austral. 7: 571 (1878). TYPIIFICATION, as cited (see below): 'Western Australia: Swan River, Drummond, 1st coll. and No. 959 (K); Murchison River, Oldfield'.

S. elatior (Benth.) Hughes, Kew Bull. 1921: 2 (1921); Black, Fl. S. Austral. edn 2: 91 (1943). Based on *S. scabra* var. *elatior* Benth. TYPIIFICATION: Hughes cites: 'Western Australia, Swan River, Drummond 1st coll. and No. 959*'; Harvey Steward 775; King Georges Sound, Brown 2603 p.p.'; by the asterisk she indicates Drummond 959 as the Type of *S. elatior* and, by implication, the Lectotype of *S. scabra* var. *elatior* Benth. Two sheets of Drummond No. 959 are at K(!) each named respectively in Bentham's and Hughes' handwritings. Duplicate specimens of this number are NSW 116766; MEL 59917, 59918.

S. scabra var. *striata* Benth., Fl. Austral. 7: 571 (1878). *S. variabilis* var. *striata* (Benth.) C. Gardner, Fl. W. Austral. 1, Gram.: 182 (1952). TYPIIFICATION, as cited (see below): 'Drummond, 133 (K!); Murchison River, Oldfield'. Gardner also cites, incorrectly, *S. incurva* Hughes and *S. falcata* Hughes as synonyms of the variety and cites 13 specimens from the South West Province of Western Australia (not seen and which may or may not be *S. flavescens*).

S. tenuiglumis Hughes, Kew Bull. 1921: 22 (1921); Black, Trans. & Proc. Roy. Soc. S. Austral. 63: 241 (1939), Fl. S. Austral. edn 2: 90 (1943). REPLACED SYNONYM: *S. scabra* var. *striata* Benth. TYPIIFICATION: Hughes cites five specimens: 'Murchison River, Oolingarra, Oldfield; Sand near Woodmans Point, Oldfield; Swan River, Drummond 133*, 138 p.p.; Buckland Hill, near Perth, limestone hills, Cecil Andrews, 1st coll. 1205,' indicating, by the asterisk, that Drummond 133 (K!) is the Type of her species and, by implication, the Lectotype of *S. scabra* var. *striata* Benth. At MEL there are probable duplicates of the Oldfield specimens from Woodmans Point and the Murchison River; these are also *S. flavescens* Labill.

S. compacta Hughes, Kew Bull. (1921): 24 (1921); 1922: 19 (1922); Willis, Handb. Pl. Victoria 1: 188 (1962), edn 2: 186, 435 (1970); Black, Fl. S. Austral. edn 2: 91 (1943). HOLOTYPE: TASMANIA: Gunn 996 p.p. (K!, CANB photo no. 237026).

S. aphanoneura Hughes, Kew Bull. 1921: 25 (1921); Black, Fl. S. Austral. edn 2: 93 (1943). HOLOTYPE: TASMANIA: Kents Group, Brown 6202 p.p. (K!, CANB photo No. 237025). We have been unable to discern any differences between *S. aphanoneura* Hughes and *S. flavescens* Labill. that could justify maintaining the former as a distinct species. In her description, Hughes states that the culms are pubescent, but in the Holotype they are not, and that the lateral nerves of the lower glume are almost obsolete, but in the Holotype they seem as distinct as in the rest of *S. flavescens*. Her illustration of a transverse section of a leaf of *S. aphanoneura* (fig. 37a, p. 29) clearly shows the difference in the indumentum (cf. fig. 6a, p. 19, *S. flavescens*) that can be readily observed on many specimens. We have, however, seen a number of intermediate specimens with a smooth outer surface of the blade and a pubescent upper surface, or vice versa, and specimens from a particular locality may be either glabrous or hairy. A manifest indumentum is more likely to occur in plants growing in habitats towards the limit of tolerance for the species (a not uncommon trend in grasses) such as on fossil sands (former sand dunes) now well away from the normal maritime or estuarine habitat of *S. flavescens*. *S. aphanoneura* then, is probably just a growth form of *S. flavescens* and is so treated here.

S. hirsuta Hughes, Kew Bull. 1921: 22 (1921). HOLOTYPE: WESTERN AUSTRALIA: Swan River, Drummond s.n., s.d. (K!)—*S. scabra* var. *barbata* Benth., Fl. Austral. 7: 571 (1878); based on same type.

S. pubescens var. *maritima* J. Black, Trans. & Proc. Roy. Soc. S. Austral. 67: 36 (1943); Black, Fl. S. Austral. edn 2: 90 (1943). HOLOTYPE: SOUTH AUSTRALIA: Marino, J.B. Cleland s.n., 8.10.1932 (AD 97422295).

POSSIBLE SYNONYMS: *S. laeviculmis* Nees in Lehmann, Pl. Preiss. 2: 99 (1846). HOLOTYPE: cited as 'In insula Van Diemen?' We have not yet found a specimen that could be regarded as the Holotype but the description would seem to apply to *S. flavescens*.

S. laevis Mez, Feddes Repert. Spec. Nov. Regni Veg. 17: 210 (1921). HOLOTYPE: cited as 'Western Australia, Esperance (Diels)'. The Holotype was in B and is no longer extant. We have not seen any specimen that could reliably be regarded as a duplicate of the Type. The description is a reasonable match for *S. flavescens*.

Caespitose perennial to 0.8–1.2 metres high with conspicuously extravaginal shoots from a short rhizome. Culms geniculate or erect, slightly compressible, terete, (1.5–) 3–4 mm wide near the base, scarcely ribbed, glabrous but sericeous just below the nodes, or puberulous to pubescent; nodes 2–4, exserted, to 40% broader than adjacent internodes, sericeous to almost glabrous. Leaf sheaths at first tightly enveloping the culms, soon becoming loose, slightly ribbed to almost smooth, minutely puberulous or scaberulous between the nerves to glabrous or occasionally densely pubescent; upper sheaths usually glabrous; inner margin glabrous or ciliate just below the orifice; outer margin ciliate but glabrous at the base. Ligule firm and coriaceous, 0.3–0.6 mm long, truncate, ciliate; abaxial surface sericeous; auricles thickened and spreading, with a sparse to dense tuft of hairs below. Leaf blades usually flexuose, occasionally erect, tightly rolled to expanded, to 7 mm wide, to 70 cm long; abaxial surface not ribbed, puberulous to glabrous or scaberulous, occasionally hirsute or scabrous with long hairs or short hooks; adaxial surface ribbed, scaberulous with minute hairs, or glabrous or rarely sparsely to densely hirsute especially in the basal shoots; margin similar to adaxial surface. Panicle (10–) 20–30 (–40) cm long, c. 3 cm wide (excluding awns), exserted late in development, contracted to loosely spreading, usually dense with moderately close fascicles of usually many-flowered branches; axis terete to angular upward, scaberulous to ± glabrous; branches to 15 cm long, terete to angular, scaberulous; pedicels to 8 mm long, terete to angular, scaberulous. Spikelets 9–14 (–16) mm long (excluding awn), gaping. Glumes unequal, membranous and translucent, scaberulous to scabrous or glabrous on the nerves or occasionally scaberulous overall; lower glume 9–14 (–16) mm long, long- to short-acuminate, the lower 25–70% 3-nerved; upper glume 9–11 (–14) mm long, the lower 30–50% 5-nerved, 3-nerved to 70%. Floret cylindrical to narrow-fusiform or slightly turbinate, (5.5–) 7–9 mm long (including callus). Lemma granular, dark brown at maturity, with sparse, spreading, erect yellow hairs becoming deep golden-brown at maturity; coma 0.3–1.2 mm long; 1–2 lobes, 0.1–0.5 mm long. Callus 1.6–3 mm long, fine and straight, sericeous with hairs similar to those of the lemma. Awn 40–70 mm long, 0.2–0.25 mm wide near the base, twice bent; column 18–30 mm long, 10–15 mm to the first bend, densely and softly pubescent with hairs (0.2–) 0.25–0.4 mm long; bristle scaberulous. Palea to 0.7 mm shorter than the lemma, acute, coriaceous, sericeous down the centre; margins glabrous; tip ciliate. Lodicules 3, membranous; 2 abaxial 0.8–1.6 mm long, spathulate; paleal c. 0.5 mm long, triangular, narrow-acute. Anthers 1.5–3.5 mm long, lightly penicillate. Caryopsis 3.5–4 mm long; embryo 25% the length; hilum 75% the length.

DISTRIBUTION: Headlands and sandy soils close to the coast of all southern States, including New South Wales.

SELECTED SPECIMENS: NEW SOUTH WALES: **South Coast:** Cave Beach, 3 miles [4.8 km] SW. of Jervis Bay, *Coveny* 3679, 12.10.1971 (NSW); Brush Island, 15 miles [24 km] S. of Ulladulla, *Rodway*, 5.9.1937 (K); Batehaven, *Reiner* 471, 22.11.1960 (CANB); Malua Beach, *Phillips* CBG 067213, 18.11.1967 (CBG); Broulee Head between Batemans Bay & Moruya, *Rodway* NSW 116722, 19.12.1948 (NSW).

VICTORIA: **Region D:** Hamilton Native Plant Reserve, Wannon, *Corrick* 1570, 2.1.1969 (Corrick herb). **Region E:** Steep limestone cliffs of Lower Glenelg River at Moretons Hut, *Willis*, 29.10.1948 (MEL); Portland, *Beaglehole* 7888, 10.1949 (NSW); Port Fairy, *Symon* 141, 8.11.1959 (ADW)

Region K: c. 24 km N. of Nelson, *Beaglehole 55340*, 6.12.1976 (ACB, NSW); E. of Port Campbell, *Beaglehole 21609*, 31.10.1966 (NSW); Apollo Bay, *Corrick 3783*, 12.12.1973 (Corrick herb). **Region N:** Loddon, *Walter*, 11.1887 (MEL); Seaholme, *Williamson*, 1.11.1930 (MEL); Yarra, *Mueller*, 1852 (MEL). **Region P:** Seaford, *Muir 31*, 28.12.1956 (MEL); Point Addis near Anglesea, *Nelson ANU 16320*, 1.1972 (CANB); Westernport, *Corrick 2964*, 12.12.1972 (Corrick herb); Phillip I. in Westernport Bay, *Vickery NSW 116727*, 7.11.1973 (NSW). **Region T:** Wilsons Promontory, *Muir 627*, 15.12.1958 (MEL). **Region Z:** 2.5 miles [4 km] NW. of Mallacoota, *Beaglehole 32113*, 26.11.1969 (NSW).

TASMANIA: Deal Island, Kents Group, *Whinray 48*, 29.2.1968 (NSW); King Island, *Blake 18437*, 27.1.1949 (BRI, NSW); Cape Barron Island, Furneaux Group, *Whinray 419*, 22.5.1969 (MEL); Tomahawk, *Townrow 112*, 12.1967 (JEST); Hobart, Old Beach, *Townrow 94*, 12.1967 (JEST); Marion Bay, *Hemsley 6683*, 3.1.1972 (NSW); South Arm, Opossum Bay, *Townrow 42*, 11.1967 (JEST); North Bruny I., Variety Bay, *Townrow 157*, 1.1968 (JEST); The Neck, Bruny I., *Phillips 787*, 29.11.1965 (CBG).

SOUTH AUSTRALIA: **Eyre Peninsula:** Fowlers Bay, *Rogers NSW 116728*, 9.1907 (NSW); Morialta, *Hilton NSW 116966*, 23.11.1953 (NSW dupl. of ADW); 2 miles [3 km] from Smokey Bay, *Hilton*, 25.8.1955 (ADW 197773); St Francis I., c. 60 km SW. of Ceduna, *Wace 128*, 8.1.1971 (NSW); Isles of St Francis, Masillon Island, *Wace 294*, 5.10.1972 (AD); Isles of St Francis, Fenelon Island, *Wace 279*, 5.10.1972 (AD); Elliston, c. 150 km NW. of Port Lincoln, *Cleland*, 21.8.1925 (AD); Beaumont, *Smith 1527*, 18.10.1968 (AD); Boston Island near Port Lincoln, *Wilson 303A*, 8.10.1958 (AD); Port Lincoln, *French*, 9.1954 (ADW); c. 15 km SSE. of Port Lincoln, *Specht 2634*, 10.11.1960 (AD); Sleaford Mere, *Alcox 3288*, 3.11.1970 (ADW, AD). **Northern Lofty:** 40 km S. of Port Wakefield, *Tindale NSW 116980*, 10.9.1970 (NSW). **Murray:** Murray Bridge, *Cleland*, 14.10.1949 (AD). **Yorke Peninsula:** Wool Bay, c. 10 miles [16 km] N. of Edinburgh, *Lothian 1133*, 7.10.1962 (AD, NSW); c. 15 km SSE. of Minlaton, *Blaylock 1554*, 10.10.1970 (AD); 8 miles [13 km] SSW. of Corny Point Lighthouse, *Blaylock 1074*, 13.10.1968 (AD); inland from Stenhouse Bay township, *Symon 9550A*, 6.10.1974 (ADW). **Southern Lofty:** Valley View near Dry Creek, *Spooner 1257*, 23.10.1970 (AD); Highbury, *Smith 1524*, 10.4.1968 (AD); Hindmarsh I., *no collector*, 10.10.1945 (AD); Walkerville cemetery, *Cleland*, 3.10.1955 (ADW 13283); Seaton Golf Course c. 9 km WNW. of Adelaide, *Smith 1443*, 7.10.1968 (AD); Heywood Park, Millswood, *Kraehenbuehl 827*, 26.10.1962 (AD); Waite Agricultural Research Institute, *Hilton NSW 116967*, 22.10.1953 (NSW, dupl. of ADW); Wayville near Adelaide, *Hilton NSW 116970*, 29.9.1946 (NSW, dupl. of ADW); Henley Beach, *Cleland*, 4.11.1932 (AD); between Glenelg & Brighton, *Black*, 16.10.1906 (AD); National Park, Belair, *Ising*, 26.11.1932 (ADW 44008); Brighton, *Hilton*, 1.1944 (ADW); Hallett Cove, *Cleland*, 29.9.1932 (AD), *Cooper*, 16.10.1964 (AD); between Hackham & Noarlunga, *Smith 788*, 31.10.1967 (AD); Port Noarlunga, *Cleland*, 5.11.1926 (K); W. of Hackham, *Cleland*, 28.10.1933 (AD); c. 0.5 km inland from Blanche Point, *Smith 363*, 22.9.1967 (AD); cliffs at Pt. Willunga near Aldinga, *Hilton*, 20.10.1946 (ADW 43879); Sellicks Beach, *Cleland*, 18.10.1941 (AD); Aldinga Bay Scrub, *Cleland*, 30.10.1928 (AD); Finnis to Milang road c. 3 km from Finnis, *Spooner 2554*, 8.10.1972 (AD); Normanville, 2 miles [3 km] W. of Yankalilla, *Hilton*, 10.10.1946 (ADW); Goolwa, *Cleland*, 10.10.1945 (AD); Murray Mouth, *Hilton*, 9.10.1954 (ADW); Port Elliot, 4 miles [6 km] NE. of Victor Harbor, *Hilton NSW 116746*, 10.10.1945 (NSW, ADW); Halls Creek, c. 5 km W. of Victor Harbor tributary of the Inman River, *Cleland*, 15.11.1930 (AD); Mouth of Inman River, *Cleland*, 12.1.1940 (AD); Encounter Bay, *Cleland*, 9.1.1941 (ADW); Callawonga Creek, *Hilton*, 25.11.1953 (ADW 44120); Waitpinga Beach, 13 km WSW. of Victor Harbor, *Crisp 945*, 27.10.1974 (CBG, NSW). **Kangaroo Island:** Kingscote, *Cleland*, 19.9.1955 (AD); Penneshaw, *Hilton* (ADW); Rocky River, *Cleland*, 27.11.1954 (AD); mouth of South-West River, *Cleland*, 27.1.1940 (AD). **South-eastern:** near Narrung, E. of the Coorong, *Cleland*, 17.11.1953 (AD); Campbell Park, *Cleland*, 16.10.1955 (AD); Bagshaws turnoff near Meningee, 8 km E. of Princes Highway, *Crisp 524*, 1.9.1973 (CBG); 8.7 km on Cape Jaffa road from Kingstone-Robe road, *Pearce 18*, 9.2.1974 (ADW); Big Heath National Park c. 25 km SW. of Naracoorte, *Weber 1671*, 3.11.1969 (AD); 1 km E. of Robe, *Crisp 3668*, 7.12.1977 (CBG); Cape Buffon, Rivoli Bay, *Cleland*, 24.2.1946 (AD); near Millicent, *Cleland*, 13.10.1949 (AD); Myora Forest area, c. 16 km ENE. of Mt Gambier, *Wilson 704*, 11.12.1966 (CANB); Pt MacDonnell, *Cleland*, 31.10.1941 (AD); near Tantanoola Caves, *Cleland*, 28.2.1947 (AD); Hoods Drift c. 14 km W. of Mt Schank, *Cleland*, 17.2.1948 (AD); Cape Northumberland, *Cleland*, 1.11.1941 (AD).

WESTERN AUSTRALIA: **Eucla:** 3.5 miles [6 km] E. of Eucla, *George 8516*, 15.10.1966 (PERTH). **Irwin:** Dongara [as Dongarra], *Maiden NSW 116760*, 10.1909 (NSW); Cockleshell Gully, *Gardner 8402*, 15.10.1946 (PERTH); Murchison R., *Oldfield* (MEL 59921) (probable duplicate of a specimen cited by Hughes as *S. tenuiglumis* Hughes). **Darling:** southwards from New Norcia, *Gardner 8665*, 10.1947 (PERTH); City Beach, 7.5 miles [12 km] W. of Perth, *Willis*, 14.9.1947 (MEL 60670); Perth to Wanneroo, *Salasoo 4169*, 24.9.1970 (NSW); Kings Park, Perth, *Gardner 861*, 30.10.1920

(PERTH); In arenosis sylvae prope Pine-Apple, Perth, *Preiss 1826*, 10.1831 (CBG, see also photo in NSW 116948, dupl. MEL 60038, LD, HBG); Karrakatta, *Fitzgerald NSW 11676*, 11.1900 (NSW); Cottesloe, *Fitzgerald NSW 116766*, 9.1901 (NSW); N. of Claremont, *Fitzgerald NSW 150902*, 26.9.1902 (NSW, PERTH); Claremont, *Gardner NSW 150899*, 9.1920 (PERTH); Catherine Beach, Rottneest, *Green*, 14.11.1956 (PERTH); Melville, 8 miles [13 km] S. of Perth, *Turvey NSW 116769*, 18.9.1965 (NSW); Fremantle to Kevinana, *Salasoo 4016*, 20.9.1970 (NSW); Woodman Pt, *Oldfield*, (MEL 59919) (presumably a duplicate of a specimen cited by Hughes as *S. tenuiglumis* Hughes); Yallingup, *Maiden NSW 116765*, 10.1909 (NSW). Eyre: North Twin Peak I., Recherche Archipelago, *Willis NSW 150901*, 20.11.1950 (PERTH, NSW); 4 km E. of Needilup, *Newbey 4919*, 10.11.1975 (PERTH); John Cove, Bremer Bay, *Newbey 4479*, 8.10.1974 (PERTH).

Bentham cited *Preiss no. 1826* under *S. scabra* var. *occidentalis* Benth. and cited *S. flavescens* Nees non Labill. as a synonym. *Preiss no. 1826* in LD and HBG is actually *S. flavescens* Labill. although differing a little from the majority of specimens in having a rather widely spreading inflorescence. The awns are very slender, delicate and loosely twice bent as in *S. flavescens*, not stout, strongly falcate and with a long bristle as in *S. tenuifolia* (syn. *S. scabra* var. *occidentalis*).

Stipa gibbosa J. Vickery, *Telopea* 2: 14 (1980).

HOLOTYPE: SOUTH AUSTRALIA: Burnsides district, Beaumont Common, c. 6 km SE. of Adelaide, J.B. Cleland, 11.10.1942 (AD 9632316).

Caespitose perennial to 1.5 metres high with a sparse basal leaf tuft to 30 cm. Culms erect, terete, not compressible, 1.5–2.5 mm wide near the base, ribbed, glabrous to scaberulous. Nodes 2–3, exserted, 35–60% wider than adjacent internodes, densely pubescent with slightly spreading short hairs. Leaf sheaths at first tightly enveloping the culms, finally becoming loose, 3–6 mm wide, strongly ribbed, glabrous except densely pubescent to puberulous just above the node; inner margin ciliate just below the orifice; outer margin ciliate. Ligule thinly coriaceous, truncate, ciliate, 0.3–0.5 mm long, although continuous with the sheath margins producing two lobes to 1 mm long, themselves ciliate with a tuft of hairs to 2 mm long; abaxial surface sericeous; auricles thickened and spreading, glabrous. Leaf blades flat or convolute to 30 cm long, 2–5 mm wide; adaxial surface very strongly ribbed, minutely puberulous, occasionally with widely scattered hairs; abaxial surface minutely puberulous or strongly scabrous with minute hairs especially on the basal leaves, occasionally with widely scattered hairs; margins similar to adjacent surface. Panicle to 30 (–40) cm long, exserted, moderately sparse with moderately closely-spaced fascicles of unequal, few-flowered, compound branches, contracted, 1.5–2 (–5) cm wide (excluding awns); axis terete, upwards flattened and scabrous, mostly on the edges; branches to 9 cm long, flattened, scabrous mostly on the edges; pedicels 4–10 mm long, flattened, scabrous mostly on the edges. Spikelets 11–17 mm long (excluding awn), gaping widely at floret disarticulation, otherwise the tips tightly closed. Glumes unequal, firm and green or yellow for most of the length, the tip membranous and white, acute to acuminate, broad and inflated at the middle, glabrous with only the nerves scabrous, or scaberulous to scabrous with dense minute hairs overall; lower glume 11–17 mm long, lower 75% 3-nerved; upper glume 8–13 mm long, lower 50–30% 5-nerved, lower 75% 3-nerved. Floret 4.5–6.0 mm long (including callus), oblong-cylindrical with a short, slightly defined neck, gibbous with a strongly eccentric awn. Lemma red-brown to almost black at maturity, surface strongly granular, with spreading white to yellow hairs, becoming golden at late maturity, the central nerve thickened; lobes absent; coma of spreading hairs, 0.8–1.3 mm long. Callus sturdy, slightly curved, 1–1.5 mm long, with hairs slightly darker than those of the lemma, the

naked point (0.15–) 0.2–0.5 mm long, and squared. Awn 25–35 (–50) mm long, twice bent, 0.3 mm wide near the base; column 12–20 mm long, 5–8 mm to the first bend, scabrous with slightly spreading hairs less than 0.2 mm long; bristle scabrous. Palea \pm equal to the lemma or to 0.5 mm longer, thickly coriaceous to the margins, granular down the centre, flat or slightly depressed between the nerves, glabrous, \pm mucronate with the apex tightly convolute and slightly recurved, the tip usually penicillate. Lodicules 3, membranous; 2 abaxial 0.8–1.3 mm long, oblong to narrow-cuneate; paleal 0.5–0.8 mm long, oblong to acute. Anthers 2.5–3 mm long, penicillate. Caryopsis c. 3.5 mm long, slightly gibbous above; embryo 30% the length; hilum 75% the length.

DISTRIBUTION: South-western New South Wales, north-western Victoria and the Northern Lofty and Southern Lofty Regions of South Australia.

SELECTED SPECIMENS: NEW SOUTH WALES: **South Western Slopes:** Urangeline, *Newman NSW 117014*, 21.11.1955 (NSW). **South Western Plains:** 29 km S. of Deniliquin, *Lloyd NSW 151487*, 7.11.1979 (NSW).

VICTORIA: **Region C:** 4–7 km from Dimboola toward Nhill, *Canning 2972*, 11.11.1969 (CBG 067316 p.p.). **Region J:** Cockajemmy Lakes, *Beauglehole 61614*, 17.11.1978 (ACB). **Region N:** 1 mile [1.5 km] S. of Laverton, *Cullimore 125*, 22.11.1967 (AD, PERTH).

SOUTH AUSTRALIA: **Northern Lofty:** Bundaleer Hills [c. 60 km SW. of Port Pirie], *Black*, 23.11.1925 (AD); Bundaleer, c. 41 km N. of Clare, *Cleland*, 28.11.1930 (AD 96323249); Spalding, *Black*, 21.11.1925 (AD); c. 91 miles [146 km] E. of Snowtown Hospital, *Copley 987*, 25.12.1966 (AD); E. of Mortlock Research Station, Mintaro, *Symon 3930*, 16.12.1965 (ADW, CANB, NSW). **Southern Lofty:** Adelaide Agricultural High School, 7.11.1932 (ADW); Beaumont Common, c. 6 km SE. of Adelaide, *Cleland*, 23.10.1935 (AD 96323196); Halls Creek, Encounter Bay, *Cleland H70*, 16.11.1930 (K).

From *S. aristiglumis* it differs in the distinctly dorsally gibbous floret (instead of \pm uniformly fusiform narrowing evenly towards the apex) and in usually being a smaller plant. From *S. blackii* it differs in the very short coma of hairs at the apex of the lemma and more distinctly gibbous lemma. From *S. setacea* it differs in the truncate ligule, short \pm obtuse callus, and palea not deeply furrowed down the back.

Stipa hemipogon Benth., Fl. Austral. 7: 569 (1878); Hughes, Kew Bull. 1921: 18 (1921), *ibid.* 1922: 18 (1922); Gardner, Fl. W. Austral. 1, Gram.: 178, 181, fig. (1952).

TYPIFICATION: Bentham cited 'W. Australia, *Drummond*, no. 231, 376', specimens at K. Hughes (1921) cites 'Swan River, *Drummond* 231, 376*' and, by her use of the asterisk, has selected *Drummond* 376 as the **Lectotype**. A duplicate of *Drummond* 376 is at MEL. Mueller, Fragm. 8: 104 (1875), regarded *Drummond* 376 (the Lectotype of *S. hemipogon*) as only a variety of *S. semibarbata* ('Varietas brachyathera') but supplied no separate description; he also wrote this *nomen nudum* on MEL 59933.

SYNONYMS: *S. nobilis* Pilger in Diels & Pritzel, Bot. Jahrb. Syst. 35: 70 (1904). **TYPIFICATION:** Pilger cited 'Coolgardie pr. Bronti inter frutices in arenosis frequens atque insignis'. His specimen was doubtless at B and presumably has been destroyed. At MEL there is a specimen (MEL 59967) from the Berlin Herbarium which is stated thereon to be part of the Type of *S. nobilis* Pilger and is annotated 'W. Australia: Dist. Coolgardie; Bronti. *Diels n. 5611*' and this is here designated as the **Lectotype**.

S. indepressa J. Black, Trans. & Proc. Roy. Soc. S. Austral. 65: 334 (1941); Black, Fl. S. Austral. edn 2: 90 (1943). **HOLOTYPE:** SOUTH AUSTRALIA: Minnipa, Eyre Peninsula, *J.M. Black*, 11.11.1915 (AD 97403332; isotype MEL 59951). Willis, Handb. Pl. Victoria 1: 184 (1962) and edn 2: 184 (1970), regarded *S. indepressa* as a synonym of *S. hemipogon* but included also *S. plagiopogon* J.M. Black (= *S. mollis* R. Br.). See also Eichler, Suppl. Black's Fl. S. Austral.: 49 (1965).

S. semibarbata var. *gracilis* J. Black, Trans. & Proc. Roy. Soc. S. Austral. 67: 36 (1943); Fl. S. Austral. edn 2: 89 (1943). TYPIFICATION: Black cited two localities, Mount Lofty Range and Kangaroo Island, when establishing the name. In his Flora of South Australia he added a third locality, Encounter Bay. All three are represented in Black's collections held at AD, and have been named *S. semibarbata* var. *gracilis* by Black.

- (i) 'Mt Lofty Range, National Park, Belair, *J.B. Cleland*, 26.11.1932' (AD 97244093). The specimen consists of a small tuft of basal leaves attached to the rootstock and a single culm with panicle now devoid of florets. Three florets have been attached to the sheet. The lemmas are 7–8 mm long, the column 25 mm long with spirally arranged hairs, and the glumes c. 20 mm long. We would confirm a previous identification of this specimen by J. E. S. Townrow as *Stipa mollis* R. Br. A probable duplicate derived from Cleland's herbarium and annotated 'National Park, 26.11.1932' (AD 96323321) is certainly *S. mollis*. The present condition of this Syntype makes it undesirable to select it as the Lectotype.
- (ii) 'Kangaroo Island, near Vivonne Bay, *J.B. Cleland*, 11.1924' (AD 97244091). The specimen consists of a single culm complete to the base but with only a small tuft of basal leaves and a single panicle in good condition with many florets still attached. We here designate this specimen as the **Lectotype** of the variety. The lemmas are c. 6 mm long, the column c. 15 mm long with spirally arranged hairs, and the glumes 15–17 mm. The specimen agrees with *Stipa hemipogon* Benth., as does an apparent duplicate (AD 96323160).
- (iii) 'Encounter Bay, *J.B. Cleland*, 17.11.1930' (AD 97244092). As this sheet was not cited with the original Latin description it is not eligible for selection as Lectotype though it was designated as such by Townrow in Pap. & Proc. Roy. Soc. Tasmania 112: 242 (1978). We confirm Townrow's identification of this specimen as *Stipa mollis* R. Br.

Caespitose perennial to 1 metre high, not rhizomatous, with a basal tuft of leaves a third to half the height. Culms erect or geniculate at the base, terete, 2–2.5 mm wide near the base, not compressible, not ribbed, minutely scaberulous; nodes 2–5, \pm exserted, not swollen. Leaf sheaths not inflated, 0.5–1 mm wide; basal sheath very slightly ribbed, scaberulous between the nerves with hairs minute (–0.3 mm long), inner margin glabrous, outer margin ciliate with hairs minute–0.2 mm long; upper sheath moderately ribbed, scabrous along the centre with minute tubercles or scaberulous, edges glabrous to sparsely pilose, inner margin glabrous, outer margin ciliate with hairs 0.1–0.3 mm long to glabrous; collar of hairs 1 mm long. Ligule truncate, membranous, (0.3–) 1.5–3 mm long, ciliate with hairs 0.4–0.6 mm long; abaxial surface sericeous with hairs (0.2–) 0.6–0.9 mm long; auricles absent. Leaf blade linear, weakly rolled, 1.5–3 mm wide, to 20 cm long; abaxial surface moderately ribbed, the surface scabrous between the nerves with minute tubercles, sometimes also with sparse hairs 0.4 mm long; adaxial surface strongly ribbed, with hairs 0.2–0.6 mm long; margins scabrous with minute stiff hairs. Panicle 10–25 cm long, exserted, with moderately close fascicles of unequal, few- to many-flowered, compound branches, contracted, 1–3 cm wide (excluding awns); axis \pm terete, scaberulous; branches 2–5 cm long, slightly angled, scabrous with hairs minute–2.5 mm long; pedicels 2–10 mm long, angled, scabrous with hairs minute–2.5 mm long. Spikelets 15–20 mm long, gaping at maturity. Glumes unequal, acute to acuminate, scaberulous to almost glabrous; lower glume 15–20 mm long, lower 45–50 (–85%) 3–1-nerved; upper glume 10–16 mm long, lower 30–40% 5-nerved, upper 60–70% 3–1-nerved. Floret cylindrical, without a neck, 5–7.5 mm long (including callus). Lemma reddish brown at maturity, the surface smooth to granular upwards, sericeous with hairs 0.3–0.7 mm long, white to golden at maturity; lobes and coma absent. Callus 1.5–3 mm long, weakly bent at the tip, densely sericeous with hairs 0.2–0.8 mm long, white to gold at maturity. Awn 30–60 mm long, twice bent, 0.2–0.3 mm wide near the base; column 10–20 mm long, c. 10 mm to the first bend, brown to straw-coloured, densely plumose with hairs 0.5–4 mm long, the hairs produced on one side of the column, spiralling

with it; bristle delicate, brown, scabrous but plumose at the base on one side with hairs 0.2–2 mm long similar to those of the column. Palea \pm equal to the lemma, acute, the surface granular to smooth, sericeous along the centre with golden hairs 0.4–1 mm long. Lodicules 2, abaxial, 1–1.5 mm long, obtuse. Anthers c. 1–1.5 mm long, not penicillate. Caryopsis 3–4 mm long; embryo 20% the length, hilum 80–100% the length.

DISTRIBUTION: Southern regions of South Australia and Western Australia, and western Victoria.

SELECTED SPECIMENS: VICTORIA: **Region J:** near Stawell, *Gauba CBG 047573*, 21.10.1952 (CBG).

SOUTH AUSTRALIA: **Eyre Peninsula:** Hundred of Hambidge, NE. of Lock, *Specht 2460*, 8.11.1966 (AD); Yeelanna, 10 miles [16 km] N. of Cummins, *Hilton NSW 116486*, 20.12.1945 (ADW, NSW); Hundred of Tooolgie, c. 85 km N. of Port Lincoln, *Kuchel 1422*, 23.10.1963 (AD). **Murray:** Alawoona, *Cleland NSW 116491*, 12.1913 (NSW, AD); Peebinga Wild Life Reserve, c. 80 km SSE. of Renmark, *Cleland*, 23.4.1963 (AD); W. of Murray Bridge, *Crocker*, 23.10.1943 (CANB 12173); Kinchina, *Wood*, 9.1939 (ADW 3969); Swanport, *Story*, 4.11.1870 (MEL 60826). **Southern Lofty:** Finniss, *Eardley*, 3.1.1935 (ADW 277 in part). **Kangaroo Island:** Stokes Bay Road, *Cleland*, 30.10.1967 (AD); American River, *Cleland*, 25.10.1967 (AD); between Kingscote & American River, *Hilton*, 7.1.1945 (ADW 44182); MacGillivray, *Crocker*, 22.11.1941 (ADW 4334).

WESTERN AUSTRALIA: **Eucla:** c. 57 km SE. of Madura, *Parsons 97*, 29.11.1967 (AD); c. 23 km SSW. of Cocklebiddy, *Parsons 154*, 1.12.1967 (AD). **Coolgardie:** *Campion, Gardner 2768*, 29.9.1931 (PERTH); Parker Range, *Merrell*, 1890 (MEL); Higginsville, *O'Donnell NSW 150910*, 1942 (PERTH); 1 mile [1.6 km] from Salmon Gums, *Phillips CBG 018938*, 6.11.1972 (CBG). **Irwin:** 23 miles [37 km] N. of Geraldton in Oakabella Hills, *Burbidge*, 2.9.1947 (CANB 15285); between Geraldton & Northampton, *Blake 18094*, 2.9.1947 (BRI, PERTH). **Avon:** 5.3 miles [8.5 km] from Wubin toward Wongan Hills, *Canning 2921*, 13.9.1968 (CBG); Cowcowing, *Koch 1132*, 9.1904 (NSW, PERTH, K); Yorkrakine, *Gardner NSW 150908*, 9.1936 (PERTH, NSW); 17 miles [27 km] E. of Pingelly, *Aplin 775*, 10.1960 (PERTH); 15 miles [24 km] S. of Tammin, *Royce 9359*, 3.11.1970 (PERTH); Wickepin, *Wallace NSW 150909*, 2.1923 (PERTH). **Darling:** 20 km from Keenan College towards New Norcia, *Ollerenshaw & Carriage CBG 062571*, 4.10.1975 (CBG); 14 miles [22 km] from Gingin towards Regans Ford, *Phillips CBG 043728*, 28.9.1968 (CBG); Kings Park, Perth, *Carne NSW 150906*, 18.10.1923 (PERTH); South Perth, *Carne NSW 150907*, 1.12.1924 (PERTH); Inglewood, North Perth, *Gardner NSW 150911*, 11.1933 (PERTH); 46 miles [74 km] from Perth along Albany Highway, *Phillips CBG 043574*, 30.9.1968 (CBG); Porongorup, *Maiden NSW 116934*, 11.1909 (NSW); Albany, *Maiden NSW 116463*, 11.1909 (NSW). **Eyre:** Ninety Mile Tank, Lake King – Norseman Track, *Hopkins & Robinson NSW 150904*, 11.1978 (PERTH); One Mile Rocks Reserve SE. of Lake King, *George 10468*, 12.11.1970 (PERTH); 21 miles [34 km] from Ravensthorpe towards Lake King, *Canning NSW 116458*, 5.11.1968 (NSW, BRI, dupl. of CBG); Desmond near Ravensthorpe, *Maiden NSW 116462*, 11.1909 (NSW, K); between Jerramungup & Ravensthorpe at West River Crossing, *Canning 7553*, 10.11.1968 (CBG); c. 21 km NNW. of the coast at Stokes Inlet, *Orchard 1668*, 20.10.1968 (PERTH); Esperance, *Maiden NSW 116464*, 11.1909 (NSW); c. 69 miles [110 km] from Esperance towards Ravensthorpe, *Canning 7092*, 1.6.1971 (CBG); Fitzgerald National Park, near Fitzgerald River, *George 10556*, 18.12.1970 (PERTH); Cape Arid National Park, E. of Esperance, *Royce 9932*, 1.12.1971 (PERTH); Cape Le Grand National Park, *Royce 8717*, 21.10.1969 (PERTH). **Stirling:** 61.2 km from Gnowangerup towards Albany, *Phillips CBG 054856*, 10.10.1962 (CBG); Frankland River W. of Cranbrook, *Hadley NSW 150912*, 12.1945 (PERTH); c. 35 miles [56 km] from Albany towards Borden via Chester Pass, *Canning CBG 042828*, 25.10.1968 (CBG).

Hughes (Kew Bull. 1921: 19 (1921) and 1922: 18 (1922)) apparently did not see the Type of *S. nobilis* Pilger, and her identification of a Victorian specimen with this species and her comments comparing *S. nobilis* with *S. mollis* and *S. semibarbata* have hence proved somewhat confusing. She cites *Drummond 116* as *S. nobilis*.

Willis, Handb. Pl. Victoria 1: 184 (1962), edn 2: 184 (1970), appears to have erroneously identified Victorian specimens of *S. mollis* as *S. hemipogon* of Western Australia. Reference is made to his comments by Eichler, Suppl. Black's Fl. South Australia: 49 (1965).

**Stipa hyalina* Nees, Agrost. Bras.: 378 (1829); Hitchcock, Contr. U.S. Natl. Herb. 24: 277 (1925); Caro, Kurtziana 3: 56 (1966); Rosengurt, de Maffei et de Artucio, Gram. Uruguayas: 77 (1970).

HOLOTYPE: 'Habitat ad Monte Video (Sellow. — Vidi in Hb. Reg. Berol.)'. The Type was *Sellow 636 d* in B which is no longer extant. There are two sheets marked "Brasilia Sello", apparently duplicates of the type, in US and these have formed the basis of our typification.

Caespitose perennial to c. 0.75 metres high, with a basal tuft of leaves, without rhizomes. Culms erect or slightly geniculate at the base, terete, c. 1 mm wide near the base, \pm compressible, moderately to slightly ribbed upwards, glabrous; nodes 3–4, exserted, glabrous, not swollen. Leaf sheaths at first tightly enveloping the culm, later becoming slightly free, glabrous and smooth; basal sheath 4–6 mm wide, slightly ribbed, moderately ribbed on the innovations; upper sheath 2–5 mm wide, strongly ribbed; margins glabrous. Ligule truncate, membranous, 0.2–2 mm long, glabrous; auricles thickened, 0.5–1.5 mm long, with tufts of hairs at the base on the innovations, glabrous elsewhere. Leaf blade expanded or loosely rolled, 1.5–4 mm wide, to 25 cm long; abaxial surface strongly ribbed, smooth and glabrous; adaxial surface strongly ribbed, smooth and glabrous to scaberulous with minute tubercles; margins scabrous with minute tubercles or sparsely ciliate with hairs to 0.2 mm long. Panicle 15–25 cm long, exserted, with distant fascicles of unequal, few-flowered compound branches, contracted, 2–4 cm wide (excluding awns); axis angular, scabrous with hairs minute–0.2 mm long; branches 2–6 cm long, angular, scabrous with stiff hairs minute–0.2 mm long; pedicels 0.5–5 mm long, angular, scabrous, with stiff hairs minute–0.2 mm. Spikelets 9 mm long, gaping. Glumes unequal, acute to acuminate, hyaline, minutely scaberulous; lower glume 9 mm long, lower 10–30% 3-nerved; upper glume 7–8 mm long, lower 40–50% 3-nerved. Floret 4 mm long (including callus), cylindrical with a weakly defined neck. Lemma surface scabrous with minute crystalline tubercles, sericeous along the midrib with white hairs c. 0.7 mm long; lobes absent; corona 0.5 mm long with crystalline spines c. 0.2 mm long on the upper margin. Callus 0.7 mm long, curved, densely sericeous with white hairs minute–1 mm long. Awn 35–40 mm long, twice bent, c. 0.2 mm wide near the base; column c. 15 mm long, 7–8.5 mm to the first bend, straw-coloured, minutely scabrous; bristle straw-coloured, scabrous with hairs minute–0.1 mm long. Palea 30–40% the length of the lemma, acute, hyaline, smooth and membranous, glabrous. Lodicules 2, abaxial, membranous, brown or hyaline, c. 1 mm long, oblong. Anthers 2–3 mm long, penicillate. Mature caryopsis not observed.

DISTRIBUTION: An introduction from S. America, uncommon on North Western Slopes of New South Wales.

SPECIMENS EXAMINED: NEW SOUTH WALES: North Western Slopes: Glen Innes to Inverell, *Plante NSW 117383*, 3.2.1951 (NSW); Gunnedah, cultivated, *Barr NSW 117385*, 1955 (NSW). Central Coast: Botanic Gardens, Sydney, cultivated, *Steenbohm NSW 117386*, 17.11.1974 (NSW).

Stipa juncifolia Hughes, Kew Bull. 1921: 11 (1921); Gardner, Fl. W. Austral. 1, Gram.: 174, 175, pl. 51 (1952), at least in part (Type cited).

HOLOTYPE: WESTERN AUSTRALIA: Swan River, *Drummond, 4th coll. no. 377* (K!, CANB photo no. 236993). It is recorded by Rica Erickson in 'The Drummonds of Hawthornden' (1969) that Drummond's 4th Collection consists of specimens from King Georges Sound, Stirling Range, Porongorups, Mt Manypeaks, Cape Riche and West Mt Barren, and from N. and E. of Moore River. Most of these localities are more likely than the cited Swan River.

Caespitose perennial to c. 1 metre high, shortly rhizomatous, without a basal tuft of leaves. Culms erect, 1–1.5 mm wide, \pm compressible, ribbed about the nodes, glabrous; nodes c. 3, exserted, glabrous. Leaf sheaths not inflated, slightly to moderately ribbed; basal sheath 7–9 mm wide, shortly puberulous with hairs < 0.5 mm long between the ribs; upper sheath 3–6 mm wide, glabrous to minutely puberulous between the ribs; margins glabrous. Ligule membranous, obtuse, 2.5–8 mm long, shortly puberulous with hairs < 0.05 mm long. Leaf blade tightly rolled, 1–2 mm in diameter, 2–4.5 mm in circumference, to 50 cm long; abaxial surface smooth and glabrous; adaxial surface densely scaberulous with minute siliceous prickles; margins scabrous with hairs 0.1 mm long or glabrous. Panicle 30–35 cm long, exserted, with distant fascicles of unequal, few-flowered compound branches, spreading, 3.5–8 cm wide (excluding awns); axis terete, glabrous; branches 1–13 cm long, slightly flattened, with sparse hairs < 0.05 mm long; pedicels 0.5–2 mm long, terete, glabrous. Spikelets 10–12 mm long (excluding awn), gaping at maturity. Glumes subequal, acute to acuminate, green at the base, purple-tinged across the centre, straw-coloured at the tip; lower glume 10–12 mm long, lower 60 (–75)% 3-nerved; upper glume 9–10 mm long, lower (30–) 40% 3-nerved. Floret cylindrical, without a neck, 6.5–9 mm long (including callus). Lemma smooth, sericeous with white hairs 0.5 (–0.8) mm long; lobes 2–2.5 mm long; coma 2–2.5 mm long. Callus 1.1–1.5 mm long, weakly bent at the tip; sericeous with white hairs 0.1–1 mm long. Awn 25–50 mm long, twice bent, 0.2–0.25 mm wide near the base; column 10–20 mm long, 5–10 mm to the first bend, scabrous with hairs 0.1–0.2 (–0.5) mm long; bristle darker than the column, scabrous with hairs 0.1–0.15 mm long. Palea equal to the lemma, 3 (–4)-toothed, slightly depressed between the nerves, surface smooth, sericeous along the centre back with hairs 0.5–1.5 mm long, margins glabrous. Lodicules 2, abaxial, membranous, obtuse, 0.5–1.5 mm long. Anthers 5 (–6) mm long, penicillate. Caryopsis not seen.

DISTRIBUTION: Margins of salt lakes or saline depressions in the southern areas of Western Australia.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: Avon: c. 20 km N. of Cranbrook, *Kuchel* 1998, 20.9.1964 (AD). Roe: Jerramangup, *Gardner*, 9.1939 (PERTH); Lake King, *George* 10466, 11.11.1970 (PERTH, NSW); 5 km S. of Peak Eleanora, *Newbey* 6341, 8.11.1979 (PERTH). Eyre: Ravensthorpe, *Gardner*, 11.1944 (PERTH); 5 km NW. of Ongerup, *Newbey* 3587, 24.9.1972 (PERTH); nr. Toompup, *Gardner*, 10.1944 (PERTH); Fitzgerald River Reserve, *Royce* 9282, 24.10.1970 (PERTH); Martin Ck nr. Fitzgerald River, *George* 10939, 7.9.1971 (PERTH); Lake Quarderwardup, *Beard* 7571, 27.9.1975 (NSW); Stirling Range, *Mueller*, 10.1867 (MEL 60662); South Stirling, *George* 6494, 11.12.1964 (PERTH); E. of Albany–Borden rd., *Aplin* 2142, 19.10.1962 (PERTH); Kalgan, *Mueller*, s.d. (MEL 60663).

The specimen from Lake King (*George* 10466) differs from the other specimens in being considerably more robust with broader sheaths, longer leaves, a more compact inflorescence and basically larger spikelet dimensions and an awn to 7 cm long. This population warrants further field studies to assess the significance of the variation.

Bentham labelled and cited (Fl. Austral. 7: 566 (1878)) the Holotype of *S. juncifolia* as *S. flavescens* Labill., and Hughes therefore cited *S. flavescens* Benth. non Labill. as a 'synonym' of *S. juncifolia*.

In his treatment of *Dichelachne setacea* (R. Br.) Nees in Lehmann, Pl. Preiss. 2: 98 (1846), Nees cited *Stipa setacea* R. Br. as the basionym; he also cited a specimen, *Preiss* 1854, from the interior of Western Australia. Veldkamp, *Blumea* 22: 11 (1974), regards a specimen of *Preiss* 1854 at BM as the Holotype of *Dichelachne setacea* Nees and identifies it as *Stipa stipoides* (Hook. f.) Veldk.

We have not been able to find a specimen of *Preiss 1854* at BM (as cited by Veldkamp), but specimens of this collection at MEL and LD are certainly not *S. stipoides*, differing in the shorter glumes and lemma, loose inflorescence and habitat as cited, but are quite consistent with *S. juncifolia* Hughes. *Preiss 1854* is also the basis of Gardner's record (Fl. W. Austral. 1, Gram.: 174 (1952)) for *S. stipoides* from Western Australia. We have seen no material of true *S. stipoides* from Western Australia.

***Stipa lanata* J. Vickery, S.W.L. Jacobs & J. Everett, sp. nov.**

S. eremophilae affinis sed lemmate glabro marginibus non incidentibus, orificio et vaginis infernis longe lanatis, foliis plerumque latioribus, statura plerumque brevior, differt.

HOLOTYPE: WESTERN AUSTRALIA: 7 miles [11 km] N. of "Mundrabilia" Homestead. Found growing on gently undulating calcareous plain up to a height of 45 cm in a herbfield. *Mitchell 2*, 31 July 1974 (PERTH).

Short caespitose perennial to c. 0.45 metres high. Culms 1–2 mm wide near the base, terete, ribbed, glabrous except pubescent for several mm below the nodes; nodes 1–2, glabrous to puberulous, exerted only in older geniculate culms. Leaf sheaths broad, the upper sheaths inflated, the innovations held tightly into bundles; ribs of lowermost sheaths long-woolly to hirsute, pubescent between the ribs, to glabrous with age on uppermost sheaths; outer margin glabrous to long-woolly ciliate, especially just below the ligule; inner margin glabrous. Ligule 0.4–1.5 mm long, truncate, densely ciliate; auricles with long woolly hairs. Leaf blades to c. 20 cm long and 1.5–4 mm wide, expanded to loosely rolled; abaxial surface densely long-woolly to very shortly pubescent or glabrous, especially on the older blades; adaxial surface densely long- to short-pubescent on upper leaves. Panicle 10–15 cm long, contracted, generally few-flowered, the base enclosed by the sheath except when fully mature; axis terete, pubescent, ribbed; branches terete, 10–40 mm long, hirsute to pubescent; pedicels angular, 4–15 mm long, hirsute to pubescent. Spikelet 19–26 mm long (excluding awn), not gaping at maturity, only slightly gaping after floret disarticulation. Glumes unequal, smooth, firm and often purple-coloured at the base, hyaline at the acuminate tips; lower glume 19–26 mm long, the lower 75% 3-nerved; upper glume 14–19 mm long, the lower 50% 5-nerved, the next 25% 3-nerved. Floret turbinate, 6.5–8 mm long (including callus). Lemma entire, dark brown at maturity, smooth except for a very few antrorsely hooked tubercles at the neck, glabrous, with a sparse coma of dark rusty hairs 1.5 mm long, in two tufts; lemma margins not fully covering the back of the palea. Callus prominent, c. 3 mm long, sericeous with hairs white to dark rusty at maturity. Awn 0.4–0.5 mm wide near the base, 65–80 mm long, twice bent; column 22–30 mm long, 10–15 mm to the first and stronger bend, densely pubescent with hairs to 0.3 mm long; bristle scaberulous. Palea obtuse, equal in length to the lemma, ciliate at the tip, otherwise glabrous, the central strip c. 0.6 mm wide exposed for most of its length. Lodicules 2–3; 2 abaxial oblong, membranous, c. 1 mm long; the paleal absent or acute, membranous, 0.5–0.8 mm long. Anthers not observed. Caryopsis 4 mm long; embryo c. 30% the length; hilum c. 85% the length.

DISTRIBUTION: Arid regions of southern Western Australia and central and western South Australia.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: **Eucla**: 7 miles [11 km] N. of 'Mundrabilla' Homestead, *Michell* 2, 31.7.1974 (PERTH); Forrest, Trans Australia Railway Line, *Johnston*, s.d. (PERTH).

SOUTH AUSTRALIA: **Gairdner-Torrens Basin**: 60 miles [100 km] ESE. of Kingoonya, *Beaglehole* 20041, 1.10.1966 (NSW). **Eastern**: Aldermans Park, 'Koonamore', *Hilton* 234, 16.10.1952 (ADW 44191); 'Koonamore', *Everett* 163, 165 & *Jacobs*, 28.11.1980 (NSW).

See *S. nullanulla* and *S. vickeryana* for comparisons with this species. It is like *S. eremophila* but differs in the glabrous lemma with reduced margins, the long woolly hairs of the orifice and lower sheaths, the usually much broader sheaths and in usually being a shorter plant. Several specimens of *S. eremophila*, listed below, approach *S. lanata* very closely in having lemmas much more sparsely hairy than typical *S. eremophila*, and in having orifices and sheaths hirsute (nevertheless, not softly woolly). These can be found among populations of typical *S. eremophila*, and not differing noticeably from the other plants in any other character. These variants are treated here as *S. eremophila*.

SPECIMENS OF *S. eremophila* SHOWING AFFINITIES WITH *S. lanata*: SOUTH AUSTRALIA: **Murray**: Moorundie [Wild Life Reserve], *Cooper*, 10.1941 (AD); Swan Reach, *Everett* 159, 160 & *Jacobs*, 27.11.1980 (NSW). WESTERN AUSTRALIA: **Eucla**: 12 miles [19 km] from Madura, towards Cocklebidy, along Eyre Highway, *Phillips*, CBG 039214, 1.9.1968 (CBG).

**Stipa leucotricha* *Trin. & Rupr.*, Mém. Acad. Imp. Sci. Saint-Pétersbourg, ser. 6, Sci., Math., Seconde Pt. Sci. Nat. 5: 54 (1842); Hitchcock, Contr. U.S. Natl. Herb. 24: 225 (1925).

HOLOTYPE: U.S.A.: Texas, (?) *Hooker* (LE) (not seen).

Caespitose perennial to c. 0.5 metres high, without rhizomes, with a basal tuft of leaves about half the height. Culms erect to slightly geniculate at the base, terete to slightly angled, 1.5–3 mm wide near the base, slightly to scarcely compressible, moderately to strongly ribbed; basal culms moderately to strongly ribbed, glabrous; upper culms slightly to moderately ribbed, glabrous to minutely scabrous; nodes c. 2, \pm exserted, not swollen, glabrous to sericeous with hairs minute–0.8 mm long. Leaf sheaths at first tightly enveloping the culm, later becoming free, glabrous to scabrous between the ribs with minute tubercles; basal sheath 0.5–1.5 cm wide, slightly to moderately ribbed, inner margin glabrous, outer margin glabrous to ciliate with hairs 0.2–0.5 mm long; upper sheath 3–4 mm wide, strongly ribbed, inner margin glabrous, outer margin glabrous. Ligule membranous, truncate, 0.4–0.7 mm long; abaxial surface glabrous to minutely scaberulous; auricles thickened and spreading, 1–2 mm long, ciliate at the base with hairs 0.3–1 mm long. Leaf blade expanded to inrolled, 2–5 mm wide, to 30 cm long; abaxial surface moderately to strongly ribbed, glabrous to sparsely pubescent with hairs 0.3–0.5 mm long; adaxial surface strongly ribbed, glabrous to sparsely pubescent with hairs 0.1–0.5 mm long, denser and longer on the innovations. Panicle c. 15 cm long, exserted, with distant fascicles of unequal few-flowered, compound branches, contracted, 1–3 cm wide (excluding awns); axis terete to slightly angular, glabrous to scabrous along the edges with hairs minute–0.4 mm long; branches 3–7 cm long, angled, glabrous to scabrous with hairs 0.1–0.6 mm long; pedicels 4–9 mm long, angled, scaberulous to scabrous with stiff hairs 0.1–0.5 mm long. Spikelets 10–17 mm long, gaping. Glumes subequal to equal, acute to acuminate, hyaline, glabrous or scabrous along the nerves with stiff hairs minute–0.6 mm long; lower

glume 10–17 mm long, lower 30–50% 3-nerved; upper glume 10–16 mm long, lower (35–) 40% (5–) 3-nerved, margins sometimes ciliate. Floret 6.5–9 mm long (including callus), cylindrical with a neck. Lemma coarsely granular upwards with minute tubercles, sericeous only along the midrib with hairs 0.5–1.5 mm long; lobes absent; corona 1.5–2.5 mm long with a firm basal part 0.5–1 mm long, ciliate with hairs 1–1.5 mm long. Callus 1.2–3.3 mm long, weakly bent at the tip, densely sericeous with white hairs 0.2–1.5 mm long. Awn 50–60 mm long, twice bent, 0.4–0.5 mm wide near the base; column 20–30 mm long, 10–20 mm to the first bend, straw-coloured, scaberulous with hairs minute–0.8 mm long; bristle delicate, straw-coloured, scabrous with hairs minute–0.1 mm long. Palea 35–50% the length of the lemma, acute to obtuse and erose, membranous, smooth and glabrous. Lodicules 2, abaxial, membranous, oblong, c. 1.5 mm long. Mature anthers not observed. Caryopsis c. 4 mm long; embryo 35% the length, hilum 85% the length.

DISTRIBUTION: Native to southern N. America; naturalised in suburban Melbourne, Victoria.

SPECIMENS EXAMINED: VICTORIA: **Region N:** Northcote, *Morris*, 10.1934 (MEL 60727 & MEL 60731); Fairfield, *Willis*, 13.11.1946 (MEL 60729); North Brighton, *Willis*, 14.11.1948 (MEL 60730).

***Stipa macalpinei* Reader**, *Victorian Naturalist* 15: 143 (1899) (as 'McAlpinei'); Hughes, *Kew Bull.* 1922: 22 (1922); Black, *Fl. S. Austral.* 4: 671 (1929), edn 2: 93 (1943); Gardner, *Fl. W. Austral.* 1, Gram.: 176 (1952); Willis, *Handb. Pl. Vic.* 1: 183 (1962), edn 2: 183 (1970); Eichler, *Suppl. to Black's Fl. S. Austral.:* 50 (1965).

TIPIFICATION: The Holotype was cited as 'Hilly Mallee country and sandy heaths. Lowan, Dimboola Shire, 1892; *F.M. Reader*'. We have not found any specimen collected by Reader in 1892 in MEL, where Reader's specimens are now located, but there are a number of specimens (cited below) collected by him in 1898, some of which are named *S. macalpinei* in his handwriting. These have been taken as the basis of typification of this distinctive species.

VICTORIA: **Region C:** Desert, Lowan, Dimboola Shire, *F.M. Reader*, 20.11.1898 (MEL 59952); Lowan, *F.M. Reader*, 20.11.1898 (MEL 60732); Little Desert, *F.M. Reader*, 5.11.1898 (MEL 60733); Little Desert, Lowan, *F.M. Reader*, 5.11.1898 (MEL 60734) and 18.11.1898 (MEL 60735).

SYNONYMS: *S. compressa* var. *lachnocolea* Benth., *Fl. Austral.* 7: 567 (1878). *S. lachnocolea* (Benth.) Hughes, *Kew Bull.* 1921: 26 (1921). (In 1922 Hughes synonymised this with *S. macalpinei* Reader.) HOLOTYPE: WESTERN AUSTRALIA: 'Drummond, n. 132' (K!).

S. setacea var. *latifolia* Benth., *Fl. Austral.* 7: 568 (1878), as 'var. ?*latifolia*'; Hughes, *Kew Bull.* 1921: 30 (1921), under 'Species dubiae vel excludendae'. Hughes did not see any of the specimens quoted by Bentham. [*S. scelerata* Behr ex Benth., *Fl. Austral.* 7: 568 (1878), *nomen nudum in syn.*] TIPIFICATION: Bentham cited 'Augusta, Behr; Crystal Brook, *F. Mueller*; Murray River, *Blandowski*'. In MEL there are two specimens collected near Angaston, South Australia, by Behr in January (MEL 59988 in part). The locality is in writing that Bentham could easily have mis-read as Augusta. These specimens are certainly *S. macalpinei* Reader. We have not been able to find the other specimens either at MEL or K and so here designate MEL 59988 as **Lectotype**.

S. scelerata Behr ex Black, *Fl. S. Austral.* 1: 65 (1922). TIPIFICATION: Black cites two elements: the synonym '*S. setacea* R. Br. var. *latifolia* Benth.' and a specimen from the 'Flinders Range, Sept. Dec.'. Since he attributes the name to Behr, whose specimen was one of the elements of Bentham's variety, it appears that *S. setacea* var. *latifolia* Benth. should be taken as the replaced synonym. At K (see CANB photo no. 237013) there is a specimen annotated in Black's handwriting '*Stipa scelerata*, Pichi Richi Pass, Flinders Range, S.A., 20.9.20, J.M.B.' which presumably represents the second element in Black's protologue. This specimen represents a species entirely different from *S. macalpinei*, with much shorter and strongly falcate awns. It has been identified as *S. arachnopus* Pilg. by some later botanist, but it is *not* the Type of that name. Black's description certainly does

not agree with *S. macalpinei*. Hj. Eichler (1965, see above) regards *S. setacea* var. *latifolia* Benth. and *S. scelerata* Behr ex Black as synonyms of *S. macalpinei* Reeder. It is uncertain to what species of *Stipa* Ewart, Fl. Vict.: 182 (1931), applied the name *S. scelerata* Behr, but his description certainly does not apply to *S. macalpinei*.

Caespitose annual (to short-lived perennial?) to 90 cm high, without rhizomes, with a basal tuft to a tenth the height when present. Culms erect, terete, \pm compressible, c. 1–2 mm wide near the base, slightly ribbed, glabrous and smooth or scaberulous becoming glabrous upwards; nodes 1–4, glabrous, rarely exserted, to 25% wider than adjacent internodes. Leaf sheaths to 13 mm wide, slightly ribbed; basal sheaths not inflated, densely minutely pubescent, also densely covered with characteristic flattened, transparent, blunt and flexuose hairs 0.8–1.2 mm long; upper sheaths inflated, either scabrous to scaberulous with minute antrorse to retrorse hairs or the same as the basal sheaths; inner margin glabrous; outer margin of almost all sheaths ciliate with hairs similar to the long flattened hairs of the lower sheaths. Ligule membranous, truncate, obtuse to lacinate on upper leaves, 1–15 mm long, longest on upper leaves, continuous on the upper sheaths with acute auricle lobes; abaxial surface minutely scaberulous; auricles thickened, 0.4–1.2 mm long. Leaf blades triangular to acuminate, expanded and as broad at the base as the sheaths, the remainder expanded to tightly inrolled, 5–15 (–20) cm long; abaxial surface slightly ribbed, glabrous and smooth to scabrous with minute antrorse to retrorse hairs; adaxial surface strongly ribbed, pubescent with hairs minute–2 mm long, longer on the innovations; margins similar to leaf surface. Panicle contracted or at length narrowly spreading, densely to sparsely flowered, with distant fascicles of unequal compound or simple branches, 10–35 cm long (excluding awns), 1–5 cm wide, exserted at last; axis scabrous to scaberulous with very short strong hairs \pm angled; branches to 15 cm long, scabrous to scaberulous, \pm angled. Spikelets 13–21 mm long (excluding awn), gaping. Glumes green to chaffy at the base, hyaline at the tip, very unequal; lower glume acuminate, 13–22 mm long, lower 45–66% 3-nerved, minutely scabrous; upper glume broadly acute, 8–14 mm long, lower 25–60% 5(–6)-nerved, upper 40–70% 4–1-nerved, glabrous but minutely scabrous at the tip, apex broadly acute, denticulate or rarely acuminate. Floret 7–8 mm long. Lemma with 1 or 2 lobes 0.1–0.4 mm long, white to pale yellow at maturity, at least the central nerve visible, pubescent with short and stiff hairs 0.2–0.4 mm long, hairs white to grey at maturity; coma absent. Callus straight, 1.5–3.5 mm long, densely covered with hairs similar to those on the lemma, 0.2–0.6 mm long. Awn 60–200 mm long, 0.2–0.35 mm wide near the base, slightly twice bent, scabrous with stiff hairs c. 0.05 mm long; column dark brown at maturity, 14–40 mm long, 10–30 mm to the first, more gradual but greater bend; bristle pale yellow, much paler than the column, delicate. Palea broadly acute, equal to or slightly longer than the lemma, similarly hairy with hairs 0.2–0.3 mm long, the tip inrolled, the surface smooth; margins glabrous. Lodicules 3, membranous; 2 abaxial oblong, 0.8–1.5 mm long; paleal acute, minute–1 mm long. Anthers 1.5–2.5 mm long, not penicillate. Caryopsis 3–4 mm long; embryo 20–25% the length; hilum 90–95% the length.

DISTRIBUTION: Drier parts of western Victoria, in heath or near coastal localities in southern South Australia and in the southern regions of Western Australia (but apparently not on the Nullarbor Plain).

SPECIMENS EXAMINED: VICTORIA: **Region B:** 12 km NW. of Broken Bucket Bushland Reserve, *Beaglehole* 57053, 19.11.1977 (MEL, NSW). **Region C:** Little Desert, *Reader*, 5.11.1898 (MEL 60733, 60734); Mt Arapiles, *Beaglehole* 29781, 23.11.1968 (NSW). **Region D:** Mt Sturgeon, *Corrick* 1246, 3.11.1968 (Corrick Herb.); Mt Abrupt, *Grampians*, *Beaglehole* 30205, 30.12.1968 (NSW).

SOUTH AUSTRALIA: **Eyre Peninsula:** Flora and Fauna Reserve, Hundred of Hincks, *Specht* 2572, 11.11.1960 (AD). **Murray:** Angaston, *Behr*, 1.1849 (MEL 59988, 59989). **Southern Lofty:** Hope Valley, Adelaide, *Cleland* NSW 116593, 9.1923 (NSW); Nangkita, *Spooner* 1719, 5.12.71 (AD); Mt Compass, *Cleland*, 26.10.1940 (ADW 43922, AD); Victor Harbor, *Black* 11.1926 (AD). **Kangaroo Island:** nr. Penneshaw, *Hilton*, 12.1946 (ADW 43919, NSW 116588, ADW 43920, 43921, 43924, 43925); between Salt Lake & American R., *Hilton*, 7.11.1945 (ADW 5678); 'Hawks Nest', *Cashmore*, 22.11.1933 (ADW 263); Rocky R., *Cleland*, 18.11.1924 (ADW 43923, AD); mouth of South West R., *Cleland*, 7.12.1934 (AD); Govt. Experimentation plots, *Symon*, s.d. (ADW 44054). **South-eastern:** Dark Island Heath 9 miles (c. 15 km) NE. of Keith, *Specht & Rayson* 2, 12.1950 (AD); 'Pitlochry' station, *Symon* 8800, 30.11.1973 (ADW 43487, NSW 116592); between The Gap & Western Flat, *Hunt* 214, 14.10.1961 (AD).

WESTERN AUSTRALIA: **Eyre:** Scaddan, *Burvil*, 30.10.1938 (PERTH); 17 miles [27 km] from Ravensthorpe, towards Lake King, *Canning* 7264, 6.11.1968 (CANB, NSW); c. 2 km N. of Moore R. bridge, *Pullen* 9731, 30.11.1974 (CANB, NSW); Esperance, *Rose*, 11.1961 (PERTH). **Irwin:** Kalbarri National Park, *Crisp* 6285, 6295, *Taylor & Jackson*, 1.10.1979 (CBG); c. 4 miles [7 km] S. of Marchagee, *Maslin* 1437, 20.10.1970 (PERTH). **Avon:** nr. Mullewa, *Adam*, 9.1928 (PERTH); Watheroo National Park, *Royce* 9534, 4.10.1971 (PERTH); Merredin, *Gardner*, 10.1924 (PERTH); c. 18 km WNW. of Cunderdin, *Haegi* 1181, 3.10.1976 (PERTH); Tutanning Reserve, 30 km E. of Pingely, *Wilson* 3913, 16.11.1965 (PERTH). **Darling:** 5 miles [8 km] SW. of Mogumber, *Fisheries Inspector*, 11.1964 (PERTH).

* *Stipa megapotamia Sprengel ex Trin.*, Mém. Acad. Imp. Sci. St.-Pétersbourg, ser. 6, Sci. Math. 1: 77 (1830); Hitchcock, Contr. U.S. Natl. Herb. 24: 275 (1925); Rosengurt & de Artucio, Bol. Soc. Argent. Bot. 9: 286 (1961); Rosengurt, de Maffei & de Artucio, Gramíneas Uruguayas: 79 (1970).

HOLOTYPE: cited as 'brasil merid.', apparently collected from Uruguay (which was then included in Brasil), collected by Otto, no date (LE) (not seen).

Caespitose perennial to c. 1.3 metres high, with a basal tuft of leaves to a quarter the height, without rhizomes. Culms erect, terete, c. 1.5 mm wide near the base, not compressible, strongly ribbed to slightly ribbed upwards, glabrous; nodes 3, exserted, glabrous, slightly swollen. Leaf sheaths at first tightly enveloping the culm, later becoming slightly free, glabrous, innovations scabrous with hairs minute–0.2 mm long; basal sheaths 7–7.5 mm wide, smooth to slightly ribbed, inner margin glabrous, outer margin glabrous on innovations, elsewhere ciliate with hairs minute–0.3 mm long; upper sheaths 5–8 mm wide, strongly ribbed, inner margin glabrous, outer margin ciliate with hairs minute–0.6 mm long, sometimes glabrous on innovations. Ligule truncate, membranous, to 0.7 mm long, glabrous; auricles \pm thickened, with a tuft of hairs 0.1–1 mm long at the base. Leaf blade expanded or loosely rolled, 3.5–4 mm wide, to 40 cm long; abaxial surface strongly ribbed to slightly ribbed upwards, glabrous; adaxial surface strongly ribbed, glabrous; margin ciliate with hairs 0.1–0.5 mm long, sparse on innovations. Panicle 25–35 cm long, exserted, with distant fascicles of unequal, few-flowered, compound branches, contracted, 2–3 cm wide (excluding awns); axis terete, with hairs 0.2 mm long; branches 7–14 cm long, slightly flattened with hairs 0.2–0.4 mm long; pedicels 0.2–0.8 mm long, slightly flattened, sericeous with hairs 0.1–0.3 mm long. Spikelets 8–10 mm long (excluding awn). Glumes subequal, acute to acuminate, straw-coloured, hyaline at the tip, scabrous along the nerves with hairs 0.1–0.2 mm long; lower glume 8–10 mm long, lower 40–60% (4-) 3-nerved, upper 40–60% (3-) 1-nerved; upper glume 9–9.5 mm long, lower 60% 3-nerved. Floret cylindrical, 5.5–6 mm long (including callus). Lemma surface scabrous with crystalline tubercles c. 0.05 mm long, sericeous along the ribs with white hairs 0.5–1.5 mm long along the nerves or glabrous; lobes 0.1–0.2 mm long; corona 0.5–0.8 mm long with spines 0.1 mm

long on the upper margin. Callus 2–2.5 mm long, weakly bent at the tip, densely sericeous with hairs 0.2–1.5 mm long. Awn c. 50 mm long with 2–3 bends, 0.3 mm wide near the base; column c. 30 mm long, 15–25 mm to the first bend, brown with hairs 0.1–0.5 mm long; bristle delicate, scabrous with hairs 0.1 mm long. Palea 20–25% the length of the lemma, membranous, non-vascular, acute, erose, glabrous and smooth. Lodicules 2, membranous, abaxial, c. 1 mm long, obtuse. Anthers not observed. Caryopsis 2.5–3 mm long; embryo 30–35% the length; hilum 65–80% the length.

DISTRIBUTION: Native to S. America; apparently still confined to the Canberra region near its point of naturalisation.

SPECIMENS EXAMINED: NEW SOUTH WALES: **Southern Tablelands:** Black Mt, Canberra, Pullen 2592, 4.2.1961 (CANB, NSW), Pullen 3009, 4.1.1962 (NSW).

Apparently an escape from CSIRO plant introduction plots. The material naturalised in Australia matches material included in *S. megapotamia* var. *megapotamia*.

***Stipa metatoris* J. Everett & S.W.L. Jacobs, *Telopea* 2(4): 399 (1983).**

HOLOTYPE: NEW SOUTH WALES: Kyalite State Forest, 34°58'S 148°32'E. Sandridge with *Dodonaea* and *Callitris*. J. Everett 341 & S.W.L. Jacobs, 16.10.1981 (NSW).

Caespitose perennial to c. 1 metre high, with a basal tuft of leaves at least half the total height. Culms erect or geniculate, 1.5–2.5 mm wide near the base, terete, not compressible, scarcely ribbed, densely pubescent to puberulous or glabrous upwards; nodes 2–3, densely sericeous, exerted, to 50% wider than adjacent internodes. Leaf sheaths tight around the culms, loose with age, 4–6 mm wide (the uppermost inflated and to 8 mm wide), densely pubescent to hirsute, or glabrous upwards; inner margin glabrous; outer margin densely ciliate with long hairs; cataphylls ciliate on both margins. Ligule thinly coriaceous, 1–2.2 mm long, broadly acute, obtuse to truncate, but always lacinate, densely ciliate; abaxial surface villous; auricles densely ciliate with long, fine, straight hair tufts. Leaf blades mostly tightly inrolled, 2–4 mm wide, to 40 cm long; abaxial surface scarcely ribbed, scaberulous and sparsely to densely pubescent, to almost glabrous; adaxial surface strongly ribbed, densely pubescent; margins scabrous with sturdy, minute antrorse hairs. Panicle spreading at maturity, 15–25 cm long, 3–6 cm wide (excluding awns), exerted but the base usually concealed; axis terete, pubescent to scaberulous. Spikelets 16–20 cm long (excluding awn), slightly gaping. Glumes unequal, glabrous or scaberulous on the nerves, the tips occasionally ciliate, firm and opaque, green or straw-coloured at the base, transparent at the tip, usually with a crescentic purple patch in the middle third; lower glume 16–20 mm long, long-acuminate, the lower 50–75% 3-nerved; upper glume 12–15 mm long, acuminate, often broad in the middle, 5-nerved in the lower 50%, the next 20% 3-nerved. Floret turbinate to cylindrical, 7–8 mm long (including callus). Lemma brown at maturity, the surface smooth, sericeous with long white to slightly fulvous hairs, sparse to absent just below the apex centrally; lobes 2, obtuse, 0.2–0.5 mm long; coma of hairs similar to those of the lemma, 2.5–3.5 mm long. Callus 2.0–2.8 mm long, straight, sericeous with hairs slightly darker than those of the lemma. Awn 0.3–0.35 mm wide near the base, 55–65 mm long, weakly twice bent; column 20–25 mm long, 11–13 mm to the first bend, pubescent with hairs 0.2–0.3 mm long; bristle scaberulous or pubescent with hairs 0.2–0.3 mm long. Palea obtuse,

slightly shorter than the lemma, ciliate at the tip, sericeous with long hairs between the nerves, the margins glabrous. Lodicules 3, membranous; 2 abaxial 1.5–2.0 mm long, oblong to slightly spatulate; paleal 0.5–1.0 mm long, acute. Anthers 1.2–4.0 mm long, penicillate. Caryopsis 3.5–4.5 mm long; embryo 30–40% the length; hilum 75–85% the length.

DISTRIBUTION: Sandy areas of south-western New South Wales and south-eastern South Australia.

SELECTED SPECIMENS: NEW SOUTH WALES: **South Western Plains:** Kyalite State Forest, *Everett 341 & Jacobs*, 16.10.1981 (NSW); c. 3 miles [5 km] W. of Stony Crossing, *Henderson 437 & 438*, 9.10.1947 (NSW); N. of Swan Hill, *Henderson 440*, 5.11.1947 (NSW); c. 3 km NNW. of Cunninyeuk, *Everett 78 & Jacobs*, 23.11.1980; Cunninyeuk, *Henderson NSW 149127*, 12.10.1946 (NSW).

SOUTH AUSTRALIA: **South-eastern:** 3 miles [5 km] SE. of Bordertown, *Specht 1584*, 12.10.1947 (AD).

***Stipa mollis* R.Br.**, Prodr.: 174 (1810); Hughes, Kew Bull. 1921: 18 (1921); Vickery, Contrib. N.S.W. Natl. Herb. 2: 78 (1953); Beadle, Evans & Carolin, Handb. Vasc. Pl. Sydney District: 531 (1963); Fl. Sydney Region: 656 (1972), edn 2: 660 (1982).

HOLOTYPE: 'Port Jackson, R. Brown, 1802–5' (BM!, isotype (no. 6205) K, CANB photo (of K sheet) no. 237016.)

SYNONYMS: *S. semibarbata* var. *mollis* (R. Br.) Benth., Fl. Austral. 7: 569 (1878). Based on *S. mollis* R. Br.

S. plagiopogon J. Black in Trans. & Proc. Roy. Soc. S. Austral. 65: 334 (1941); Fl. S. Austral. edn 2: 89 (1943). TYPIFICATION: Black cited four syntypes: 'Victor Harbor'; 'Inman Valley, 1926, J.B. Cleland'; 'Mt. Pleasant, 1933, E.C. Black'; 'Wilpena Pound, 1930, J.B. Cleland'. Specimens from Black's herbarium are mounted together on AD 97403342. The specimen mounted on the right hand side of the sheet, from Victor Harbor, Nov. 1926, consists of a complete culm with associated inflorescence in good condition, and we here designate this specimen as the **Lectotype** of *S. plagiopogon* J.M. Black (Dupl. MEL 59968). It is supported by a few detached florets, notes and sketches mounted on the lower left hand corner of the double mounting folder. The specimen 'Inman Valley, 1926, J.B. Cleland' has not been found; there are, however, a few detached glumes and lemmas, with notes and sketches, from 'Back Valley [which is near Inman Valley] 17.11.1930, J.B. Cleland'. The specimen from 'Mt Pleasant, 1933, E.C. Black' consists of a good inflorescence and culm but, as mounted, it is somewhat confused with an additional ticket bearing a few detached florets, sketches and notes, and annotated 'This specimen given Vict. Harb. July 1942' (sic!) (after the species was described). The specimen 'Wilpena Pound, 1930, J.B. Cleland' is represented on this sheet only by detached lemmas and notes. There is, however, another sheet, (AD 96323176) that bears a good specimen from 'Wilpena Pound, J.B. Cleland, 30.11.1930', but we are uncertain whether this was derived directly from Black's herbarium or subsequently from Cleland's herbarium. All the abovementioned specimens are *Stipa mollis* R. Br.

Caespitose perennial to c. 1 metre high, not rhizomatous, with a basal tuft of leaves c. one-fifth the height. Culms erect, terete, 1.5–5 mm wide near the base, not compressible, very slightly ribbed to smooth; basal internodes pubescent with hairs minute–0.4 mm long near the nodes; upper internodes minutely scabrous to pubescent; nodes 3–5, exerted with age, densely sericeous with hairs minute–0.3 mm long to glabrous, if swollen then 15–25% wider than adjacent internodes. Leaf sheaths at first tightly enveloping the culm, later becoming slightly loose, 5–10 mm wide; basal sheath very slightly ribbed, minutely pubescent to glabrous, inner margin glabrous, outer margin ciliate with hairs minute–0.4 mm long; upper sheath slightly to strongly ribbed, pubescent to tomentose, sometimes glabrous, inner margin glabrous, outer margin glabrous to ciliate with hairs 0.1–0.3 mm long; collar ciliate with hairs 0.6–0.7 (–1.1) mm

long. Ligule truncate, membranous, 0.3–3 mm long, ciliate with hairs 0.3–0.7 mm long; abaxial surface densely pubescent to hirsute; auricles absent. Leaf blade linear, tightly rolled, 1.5–3 mm wide, to 30 cm long; abaxial surface slightly to moderately ribbed, glabrous; adaxial surface strongly ribbed, tomentose with hairs minute–0.3 (–0.8) mm long; margins glabrous to minutely scabrous. Panicle 10–30 cm long, exserted, with close fascicles of unequal many- to few-flowered, compound branches, contracted, 2.5–3.5 cm wide (excluding awns); axis terete, scabrous with stiff hairs minute–0.15 mm long; branches 1.5–8 cm long, angled, scabrous with stiff hairs to 0.2 mm long; pedicels 1–10 mm long, angled, scabrous. Spikelets 16–20 mm long (excluding awn), gaping. Glumes equal to subequal, acuminate, hyaline, minutely scabrous, with occasional stiff hairs to 0.5 mm long on the nerves; lower glume 16–20 mm long with lower 55–75% 3-nerved; upper glume 15–20 mm long with lower 20–40% 6-nerved, upper 80–60% 4–1-nerved. Floret narrow-cylindrical, 7.5–9 mm long (including callus), without a neck. Lemma red-brown at maturity, the surface smooth to granular upwards, sericeous with hairs 0.4–0.8 mm long, lobes and coma absent. Callus 1.5–3 mm long, weakly bent at the tip, densely sericeous with white hairs 0.2–0.9 mm long, becoming yellow to fulvous at maturity. Awn 60–100 mm long, twice bent, 0.3–0.4 mm wide near the base; column 20–35 mm long, 10–17 mm to the first bend, brown, plumose with hairs 0.6–2 mm long, the hairs produced mostly along one side of the awn, appearing to spiral as the column twists; bristle dark brown to straw-coloured, scabrous with hairs 0.1 mm long and usually plumose at the base on one side with hairs similar to those of the column. Palea ± equal to the lemma, acute, sericeous along the centre with hairs (0.1–) 0.4–0.6 mm long down the centre, surface slightly granular to smooth. Lodicules 2, abaxial, membranous, 1.5–2 mm long, acute. Anthers 1–4.5 mm long, penicillate. Caryopsis c. 4 mm long; embryo 20% the length; hilum 60–80% the length.

DISTRIBUTION: Widespread on sandy and/or low nutrient soils of the southern States, including New South Wales.

SELECTED SPECIMENS: NEW SOUTH WALES: **Central Coast:** Centennial Park, Sydney, *Cheel* NSW 115832, 15.10.1899 (NSW); Tempe district, *Boorman* NSW 115827, 10.1899 (NSW); Kogarah, *Camfield* NSW 115831, 10.1893 (NSW); Maroubra, *Vickery* NSW 115830, 17.10.1929 (NSW); Long Bay, *Hilton* NSW 116530, 22.11.1944 (ADW, NSW, AD); Sand hills near Sydney, *Maiden, Kneucker, Gram. Exsicc. No. 196*, 10.1900 (NSW); *Sieber, Agrostotheca 60* [probably from the Port Jackson District] (MEL; ex Herb Lang). **South Coast:** Bowen Island, *Rodway* NSW 115823, 17.12.1931 (NSW); Ulladulla, *Pulley 329*, 20.10.1969 (CBG); Bermagui, *Vickery* NSW 116487, 15.1.1940 (NSW); Green Cape, *Phillips CBG 1270*, 8.10.1961 (CBG). **Central Tablelands:** Towrang, *Thomson* NSW 115822, 15.11.1912 (NSW); Marulan to Berrima, *Vickery* NSW 116488, 11.1.1956 (NSW). **Southern Tablelands:** summit of Mt Budawang E. of Braidwood, *Pullen 4126*, 6.12.1965 (NSW, CANB, AD, MEL, BRI); Canberra, *Moore M147*, 19.12.1945 (CANB); Duntroon, A.C.T., *Symon*, 21.1.1952 (ADW 44144); Jerrabomberra lookout near Queanbeyan, *Gray 4663*, 29.12.1959 (CANB). **Central Western Slopes:** Temora, *Dwyer*, 11.1916 (BRI, NSW).

VICTORIA: Region B: Pink Lakes, *Williamson*, 10.1928 (MEL 60761); Big Desert, 12 km NW. of Broken Bucket Bushland Reserve, *Beaglehole 57054*, 19.11.1977 (MEL). **Region C:** near Dimboola, *Reader* (MEL 60724); Horsham to Hamilton road, W. of the Grampians, *Phillips* NSW 116511, 31.10.1960 (NSW); Mt Arapiles, *Beaglehole 29611*, 19.11.1968 (NSW); between Booroopki & Kaniva, *Phillips CBG 054858*, 2.11.1971 (CBG); John Smith Reserve, c. 12 miles [19 km] SW. of Horsham, *Beaglehole NSW 116909*, (NSW); N. side of Mt Zero, Grampians, *Beaglehole 17823 & Corrick*, 5.11.1967 (NSW). **Region D:** Mt Sturgeon, *Corrick 1614*, 26.12.1968 (Corrick Herb); Billywing Swamp near Gleninsla, 40 miles [64 km] N. of Hamilton, *Phillips CBG 001271*, 31.10.1960 (CBG); Lower Glenelg Plantation near Renwick, *Shepherd*, 11.1950 (MEL 60760); W. of Mirranatwa Gap on Dunkeld to Halls Gap road, *Symon 1724*, 1.11.1961 (ADW); Grampians, Victoria Range, Kappa Cave area, *Finch & Beaglehole 4609*, 2.3.1957 (NSW); Lake Mundi area W. of Casterton, *Swindley 1128*, 29.11.1962 (MEL); 7.5 miles [12 km] W. of Casterton, *Beaglehole 37908*, 17.11.1971 (NSW); c. 14 miles [22 km] W. of Hamilton, *Corrick 1545*, 8.12.1968 (Corrick

Herb). **Region E:** Mt Richmond National Park, *Phillips CBG 003170*, 26.10.1963 (CBG). **Region F:** c. 22 km SSW. of Robinvale, *Beaglehole 56200*, 5.5.1977 (MEL); Annuello, c. 23 km NNW. of Manangatang, *Beaglehole 55889*, 24.9.1977 (MEL). **Region G:** 5 km SW. of Chinkapook, c. 18 km S. of Manangatang, *Beaglehole 55494*, 17.4.1977 (MEL); Wathe Wildlife Reserve, 5 km W. of Gama, *Beaglehole 56909*, 22.10.1977 (MEL). **Region H:** Borung, mallee scrub, *Reader*, 25.10.1903 (MEL 60762); Lower Lodden, *Walter NSW 116524* (NSW); Donolly, *Phillips CBG 027106*, 30.10.1963 (CBG); Wimmera, *Wilson*, 1870 (MEL 60763). **Region J:** 2 miles [3 km] SE. of Stawell, *Muir 2647*, 3.11.1962 (MEL); Grampians, Halls Gap, *Symon 299*, 13.11.1959 (ADW); Mt William, Grampians, *Beaglehole 22229*, 13.11.1966 (NSW); Moyston, *Sullivan*, 12.1880 (MEL 60822); Wannan R., *Williamson NSW 116493*, 11.1899 (NSW). **Region K:** Port Campbell National Park, *Finck & Beaglehole 21465*, 29.10.1966 (NSW). **Region M:** Epson near Bendigo, *Paton*, 11.1921 (MEL 60833); Ravenswood, *Bissill*, (MEL 60823); 8 miles [13 km] ESE. of Melbourne, beyond Alamein railway station, *Cullimore 92*, 16.10.1967 (MEL, NSW). **Region N:** Puckapunyal, *Davis NSW 116519*, 10.11.1942 (NSW); Studley Park, Melbourne, *Muir 519*, 18.10.1958 (MEL, NSW, AD, CANB, BRI); near Dandenong Ranges, *Dixon NSW 116499*, 1891 (NSW, MEL, PERTH); Brighton, ex *Herb. Hook. NSW 116510*, (NSW); Sandringham, *Meebold 21579*, 11.1936 (NSW). **Region P:** Frankston, *Meebold NSW 116492*, 1.1937 (NSW); Frankston to Langwarrin, *Hart*, 31.10.1931 (MEL 59996); Anglesea, *Phillips NSW 116895*, 28.10.1971 (CBG, NSW). **Region S:** Licola to Heyfield road, *Beaglehole 43381*, *Willis & Chesterfield*, 21.10.1973 (ACB, NSW). **Region T:** Wilsons Promontory on road towards Five Mile Beach, *Phillips CBG 027107*, 23.11.1961 (CBG); Wilsons Promontory, Norman Point, *Muir 614*, 13.12.1958 (MEL). **Region W:** Bairnsdale, *Vickery NSW 116900*, 25.1.1935 (NSW); Sperm Whale Head, W. of Lakes National Park, *Muir 2308*, 13.10.1961 (MEL). **Region Z:** 2.5 miles [4 km] W. of Genoa, *Beaglehole 32776*, 24.12.1969 (NSW); 11.5 miles [18 km] SSW. of Mallacoota, *Beaglehole 31068*, 8.10.1969 (NSW); c. 5 miles [8 km] WNW. of Cape Everard, *Beaglehole 32235 & Finck*, 10.12.1969 (NSW); 1 mile [1.6 km] NNW. of Cape Conran, *Beaglehole 34515*, 12.11.1970 (NSW).

TASMANIA: Waterhouse Estate, NE. Tasmania, *Townrow 110*, 18.12.1967 (JEST); 5.5 miles [9 km] S. of St Helens, *Townrow 187*, 19.1.1968 (JEST); Slopen I., *Townrow 81*, 82, 11.12.1967 (JEST); Dianas Basin, *Simson*, 11.1878 (MEL 60809); Launceston, *Cleland NSW 116509*, 11.1912 (NSW); Risdon, *Blake 18323*, 18.1.1949 (NSW, BRI); South Esk, *Stuart 267* (MEL); 6 miles [9 km] N. of Ranger's house, Coles Bay, *Townrow 180*, 18.1.1968 (JEST); Prosser River, 2.1 miles [3 km] W. of Orford, *Townrow 71*, 24.11.1967 (JEST); Runnymede, *Townrow 63*, 24.11.1967 (JEST); 2 miles [3 km] S. of Richmond on Cambridge road, *Townrow 75*, 25.11.1967 (JEST); between Dunalley & Murdunna, *Burbidge 3218*, 20.1.1949 (CANB); Mt Wellington, *Martin NSW 116503*, 3.1933 (NSW); Opossum Bay, *Townrow 49*, 22.11.1967 (JEST).

SOUTH AUSTRALIA: **Flinders Ranges:** Alligator Gorge, *Hilton 44089*, 5.8.1952 (ADW). **Eyre Peninsula:** Kimba district, *French 28131*, 9.1954 (ADW); Koppio turnoff on road from Tumbly Bay, 11 miles [18 km] from Tumbly Bay, *Symon 917*, 12.11.1960 (ADW); 4 miles [7 km] E. of Wanilla, *Tindale 560a*, 9.1970 (NSW); Port Lincoln, *Crocker*, 12.10.1944 (CANB); MacLaren Flat, *Kraehenbuehl 1341*, 1.11.1964 (AD). **Northern Lofty:** Mangalo area, *Turner 28142*, 12.1954 (ADW); Julia Range, 10 miles [16 km] S. of Burra, *Symon 9355*, 12.12.1953 (ADW); Mona Reserve, c. 5 km W. of Bute, *Copley 834*, 30.10.1966 (AD); Sevenhills, *Copley 3264*, 15.11.1970 (AD); Black Springs, *Symon*, 12.12.1953 (ADW 9354); Central Tothill Range, *Kraehenbuehl 2195*, 27.10.1963 (AD); S. of Freeling, *Kraehenbuehl 1780*, 6.11.1966 (AD). **Murray:** Monarto City Centre site, *Symon 9733*, 26.11.1974 (ADW); Kinchina, *Cleland*, 8.11.1924 (AD, NSW); Wynarka, *Colquhoun 2492*, 12.1936 (ADW); c. 5 km W. of Monarto South, *Spooner 1639*, 24.10.1971 (AD). **Yorke Peninsula:** Happy Valley, *Cleland*, 7.11.1926 (AD). **Southern Lofty:** 1 km N. of Tanunda, *Kraehenbuehl 1675*, 23.10.1966 (AD); Mt Lofty Range, between Gawler & Williamstown, *Salasoo 1727*, 1.1.1959 (NSW); Altona, via Lyndoch, *Hilton 189*, 27.10.1952 (ADW); Highbury, *Smith 1801*, 13.10.1969 (AD); Black Hill, Athelstone, *Spooner 1692*, 17.11.1971 (AD); The Pinery, Grange Golf Links, *Kraehenbuehl 712*, 21.10.1962 (AD); Seaton Golf Links, *Smith 649*, 13.10.1967 (AD); Nixon Skinner Reserve, *Cleland*, 14.11.1944 (AD); Camden [suburb of Adelaide], *Kraehenbuehl 130*, 3.11.1959 (AD); Barossa Reservoir, *Cleland*, 22.11.1939 (AD); Morialta, c. 10 km E. of Adel., *Cleland*, 11.1938 (AD, NSW 116914); Stoneyfell Hills, *Cleland*, 19.10.1952 (AD); Coxs Scrub, *Crisp 115*, 31.10.1971 (AD); Longwood, *Lazaroff 39*, 9.11.1971 (AD); Torrens Gorge West, *Spooner 1119*, 21.10.1970 (AD); Dernancourt, *Smith 1792*, 22.10.1969 (AD); W. of Crafers, *Belcher 502*, 26.10.1967 (BRI); Mount Lofty Botanic Gardens, *Kuchel 1493*, 5.12.1963 (AD); Blackwood, Adelaide, *Hilton 43961*, 17.11.1940 (ADW); Belair, *Koch 937*, 11.1902 (K, NSW); Happy Valley Reserve, *Symon 1922*, 28.11.1961 (ADW); Echunga, *Parsons 29*, 27.9.1961 (AD); Macclesfield, *Blackburn 28129*, 20.10.1954 (ADW); McLaren Flat, *Jackson 567*, 30.10.1963 (AD); Douglas Gully Scrub, 4 km NE. of McLaren Flat, *Bell 3*, 12.11.1976 (BRI ex AD); Southern hills at Yundi, 5 miles [8 km] SE. of Willunga, *Hilton*, 11.11.1941 (ADW 43963). **Kangaroo Island:** Cape Borda, *Rogers NSW 116918*, 9.1907 (NSW); Haven Garden, American River, *Cleland* (AD); between Kangaroo

River and Kingscote, *Hilton*, 7.11.1945 (ADW 43966, NSW 116907); Stun'sail Boom River, *Eichler 15434*, 12.11.1958 (NSW). **South-eastern:** between Renmark & Blanchetown, *Griffiths NSW 116603*, 18.9.1969 (CANB, NSW); Loveday, *Gauba CBG 047571*, 20.11.1943 (CBG); Back Valley, near Inman Valley, *Cleland*, 17.11.1930 (AD); Messent Wild Life Reserve, c. 170 km SE. of Adelaide, *James 152*, 14.11.1965 (AD); 10 miles [16 km] NE. of Keith on road to Sherwood, *Hilton*, 10.10.1953 (ADW 44079); Dark Island Heath, 15 km NE. of Keith, *Specht 1 & Rayson*, 12.1950 (AD); Bordertown, *Hunt 1619*, 27.10.1963 (AD); between Western Flat & Bordertown, *Hunt 312*, 28.10.1961 (AD); Bangham Scrub, 7–8 miles [11–13 km] S. of Western Flat, *Symon 25881*, 21.11.1962 (ADW); Lucindale, *Carrodus*, 8.1956 (AD); road to Naracoorte Caves, *Phillips 356*, 1.11.1971 (CBG); Stewarts Range district, *Blackburn*, 15.10.1954 (ADW 28128); Big Heath National Park, Hundred of Spence, *Alcock 3066*, 9.11.1969 (AD); 1.6 km NE. of Nangwarry, *Wilson 614*, 24.10.1966 (CANB, AD); 4 miles [6 km] N. of Millicent, *Cleland*, 12.1922 (AD); Princess Margaret Caves, *Hilton*, 31.1.1947 (ADW 44021).

WESTERN AUSTRALIA: **Darling:** between Augusta & Nannup turnoff on highway, *Phillips CBG 027108*, 18.10.1962 (CBG); Tunney, S. of Kojonup, *Royce 8052*, 4.10.1963 (PERTH); near Lake Carabundup between Frankland & Mt Barker, *Pullen 9996*, 12.12.1974 (CANB); Kalgan, *Mueller*, 10.1867 (MEL 60811); 36.5 miles [58 km] from Albany towards Borden via Chester Hill, *Canning 6929*, 28.10.1968 (BRI, AD). **Avon:** Wedgicarrup, W. of Wagin, *Burbidge 2358*, 10.9.1947 (CANB). **Eyre:** c. 32 km NNE. of the coast at Stokes Inlet, *Orchard 1605*, 18.10.1968 (PERTH); Cape Le Grand National Park, *Royce 8777*, 22.10.1969 (PERTH); Fitzgerald River near junction with Tivertup, *George 10557*, 19.12.1970 (PERTH).

S. mollis is quite similar to both *S. semibarbata* and *S. hemipogon*. From *S. semibarbata* it differs in the shorter floret (9–11 mm in *S. semibarbata*) and the tendency for the hairs on the column to be longer and arranged in a more distinct spiral. From *S. hemipogon* it differs in the longer upper glume (10–16 mm in *S. hemipogon*), longer floret (5–7.5 mm in *S. hemipogon*) and relatively shorter hairs on the longer column (0.5–4 mm; 10–20 mm in *S. hemipogon*).

Forms with hairs extending almost to the tip of the bristle could be confused with *S. plumigera*, but the presence of much longer hairs on the column, especially upwards, readily distinguishes *S. mollis*.

Stipa muelleri Tate, Trans. & Proc. Roy. Soc. South Austr. 7: 70 (1885); Hughes, Kew Bull. 1921: 11 (1921), *ibid.* 1922: 16 (1922); Black, Fl. S. Austral. 1: 65 (1922), edn 2: 86 (1943); Willis, Handb. Pl. Vict. 1: 181 (1962), edn 2: 181 (1970).

HOLOTYPE: SOUTH AUSTRALIA: 'Open parts in the stringy bark forests (*Eucalyptus obliqua*) at Uraidla, Mt Lofty Range, and scrublands c. Mt Jagged, towards Encounter Bay, flowering in October, R. Tate' (AD!).

Spreading perennial to c. 1 metre high without a basal tuft of leaves, shortly rhizomatous. Culms decumbent or at first erect, 0.7–0.9 (–1.2) mm wide near the base, wiry, compressible only when young, usually branching at the nodes, slightly ribbed, scabrous with hairs 0.2–0.25 mm long to glabrous upwards; nodes 3–7, exserted, not swollen, glabrous. Leaf sheaths tightly enveloping the culm, except where branching occurs; basal sheaths c. 4 mm wide, slightly to moderately ribbed, glabrous; upper sheaths 1–5 mm wide, very slightly ribbed, glabrous to tuberculate. Ligule a tuft of minute hairs; auricles absent. Leaf blade linear, thickened, 0.15 mm wide, to 1 mm long, readily deciduous; abaxial surface not ribbed, glabrous; adaxial surface not ribbed, scabrous with tubercles; margins glabrous. Panicle reduced to 1–3 spikelets, 2–3.5 cm long, exserted, without branches, open; axis terete, scabrous with stiff hairs 0.2 mm long; pedicels 0.6–1.5 cm long, terete to slightly flattened, scabrous with stiff hairs 1.5 mm long. Spikelets 1.8–3 cm long (excluding awn), gaping at maturity,

otherwise tightly closed. Glumes subequal to equal, acute, straw-coloured or purple, glabrous on lower 80%, upper 20% scabrous with stiff hairs 0.05–0.2 mm long; lower glume 18–30 mm long, lower 95% 3-nerved, upper 5% 2-nerved; upper glume 15–30 mm long, lower 70% 5-nerved, upper 30% 3–2-nerved. Floret narrow-cylindrical, without a neck, c. 13–20 mm long (including callus). Lemma surface tuberculate, sericeous with hairs 0.3–0.6 mm long; lobes c. 3 mm long; coma absent. Callus c. 2–3 mm long, weakly bent at the tip, sericeous with white hairs 0.5–1 mm long. Awn 50–100 mm long, 0.5 mm wide near the base, twice bent, second bend stronger; column 40–55 mm long, 35–45 mm to the first bend, straw-coloured or dark brown, scabrous with hairs 0.02–0.2 mm long; bristle scabrous. Palea 75% the length of the lemma, acute to acuminate, surface smooth with a band of hairs 0.2–0.5 mm long down the centre back, margins glabrous. Lodicules 3; 2 abaxial membranous, 2–5 mm long, acute or erose; paleal membranous, 3.5–5 mm long, erose. Anthers 8–13 mm long, penicillate. Mature caryopsis not observed.

DISTRIBUTION: Woodland and shrubland of southern Victoria and south-eastern South Australia.

SPECIMENS EXAMINED: VICTORIA: **Region D:** Grampians, *Williamson* NSW 116016, 11.1902 (ADW, NSW); 5 miles [8 km] W. of Mirranatwa Gap, *Muir* 2738, 6.11.1962 (MEL); Mirranatwa Gap, *Symon* 146, 9.5.1959 (ADW); Victoria Range, *Walter*, 11.1899 (MEL 60742); Wannon R. above Dunkeld, *Williamson*, 10.11.1899 (MEL 60738). **Region E:** S. of Moleside, *Beauglehole* 715, 10.1946 (NSW). **Region N:** South of Belgrave, *Corrick* 3498, 20.10.1973 (NSW); Emerald, *St. John*, 11.1907 (MEL 59956). **Region P:** Arthurs Seat, *Melville* 2168, 30.11.1952 (NSW). **Region S:** Beenak, *Willis*, 22.12.1946 (MEL 60737); Gembrook, *French*, 11.1885 (MEL 60922).

SOUTH AUSTRALIA: **Southern Lofty:** Mt Lofty, *Crisp* 1853, 24.12.1975 (CBG); Stirling West, *Ising*, 7.12.1959 (AD); Mosquito Flat nr. Mt Compass, *Cleland*, 26.10.1940 (AD); between Currency Creek & Mt Compass, *Cleland*, 15.1.1940 (AD); S. of Second Valley Forest Reserve, *Cleland*, 12.12.1938 (AD); nr. Yankalilla, *Eichler* 14383, 15.11.1957 (AD). **Kangaroo Island:** Kangaroo Island, *Tate*, 1883 (MEL 60739). **South-eastern:** Riddock [Bay], *Crocker*, 9.11.1939 (ADW 4126).

Stipa multispiculis J. Black, Trans. & Proc. Roy. Soc. S. Austral. 65: 333 (1941); Black, Fl. S. Austral. edn 2: 91 (1943).

TIPIFICATION: Black cited three Syntypes, all of which are extant in his herbarium now at AD. The first cited, 'Morialta, Oct. 1925, J.B. Cleland', represents a species different from the other two; it agrees with the species which Black knew as *S. tenuiglumis* (= *S. flavescens*). There is little doubt that Black drew upon the characters of this specimen, as well as the other two, in compiling his description, notably in arriving at the dimensions of the lemma and callus. However, Black's comments clearly indicate that he was distinguishing his new species from *S. tenuiglumis* and it would therefore be inappropriate to select the specimen from Morialta as the lectotype.

The second cited specimen, 'Port Noarlunga, Nov. 1926, J.B. Cleland' (AD 97421231), is a reasonably good specimen (though lacking the base) and seems to represent the species that Black was intending to describe. Black has clearly written '*Stipa multispiculis*' on the sheet beside the specimen and initialled it. We here designate this specimen as the **Lectotype** of *S. multispiculis* J. Black. A good duplicate of it, derived from the Cleland herbarium, is also in AD.

The third cited specimen, 'Ardrossan (Yorke Peninsula) Nov. 1932, E.C. Black', consists of a single panicle without foliage or culm, but it certainly agrees with the specimen from Port Noarlunga.

Caespitose perennial to c. 1 metre high, with few conspicuously extravaginal shoots from a short rhizome. Culms geniculate or erect, not compressible, terete, (2–) 3–3.5 mm wide near the base, scarcely ribbed, scaberulous with dense, minute stiff hairs or puberulous to sericeous (especially just below the nodes) or occasionally \pm glabrous; nodes 3–5, exerted, to 30% broader than adjacent internodes, densely sericeous. Leaf sheaths at first tightly enveloping the culms, soon becoming loose, slightly ribbed, scaberulous with dense, minute

hairs, with or without scattered scabrous or soft hairs, or puberulous to almost glabrous; basal sheaths usually with more and longer hairs; inner margin glabrous; outer margin long-ciliate. Ligule firm and coriaceous, 0.2–0.7 mm long, truncate, usually dark-coloured, short- or long-ciliate; abaxial surface densely sericeous; auricles usually thickened and spreading with a tuft of hair at the base. Leaf blade expanded or only loosely rolled, to 8 mm wide and 60 cm long; abaxial surface ribbed, scaberulous with dense minute hairs or occasionally \pm glabrous; basal leaves usually more scabrous; adaxial surface ribbed, minutely scabrous or scaberulous to almost glabrous; margins glabrous. Panicle to 40 cm long, to 6 cm broad (excluding awns), exerted, loosely contracted, dense, with moderately distant fascicles of unequal many-flowered branches; axis terete to angular upwards, scabrous or scaberulous; branches to 12 cm long, terete to angular upwards, scabrous or scaberulous; pedicels 2–10 mm long, terete to angular upwards, scabrous or scaberulous. Spikelets 8.5–10 mm long (excluding awn), gaping. Glumes subequal, membranous, colourless, or green or purple-tinged, appressed-pubescent to scaberulous overall or scaberulous only on the nerves; lower glume 8.5–10 mm long, long-acuminate, the lower 55–65% 3-nerved; upper glume 6.5–9.0 mm long, acuminate, the lower 45–50% 5-nerved, the next 20% 3-nerved. Floret narrow-cylindrical to narrow-fusiform, 4.5–6.0 mm long (including callus), with a weakly developed neck, the 3 main nerves slightly thickened at the apex. Lemma very finely granular, with sparse spreading white to yellowish hairs; coma 0.2–0.8 mm long; lobes 1–2, c. 0.1 mm long. Callus 0.5–1.2 mm long, sturdy and curved, with hairs similar to those of the lemma. Awn 25–40 mm long, 0.2–0.3 mm wide near the base, gently twice bent; column 15–20 mm long, 7–12 mm to the first bend, scaberulous and densely pubescent with soft hairs 0.25–0.5 mm long; bristle scabrous. Palea broad-acute to obtuse, to 0.5 mm shorter than the lemma, coriaceous, smooth, with a band of sparse hairs down the centre; margins glabrous; tip ciliate. Lodicules 3, membranous; 2 abaxial c. 1 mm long, spathulate; paleal c. 1 mm long, triangular, broadly acute. Anthers 1.8–2.5 mm long, penicillate. Mature caryopsis not observed.

DISTRIBUTION: Northern Lofty, Yorke Peninsula and Southern Lofty regions of South Australia.

SPECIMENS EXAMINED: SOUTH AUSTRALIA: **Northern Lofty:** South Hummocks Range, *Copley 3235*, 25.10.1970 (AD). **Yorke Peninsula:** Innes National Park, *Copley 4434*, 28.8.1974 (AD). **Southern Lofty:** 3 miles (c. 4 km) from Sandy Creek on the Williamstown road, *Harris 36*, 1.10.1959 (AD); Gawler cemetery, *Spooner 3109*, 13.10.1973 (AD); Torrens Gorge West, *Spooner 1115*, 13.11.1970 (AD); Enfield, *Smith 920*, 12.10.1967 & *1456*, 24.10.1968 (AD); Morialta Conservation Park, *Spooner 3208*, 4.12.1973 (AD); Glen Osmond, *Cleland*, 9.10.1955 (AD); Waite Institute, *Hilton*, 20.9.1944 (ADW 43835, NSW); Greenhill Road, *Cleland*, 9.10.1948 (AD); Waterfall Gully, Adelaide Hills, *Hilton*, 14.10.1944 (ADW 44010); Blackwood, *Ewers s.n.*, 14.10.1956 (AD 97737564); Port Noarlunga, *Smith 449*, 27.9.1967 (AD).

Similar to *S. flavescens* but differing in the shorter (8.5–10 mm lower, 6.5–9 mm upper) glumes and shorter (4.5–6 mm) floret. Young plants of *S. curticola* could be confused with *S. multispiculis* but differ in the longer (6.5–8 mm) floret and longer (4.5–6.5 cm) awn.

***Stipa mundula* J. Black**, Trans & Proc. Roy. Soc. S. Austral. 65: 333 (1941); Black, Fl. S. Austral. edn 2: 91 (1941).

HOLOTYPE: SOUTH AUSTRALIA: Chaunceys Line (N. of Lake Alexandrina), *J.B. Cleland* 12.10.1933 (AD 97423406; probable isotypes AD 96323226, 96323235, 97422298 in part; MEL 59957; ADW 44028, 44191).

Densely caespitose perennial to 60 cm high with conspicuously extravaginal basal leaves usually c. one-third the height. Culms erect or geniculate, to 1 mm wide near the base, terete, compressible, scarcely ribbed, glabrous to puberulous, especially just below the nodes; nodes 2, pubescent to almost glabrous, just exerted, to 30% broader than adjacent internodes. Leaf sheath tightly enclosing the culm, slightly ribbed, glabrous to minutely puberulous; inner margin glabrous; outer margin long-ciliate or, on the upper sheaths, glabrous. Ligule firmly membranous, truncate, 0.3–3.0 mm long, continuous with the sheath margin, ciliate or glabrous, abaxial surface glabrous; auricles often with a tuft of long straight hairs. Leaf blades tightly convolute-erect, 0.5–1 mm in diameter, to 15(–30) cm long; abaxial surface unribbed, glabrous or with occasional strong or weak hairs; adaxial surface ribbed, scabrous with dense minute hairs and densely pubescent to hirsute; margins scabrous with short hooks. Panicle contracted or narrowly spreading, sparse, to 12 cm long, to 3 cm wide, exerted at length, with fascicles of few, unequal, few-flowered branches; axis \pm terete, scaberulous with very short hairs; branches terete to slightly angular, to 4 cm long, scaberulous with very short hairs; pedicels terete to slightly angular, to 10 mm long, scaberulous with very short hairs. Spikelets 12–17 mm long (excluding awn), gaping early in development. Glumes subequal to unequal, narrow, membranous, usually deeply purple-tinged at the base, hyaline at the tip, glabrous to minutely scaberulous on the nerves; lower glume 12–17 mm long, finely acuminate, the lower 60% obscurely 3-nerved; upper glume 8–14 mm long, acuminate to broad-acute, the lower 30–60% 5-nerved, the next 10–20% 3-nerved. Floret narrow-turbinate to narrow-fusiform, the main nerve just visible, 6.5–8.0 mm long (including callus). Lemma red-brown at maturity, finely granular; hairs sparse, sparser at the apex, white becoming fulvous at maturity; coma obscure, 0.5–1.5 mm long; lobes 2, 0.1–0.5 mm long. Callus 2.2–3.0 mm long, fine and straight with hairs similar to those of the lemma. Awn 50–80 mm long, 0.25–0.35 mm wide near the base, gently twice bent; column 22–30 mm long, 10–16 mm to the first bend, pubescent with hairs 0.35–0.70 mm long; bristle scaberulous. Palea obtuse, c. 0.5 mm shorter than the lemma, very finely granular and with a band of dense long hairs down the centre, hyaline and glabrous at the margins, the tip ciliate. Lodicules 3, membranous; 2 abaxial, 1–1.5 mm long, oblong; paleal less than 0.2 mm long, acute. Anthers c. 3.5 mm long, not penicillate. Caryopsis 3–4 mm long; embryo 25% the length; hilum 80% the length.

DISTRIBUTION: South-eastern South Australia, extending into Victoria.

SPECIMENS EXAMINED: VICTORIA: **Region B:** Big Desert, 35° 17' S, 141° 14' E, *Corrick 6394*, 2.10.1979 (NSW). **Region C:** Little Desert National Park, 36° 31' S, 141° 58' E, *Everett 203 & Jacobs*, 30.11.1980 (NSW); Sandy Desert, *Reader*, 27.10.1895 (MEL 60775); N. side of Mt Arapiles, *Beaglehole 29857*, 27.11.1968 (NSW). **Region E:** E. bank of Glenelg River, c. 1.6 km upstream from Donovans, *Jackson 252*, 18.11.1959 (AD).

SOUTH AUSTRALIA: **Eyre Peninsula:** Warramboe, *French 11*, 10.1954 (ADW); Hincks National Park, *Alcock 2178*, 6.10.1968 (AD); Mt Wedge, *Eichler 19388*, 9.10.1967 (AD). **Murray:** Wanbi, *Cleland*, 12.10.1960 (AD 968061296). **Yorke Peninsula:** Hundred of Curramulka, *Blaylock 252*, 8.10.1966 (AD); Point Davenport, nr. 35° 12'S., 137° 24'E., *Symon 11890*, 4.11.1979 (ADW). **South-eastern:** 32 km E. of Tailem Bend, *Everett 304*, 23.9.1981 (NSW); Ki-Ki, 30 miles [48 km] SE. of Tailem Bend, *Hilton NSW 116369* (NSW); 2 miles [3 km] W. of Coombe, *Hilton*, 11.10.1953 (ADW 44077); Big Heath National Park, *Alcock 3029*, 6.11.1969 (AD); Beachport & Robe, *Crocker*, 3.1940 (ADW 4123); MacDonnell, c. 27 km S. of Mt Gambier, *Cleland*, 1.11.1941 (AD 96323318).

* *Stipa neesiana* Trin. & Rupr., Mém. Acad. Imp. Sci. Saint-Pétersbourg, ser. 6, Sci., Math., Seconde Pt. Sci. Nat. 5: 17 (1842); Hitchcock, Contrib. U.S. Natl. Herb. 24: 279 (1925); Caro, Kurtziana 3: 25 (1966); Rosengurtt, de Maffei & de Artucio, Gramineas Uruguayas: 80 (1970).

HOLOTYPE: 'Monte Video, Sellow' (LE, not seen).

SYNONYM: *S. eminens* Nees, Agrost. Bras.: 374 (1829), non Cav. (1799). For further synonymy see Hitchcock (*loc. cit.*).

Caespitose perennial to c. 0.75 metres high, with a basal tuft of leaves to half the height, without rhizomes. Culms erect or geniculate at the base, slightly angled, c. 1 mm wide near the base, \pm compressible, moderately to slightly ribbed, glabrous; nodes c. 2, exserted, sericeous with hairs (minute-) 0.3–1.2 mm long, slightly swollen, to 25% wider than the adjacent internodes. Leaf sheaths at first tightly enveloping the culm later becoming slightly free, 0.5–1 mm wide, strongly ribbed; basal sheath glabrous or minutely scabrous, margins glabrous; upper sheath with scattered hairs 0.3–0.9 mm long to glabrous, outer margin ciliate with hairs 0.3–0.4 mm long to glabrous, inner margin glabrous. Ligule sometimes almost absent on lower leaves, otherwise truncate to obtuse, membranous, 0.5–3 mm long, with tufts of hairs at the sides, glabrous elsewhere; auricles thickened, 0.5–1.3 mm long, sparsely covered with hairs 0.1–0.3 mm long to glabrous. Leaf blade expanded to loosely inrolled, 2–2.5 mm wide, to 30 cm long; abaxial surface moderately to strongly ribbed, hirsute with hairs 0.1–1 mm long to glabrous; adaxial surface strongly ribbed, with hairs minute–0.7 mm long; margins scabrous with minute tubercles and occasional hairs 0.2–0.5 mm long. Panicle 10–40 cm long, exserted, with distant fascicles of unequal, few-flowered compound or simple branches, contracted, although narrowly spreading at anthesis, 1(–7) cm wide (excluding awns); axis angled, strongly ribbed, scabrous along the edges with hairs minute–0.4 mm long; branches 2.5–8.5 cm long, angled, scabrous along the edges with hairs 0.1–0.5 mm long; pedicels 1–8 cm long, angled, scabrous along the edges with hairs minute–0.6 mm long. Spikelets 14–18 mm long, gaping. Glumes equal to subequal, acuminate, hyaline; lower glume 14–18 mm long, lower 30–55% 3-nerved, scabrous along the nerves with hairs 0.1–0.5 mm long; upper glume 10–18 mm long, lower 20–50% 5 (–3)-nerved, upper 50–80% 3–1-nerved, scabrous along the nerves with hairs 0.1–0.8 mm long. Floret 6–10 mm long (including callus), cylindrical with a neck. Lemma with one involute-margin coarsely scabrous with crystalline tubercles to c. 0.1 mm long, sericeous along the midrib of the lemma with white hairs 0.4–1.2 mm long; lobes absent; corona 1.5 mm long with spines c. 0.5 mm long on the upper margin. Callus 2.5–3.5 mm long, weakly bent at the tip, densely sericeous with white hairs 0.1–1.5 mm long. Awn 45–85 mm long, bent 2–3 times, 0.4 mm wide near the base; column 25–55 mm long, 15–30 mm to the first bend, straw coloured, scabrous to pubescent with hairs 0.1–0.5 mm long; bristle straw-coloured, scabrous with hairs c. 0.1 mm long. Palea membranous, non-vascular, similar to the lodicules, erose, oblong-acute, 20–25% the length of the lemma, glabrous and smooth. Lodicules 2, abaxial, membranous, 1–1.3 mm long, obtuse. Anthers 3–3.5 mm long, penicillate. Caryopsis 3–5 mm long; embryo 30–40% the length; hilum 80% to equal the length.

DISTRIBUTION: Introduced from S. America and now spreading in the Central Coast, Northern Tablelands and Southern Tablelands subdivisions of New South Wales, also in Victoria.

SPECIMENS EXAMINED: NEW SOUTH WALES: **Central Coast:** Mt Druitt, *Campbell* NSW 117398, 7.11.1974 (NSW). **Northern Tablelands:** Tenterfield, 29° 06' S, 152° 00' E, *Johnson* NSW 117399,

1.12.1976 (NSW); Glen Innes, *Plante NSW 117402*, 6.2.1948 (NSW). **Southern Tablelands:** Burbong, *Pullen 2485*, 20.12.1960 (CANB, NSW); Black Mountain, *Gray 6443*, 4.12.1969 (CANB, NSW, BRI); Commonwealth Gardens, Canberra, *Gray 6441*, 30.11.1969 (CANB, NSW); O'Connor, Canberra, *Gray 6442*, 2.12.1969 (CANB, NSW, BRI).

VICTORIA: Region J: "Bung Bong", Yan Yean, *Hewson*, 16.1.1961 (MEL). **Region K:** Purnim, c. 9 miles [14 km] NE. of Warrnambool, *Crook*, 3.5.1967 (MEL 59964). **Region N:** Woodstock, *Colchin*, 1.1964 (MEL); Rosanna, Melbourne, *Corrick 2914*, 28.11.1973 (Corrick Herb).

All Australian specimens seem to belong to *S. neesiana* var. *neesiana*.

***Stipa nitida* Summerhayes & Hubbard**, *Kew Bull.* 1927: 60 (1927); Black, *Fl. S. Austral.* edn 2: 87 (1943).

HOLOTYPE: SOUTH AUSTRALIA: Finnis Springs (S. of Lake Eyre), *F.D. Warren*, 25.8.1926 (K, 4 sheets!; CANB photo 237015; isotypes: AD 97422294, MEL 59959).

SYNONYM: *S. scabra* var. *pallida* Reader, *Victorian Naturalist* 17: 156 (1901). **HOLOTYPE:** VICTORIA: Desert, Lowan, *F.M. Reader*, 11.1898 (MEL).

POSSIBLE SYNONYM: *S. scabra* var. *auriculata* J. Black, *Fl. S. Austral.* 1: 67 (1922). We have not yet found a specimen that can be definitely recognized as the Type, which was cited only as 'Dry districts'. One specimen labelled as *S. scabra* var. *auriculata* in Black's handwriting, from Laura, 8.10.1916 (K!) is a specimen of *S. drummondii* Steudel (see also note under that species).

Caespitose perennial c. 0.75 metres high, without rhizomes, with a basal tuft of mainly intravaginal shoots about half the height. Culms erect or slightly geniculate at the base, terete, 1–3 mm wide near the base, \pm compressible; basal culms smooth to slightly (–moderately) ribbed, glabrous or minutely puberulous to scaberulous with hairs minute–0.2 mm; upper culms smooth and glabrous; nodes 2–3, exserted at length, glabrous, to 50% wider than the adjacent internodes. Leaf sheaths at first tightly enveloping the culm, later becoming slightly loose; basal sheath 3–9 mm wide, slightly (to moderately) ribbed, glabrous to scaberulous to pubescent with hairs minute–0.3 mm long, inner margin glabrous, outer margin glabrous to ciliate with hairs (0.1–) 0.2–0.4 mm long; upper sheath 3–5 mm wide, moderately ribbed, (glabrous–) scaberulous to puberulous with minute tubercles or hairs minute–0.2 mm long, the innovations (glabrous–) scabrous to pubescent with minute tubercles or hairs, inner margin glabrous, outer margin glabrous or ciliate with hairs (0.1–) 0.4–0.8 mm long. Ligule truncate, membranous, 0.3–1(–1.5) mm long, ciliate with hairs minute–0.2 (–0.6) mm long; abaxial surface glabrous; auricle, when present, glabrous, c. 0.5 mm long, auricular lobes 0.5–3 mm long, ciliate with hairs 0.2–2 mm long, sometimes longer on the innovations. Leaf blade expanded to inrolled, 1–2 mm wide, to 40 cm long; abaxial surface slightly to moderately ribbed, (glabrous–) scaberulous to scabrous with hairs or tubercles minute–0.1 (–0.5) mm long, the innovations sometimes hispid with hairs 0.1–0.5 mm long; margins glabrous to ciliate with hairs 0.1–0.2 mm long; collar glabrous. Panicle 25–55 cm long, \pm exserted, with distant fascicles of unequal, few-flowered, compound or simple branches, \pm contracted (although spreading at anthesis), 0.5–7 cm wide (excluding awns), axis smooth to moderately ribbed, terete to slightly angled, glabrous to minutely scabrous; branches 2–6 cm long, angled, scaberulous with hairs to 0.1 mm long; pedicels 2–10 mm long, almost flat, scaberulous with hairs to 0.1 mm long. Spikelets 8–13 mm long (excluding awn), gaping slightly. Glumes subequal, straw-coloured, acute to acuminate, 8–13 mm long, glabrous to scabrous along the midrib with hairs to 0.1 mm long; lower glume with the lower 20–30 (–40)% 3-nerved; upper glume with the lower (15–) 30 (–35)% (3–) 5-nerved, upper (65–) 70 (–85)% 3–1-nerved. Floret narrow-

cylindrical, without a neck, (4-) 5-6 mm long (including callus). Lemma smooth to slightly granular, sericeous with hairs (0.2-) 0.3-0.5 (-0.6) mm long; lobes to 0.15 mm long, glabrous to ciliate with hairs to 0.1 mm long; coma obscure, of few hairs (0.2-) 0.3-0.8 mm long. Callus 1.2-2.2 mm long, weakly bent at the tip, densely sericeous with hairs to 1.5 mm long. Awn 45-70 mm long, falcate, 0.1-0.2 mm wide near the base; column 10-13 mm long, 6-9 mm to the first bend, straw-coloured to brown at maturity, scaberulous to pubescent with hairs mainly 0.1-0.3 mm long; bristle delicate, angled, straw-coloured to brown at maturity, scabrous with hairs to 0.2 mm long. Palea c. 90% the length of the lemma, obtuse to acute, often erose, smooth to slightly granular, sericeous down the centre back with hairs 0.2-0.4 (-0.7) mm long. Anthers usually penicillate, 1-3.5 mm long. Lodicules 2, abaxial, membranous, obtuse, 0.6-1.2 mm long. Caryopsis 2.5-3.5 mm long; embryo 25-40% the length; hilum 30-80% the length.

DISTRIBUTION: Widespread on sandy soils of the drier winter rainfall areas in all mainland States.

SELECTED SPECIMENS: **NEW SOUTH WALES:** **North Western Plains:** Gundabooka, *Henderson NSW 117249*, 16.1.1948 (NSW); c. 40 km from Louth, Tilpa road, *Moore 4079*, 20.9.1966 (CANB); 121 miles [194 km] W. of Cobar towards Wilcannia, *Dunlop 1219*, 27.8.1969 (CBG). **South Western Plains:** 21 km E. of Darnick, *De Nardi 1094*, 22.10.1972 (NSW); 12 miles [19 km] N. of Ivanhoe, *Leigh NSW 117033*, 30.9.1966 (NSW); Cunninyeuk, S. of Balranald, *Henderson 181*, 12.10.1946 (NSW). **North Far Western Plains:** Broken Hill, *Johnson NSW 117029*, 29.8.1946 (NSW); 11 miles [18 km] S. of Broken Hill on Silver City Highway, *Jacobs 125*, 11.11.1971 (NSW); 60 miles [96 km] E. of Broken Hill, *Vickery NSW 117271*, 20.8.1939 (NSW); 115 miles [184 km] E. of Broken Hill, *Pidgeon & Vickery NSW 117272*, 20.8.1939 (NSW); 10 miles [16 km] E. of Silver City Highway on "Bindara" & "Middlecamp" road, *Jacobs 177*, 12.11.1971 (NSW). **South Far Western Plains:** Menindee, *Henderson 456*, 18.9.1948 (NSW); Kinchega National Park, *Ryan & Everley NSW 117259*, 2.6.1969 (NSW); 26 km NW. of Gum Lake Railway Station, c. 28 km ESE. of Menindee, *De Nardi 639*, 22.9.1971 (NSW); Harcourt, *Butler NSW 17261*, 28.8.1968 (NSW); 37 miles [59 km] from Pooncarie towards Darnick, *Dunlop 1454*, 31.6.1969 (CBG); 71 km from Pooncarie on road to Wentworth, *De Nardi 1048*, 18.10.1972 (NSW); Wilcannia road, Dareton, *Butler NSW 117260*, 18.7.1969 (NSW); 12.8 km W. of Balranald, *De Nardi 1020*, 16.10.1972 (NSW).

SOUTH AUSTRALIA: **North-western:** Ernabella Mission Station, *Turvey NSW 117239*, 20.7.1969 (NSW); 16 miles [26 km] SE. of Emu, *Forde 439*, 30.8.1956 (K ex CANB). **Lake Eyre Basin:** 'Allandale' Station, c. 20 km SE. of Oodnadatta, *Kuchel 661*, 5.8.1963 (BRI, dupl. of AD); 5 miles [8 km] N. of 'Mungeranie' Homestead, c. 190 km NNE. of Marree, *Lothian & Francis 325*, 24.8.1960 (BRI, dupl. of AD); 'Evelyn Downs', *Ising*, 16.9.1955 (ADW 19782, 19780, NSW 117022); 50 miles [80 km] S. of Coober Pedy, *Story 7837*, 8.9.1956 (CANB); N. of Irapatana, *Cleland NSW 117017*, 7.8.1931 (NSW); Wangianna, 40 km W. of Marree, *Cleland*, 4.9.1941 (AD); 'Commonwealth Hill' Station, 55 miles [88 km] W. of homestead, *Symon 3371*, 19.2.1965 (ADW). **Nullarbor:** 15 miles [24 km] N. of Maralinga, *Perry 5559*, 26.1.1956 (CANB); 15 miles [24 km] E. of Immarna, *Calaby*, 18.10.1947 (CANB 15007); Cook-Ooldea, *Hilton 1744*, 23.8.1955 (ADW); Cook, *Blake 18162*, 10.9.1947 (BRI); Hughes, *Hubbard 8369*, 26.4.1931 (K, NSW); Talloran Tank near 'Nullarbor' Station, NNW. of Fowlers Bay, *Cleland*, 17.10.1953 (ADW 44067, 44058). **Gairdner-Torrens Basin:** Wynbring, *Ising 1216*, 9.1920 (ADW, BRI, NSW); 'Purple Downs' Station, *Andrewartha*, 5.1938 (ADW 8291); 'Coondambo' Station, near Kingoonya, *Reid*, 28.8.1954 (ADW 28125, 28121); 'Wirraminna' Station, *Reid*, 28.8.1954 (ADW 28126); 10 miles [16 km] E. of Lake Hart, W. of Woomera, *Beaglehole 22713*, 24.6.1967 (NSW); 'Arkoona' Homestead, c. 18 miles [29 km] NE. of Woomera, *Gauba CBG 047568*, 22.6.1955 (CBG). **Flinders Ranges:** lower slopes of hills below Paralana Springs, *Symon 6082*, 24.8.1968 (ADW, NSW); Mt Lyndhurst, *Koch 371*, 8.1899 (K, NSW); 22 km NE. of Lyndhurst, *Sikkis 1138 & Ollerenshaw*, 26.9.1973 (CBG); c. 3 km E. of Nepabunna Mission, *Lothian 2579*, 27.9.1963 (BRI, dupl. of AD); Parachilna, *Cleland NSW 117032*, 19.8.1921 (NSW). **Eastern:** Billeroo Creek area, c. 45 km ENE. of 'Frome Downs' Homestead, *Whibley 3432*, 25.7.1971 (AD, NSW); Koonamore [60 km N. of Yunta], *Carrick 1798*, 6.10.1968 (AD, NSW); 20 km S. of Yunta, *Carrick 2111*, 7.10.1968 (AD, NSW); White Well, *Cleland*, 19.10.1954 (ADW 43886). **Eyre Peninsula:** 49 miles [78 km] from Nundroo toward 'Nullarbor' Homestead, *Canning CBG 039492*, 3.9.1968 (CBG); 'Yudnapinna' Station, *Crocker*, 10.1939 (ADW 22959); Ceduna, *Canning 2352*, 3.9.1968 (NSW dupl. of CBG); near Yardea, 50 miles [80 km] NE. of Minnipa, *Cleland*, 12.10.1954 (ADW 43889); Minnipa-Wudinna, *French 4*, 10.1954 (ADW 43711, NSW); Whyalla, *Hilton*, 10.9.1952 (ADW 43905); towards Whyalla from Port

Augusta, beyond Iron Knob turnoff, *Phillips CBG 067216*, 15.9.1973 (CBG); between Kimba & Port Augusta, *Reeve 364*, 21.8.1972 (CANB); 2 miles [3 km] N. of Cowell, *Pearce*, 2.1965 (ADW 44115). **Murray**: 'Bunyang' Station, Morgan, *Reid*, 1.4.1954 (ADW 44131); Florieton, N. of Mount Mary, *Clarke*, 26.10.1936 (ADW 19779); 22 km from Morgan towards Burra, *Phillips CBG 059904*, 2.9.1962 (CBG); Stoney Pinch Dam, 'Calperum' Station, NE. of Overland Corner, *Symon 3845*, 11.10.1965 (ADW); Loveday, *Gauba CBG 006473*, 14.12.1944 (CBG).

NORTHERN TERRITORY: 120 miles [192 km] S. of Alice Springs, *Vasek*, 17.9.1968 (CANB); Erldunda, c. 125 miles [200 km] S. of Alice Springs, *Paige*, 12.11.1968 (CANB, dupl. of NT); 8 miles [13 km] WNW. of Ayers Rock, *Lazarides 6152*, 7.9.1956 (CANB); between 'Mt Cavenagh' & 'Victory Downs' Homesteads, *Beaglehole 22771*, 27.6.1967 (NSW).

WESTERN AUSTRALIA: **Eucla**: 74 miles [118 km] E. of Rawlinna, *Goodall 2708*, 19.8.1966 (PERTH); c. 100 miles [160 km] N. of Rawlinna, *George 8475*, 12.10.1966 (PERTH); Eucla, *Phillips CBG 042585*, 1.9.1968 (CBG, BRI); 25 miles [40 km] W. of Cocklebiddy, *Main*, 29.11.1959 (PERTH). **Austin**: 11 miles [18 km] N. of Meekatharra, *Speck 1082*, 29.7.1958 (CANB, NSW); 6 miles [10 km] NW. of Mt Newman, *Severne 360978* (PERTH); 'Barnong' Station, *Humphries*, 17.9.1951 (PERTH); Leonora road, 38 km WSW. of Laverton, *Beaglehole 59801 & Errey*, 15.9.1978 (NSW); 18 miles [29 km] N. of Menzies, towards Leonora, *Phillips CBG 0417459*, 7.9.1968 (CBG, BRI); between Menzies & Comet Vale, *Blackall 4185*, 13.9.1939 (PERTH). **Carnarvon**: Hamelin Pool, *George 1484*, 1.9.1960 (PERTH). **Coolgardie**: 3 miles [5 km] E. of Coolgardie, *Phillips CBG 020680*, 13.9.1962 (CBG); Kalgoorlie, *Blake 18160*, 9.9.1947 (BRI). **Avon**: Walgoolan, *O'Leary*, 3.4.1924 (K). **Giles**: Docker Mission Road, 171 km E. of Warburton Mission, *Beaglehole 60253 & Errey*, 20.9.1978 (NSW).

S. nitida is a very variable species. The population represented by the Holotype has woolly-hairy auricles. The auricles from other populations vary from glabrous to woolly, with no detectable pattern that we could correlate with variation in other characters. There is similar variation in other vegetative characters; for example, the following specimens all have broad leaves and sheaths:

SOUTH AUSTRALIA: Ooldea, *Cleland NSW 15100*, 25.8.1922 (NSW); Upper Arkaringa Vale, *Helms*, 29.6.1891 (NSW); Government NW. expedition, *Basedow 118, 508*, 1908 (NSW). WESTERN AUSTRALIA: NW. Australia, *Crawford 368*, 1909 (NSW 151497, 151498, 151499); 5 miles [8 km] S. of Yelma, *Speck 1342*, 1.9.1958 (NSW); c. 42 km SW. of Meekatharra, *Beaglehole 49060A*, 22.8.1974 (NSW); 65 km NE. of Laverton, *Beaglehole 59963 & Errey*, 16.9.1978 (NSW); 5 km N. of Kalgoorlie, *Hoble 6*, 10.8.1973 (NSW); Gindalbie, *Noble 242*, 10.8.1973 (NSW); Lawlers, *Fitzgerald*, 7.1899 (NSW); Fraser Range, *Helms*, 12.10.1891 (NSW).

Other such groups of specimens can be separated from *S. nitida* but we have been unable to detect any reliable pattern in the variability. Clearly this large species and its many forms would be worthy of further studies.

Hughes incorrectly determined specimens of *S. nitida*, 'without precise locality, Sinclair' (CANB 117325 received from BM) and 'Mt Lyndhurst, M. Koch no. 371, 8.1899' (K) as *S. scabra* Lindl. The Koch specimen was the basis for her figures 18 and 18A. We have not seen all the other sheets she cites from South Australia and Western Australia but it seems possible that they also may be *S. nitida*.

S. nitida is host to a previously unrecorded 'Cockle' infection caused by an apparently undescribed Anguinid (tribe Anguinieae) nematode (Dr. J. Southey, pers. comm.). This infection causes the inflorescence to become dense and compact, 'Barley-like' is used on one herbarium label. The shape of the floret changes, losing the characteristics of the genus *Stipa*. The lemma is only gently curved and barely overlaps the palea margins. The awn remains more or less straight and does not twist. The pseudo-caryopsis has neither embryo nor hilum and on breaking it open the coiled desiccation-resistant larval stage of the nematode can be seen. The following specimens are examples of this infection:

VICTORIA: Wyperfeld National Park, *Beaublehole* 28523, 19.9.1968 (NSW, IMI p.p.). SOUTH AUSTRALIA: 2 miles [3 km] E. of Maralinga, *Bown* 130, 9.1956 (K, IMI, ?AD); nr. Corunna Hill, Iron Knob, *Copley* 2317, 2.10.1968 (AD, IMI).

Further specimens may exist but the changed appearance of inflorescence and spikelet may have led to their being incorrectly identified.

***Stipa nivicola* J.H. Willis**, Victorian Naturalist 73: 149 (1957); Handb. Pl. Victoria 1: 188 (1962), edn 2: 188, 435 (1970); Burbidge & Gray, Fl. Austral. Cap. Terr.: 153 (1970).

HOLOTYPE: VICTORIA: Bogong High Plains, 1650 m, grassy slopes of Middle Creek, near Rover Scout Hut, *J.H. Willis*, 2.2.1949 (MEL; isotype NSW 116164).

Caespitose perennial to c. 0.5 metres high, shortly rhizomatous with a basal tuft of leaves c. half the height. Culms erect, or decumbent, c. 1 mm wide near the base, scarcely compressible, slightly ribbed or smooth, very shortly pubescent just below the lower nodes, minutely sericeous just below the upper nodes, glabrous elsewhere. Nodes 2–3, \pm exserted, not swollen; lower nodes glabrous to rarely sericeous with hairs 0.05 mm long; upper nodes sericeous with hairs 0.05–0.15 mm long. Leaf sheaths at first tightly enveloping the culm, later becoming slightly loose; basal sheath 4–5 mm wide, moderately ribbed at the base, very slightly ribbed elsewhere, glabrous to minutely scabrous between the nerves, margins glabrous; upper sheath 3–4 mm wide, strongly ribbed, centre glabrous, edges minutely scaberulous, inner margin glabrous to ciliate with hairs c. 0.15–0.2 mm long, outer margin ciliate with hairs 0.1–0.3 mm long to glabrous. Ligule truncate, firm, 0.4–1.5 mm long, ciliate with hairs 0.05–0.5 mm long; auricles absent. Leaf blade linear, tightly rolled, 1.5–3.5 mm wide, to 20 cm long; abaxial surface smooth to very slightly ribbed, glabrous; adaxial surface strongly ribbed, densely scaberulous with minute siliceous prickles; margins scabrous with hairs to 0.05 mm long or glabrous upwards. Panicle 5–20 cm long, exserted, sparse with 8–12 spikelets, with distant fascicles of unequal few-flowered branches, contracted, 1–2.5 cm wide (excluding awns); axis terete or slightly flattened, slightly scabrous with minute tubercles or hairs 0.1–0.2 mm long; branches 3–4 cm long, angular, scabrous with hairs 0.2 mm long; pedicels 1–3 cm long, angular, scabrous along the edges with hairs 0.05–0.15 mm long. Spikelets 20–25 mm long (excluding awn), gaping. Glumes subequal, purple, with prominent straw-coloured nerves, minutely scabrous on the margins and across the tip with hairs less than 0.5 mm long to glabrous; lower glume acute to acuminate, 20–25 mm long, lower 60–80% 4-nerved, upper 40–20% 2–1-nerved; upper glume acute, 15–20 mm long, lower 35–50% 5-nerved, upper 65–50% 4–1-nerved. Floret narrow-cylindrical, 12–15 mm long (including callus), without a neck. Lemma surface scabrous with minute tubercles, sericeous with hairs 0.5–1 mm long; coma and lobes absent. Callus c. 3.5 mm long, weakly bent at the tip, densely sericeous with hairs to 0.8 mm long, white to orange at maturity. Awn 85–130 mm long, twice bent, c. 0.5 mm wide at the base; column 55–70 mm long, 45–60 mm to the first bend, straw-coloured, sparsely scabrous with hairs 0.05–0.5 mm long; bristle delicate, straw-coloured, scabrous with hairs 0.1–0.15 mm long. Palea equal to the lemma, acute, glabrous. Lodicules 2, abaxial, oblong, 1–1.7 mm long. Caryopsis 6–7.5 mm long; embryo 20% the length; hilum equal to the length.

DISTRIBUTION: Southern New South Wales and northern Victoria on the Australian Alps and Bimberi Range.

SELECTED SPECIMENS: NEW SOUTH WALES: **Southern Tablelands:** Brindabella Range, 1.3 km ENE. of Mt Ginini, *Crisp 2454*, 28.1.1977 (CBG); Ginini Flats, *Solling NSW 116183*, 24.3.1972 (NSW); Snowy Flat, nr. Mt. Gingera, Bimberi Range, *Pullen 3833*, 27.2.1963 (CANB, NSW, BRI); Mt Gingera, *Gray 6009*, 10.2.1967 (CANB, BRI, MEL); plain N. of Kiandra, *Gauba CBG 006095*, (CBG, AD); 2 miles [3 km] W. of Kiandra, *Burbidge 3907*, 22.2.1955 (CANB); Kiandra, *Newman NSW 116155*, 8.2.1954 (NSW); S. of Kiandra, *Gauba CBG 003942*, 16.1.1950 (CBG, MEL, BRI); ridge above Happy Jacks township, *Vickery NSW 42740*, 20.1.1958 (NSW); McKeahnies Creek catchment, *Phillips CBG 008884*, 28.1.1965 (CBG); 8 km SSE. of Mt Selwyn, *Everett 465*, 3.1.1984 (NSW); Upper Tumut Catchment, nr. Doubtful River, *Newman NSW 116163*, 26.3.1954 (NSW); Perisher Creek, *Johnson NSW 18686*, 23.1.1951 (NSW); Kydra Peaks, *Willis NSW 116705*, 11.1.1970 (NSW, dupl. of MEL 501959); Mt Kosciusko, *Mueller NSW 116156*, 25.3.1953 (NSW); Doubtful River, *Mueller NSW 116160*, 23.2.1953 (NSW); Monaro, *Taylor NSW 116161*, 13.2.1953 (NSW).

VICTORIA: **Region R:** Mt Buffalo, *Willis*, 18.2.1963 (MEL). **Region S:** Snowy Range, Airstrip Plain, *Beaglehole 40974*, 5.1.1973 (NSW); Snowy Range, Buyee Plain, *Beaglehole 40872 & Chesterfield*, 31.12.1972 (NSW); Big Plain, NW. of Mt Wellington, *Willis NSW 116702*, 12.3.1966 (NSW, dupl. of MEL 503312). **Region V:** Buckety Plain, Bogong High Plains, *Beaglehole NSW 116169*, 28.1.1966 (NSW). **Region W:** Brumby Point, Nunniong Plateau, *Beaglehole 36537 & Finck*, 21.1.1971 (NSW).

Neither open florets nor exerted anthers have been observed amongst the material examined but anthers have been observed to be shedding pollen while totally enclosed by the lemma; it appears that the spikelets are normally cleistogamous.

Stipa nodosa S.T. Blake, Proc. Roy. Soc. Queensland 62: 89 (1952); Black, Fl. S. Austral., rev. Jessop, edn 3, 1: 108 (1978).

HOLOTYPE: SOUTH AUSTRALIA: Flinders Ranges in Parachilna Gorge, between Blinman and Parachilna Spring, S.T. Blake 16914, 1.9.1946 (BRI 008016, 008017; isotype AD).

SYNONYMS: *S. effusa* Hughes, Kew Bull. 1922: 20 (1922), non Mez (1921); Black, Trans. & Proc. Roy. Soc. S. Austral. 63: 241 (1939). HOLOTYPE: NEW SOUTH WALES: Lachlan River, *Mueller*, Sept. 1878 (US 993696!; isotype K, also CANB photo 237023). The specimen at Kew consists of a pencil habit-drawing of a portion of the plant in the U.S. National Herbarium, which was lent to Kew in 1921, together with a packet containing a few spikelets and florets. The specimen at US is in good condition and bears the name '*Stipa effusa* Hughes' in Hughes' own handwriting.

S. falcata var. *minor* J. Black in Trans. & Roy. Soc. S. Austral. 65: 334 (1941); Fl. S. Austral. edn 2: 87 (1943). LECTOTYPE, here designated: Wilpena Pound, J.B. Cleland s.n., 10.11.1928 (AD 97424083). Black cited 'Flinders Range' without specifying any particular location. In his herbarium at AD there are several presumed syntypes from the Flinders Ranges on which he has written the name. They are all specimens of *S. nodosa* Blake. Presumed syntypes include specimens mounted on the sheets AD 97424083, 97424085, 9742084, 97424087, 97424086, 97424082.

[MISAPPLIED NAME: A specimen of *S. nodosa* from Ardlethan [New South Wales], R.H. Cambage NSW 117120, 1.10.1916 (NSW), formed the basis of the illustration over the caption '*Stipa scabra*' in Breakwell, Grasses and Fodder Plants of N.S.W.: 226, fig. 111 (1923).]

Caespitose perennial 0.5–1 metre high, without rhizomes, with a basal tuft of mainly extravaginal shoots about a third the height, and numerous culm leaves. Culms erect or slightly geniculate at the base, terete, 1–2 mm wide near the base, not compressible, slightly to moderately ribbed, glabrous or scabrous with minute tubercles; nodes 3–5(–8), ± exerted, glabrous but sometimes with a band of sericeous hairs just below the node, c. 50% wider than the adjacent internodes. Leaf sheaths at first tightly enveloping the culm, later becoming loose; basal sheath 4.5–7 mm wide, slightly to moderately ribbed, glabrous to scaberulous with minute hairs or tubercles or, on the innovations minutely pubescent; inner margin glabrous; outer margin glabrous to sparsely ciliate with hairs 0.1–0.4 mm long, to 0.6 mm on the innovations; upper sheath 3–4.5 mm

wide, moderately to strongly ribbed, scaberulous with minute tubercles to glabrous, inner margin glabrous, outer margin ciliate with hairs (0.1–) 0.4–0.8 mm long or glabrous. Ligule truncate, membranous, 0.5–2 mm long, glabrous to sparsely ciliate, abaxial surface glabrous; auricles usually thickened and spreading, 0.7–1 mm long, ciliate at the base with hairs (0.5–) 1–2 mm long. Leaf blade expanded to inrolled, 1–3 mm wide, to 30 cm long; abaxial surface moderately to strongly ribbed, scaberulous with minute tubercles or hairs; adaxial surface strongly ribbed, pubescent, scaberulous or puberulous with hairs to 0.2 (–0.5) mm long; collar glabrous, margins glabrous or sparsely ciliate with hairs to 0.5 mm long. Panicle 15–50 cm long, exserted, with distant fascicles of unequal, few-flowered, compound branches, open or occasionally contracted, 1–7 cm wide (excluding awns); axis terete to slightly angled, glabrous to scabrous or scaberulous with minute hairs or tubercles; branches 1–8 cm long, slightly angled to flattened, scabrous to scaberulous along the edges; pedicels 2–15 mm long, flattened, scabrous along the edges. Spikelets 10–15 mm long (excluding awn), gaping after floret disarticulation, otherwise tightly closed. Glumes subequal to unequal, acute to acuminate, transparent, straw-coloured or purple-tinged; lower glume 10–15 mm long, glabrous to minutely scabrous, hairs sometimes longer along the midrib, lower 25 (–35)% 3-nerved; upper glume 7–14 mm long, minutely scaberulous to glabrous, lower (15–) 20 (–40)% 5-nerved, upper (60–) 80 (–85)% 3–1-nerved. Floret narrow-cylindrical without a neck, 4–7 mm long (including callus). Lemma surface slightly granular to smooth, sericeous with hairs 0.3–0.6 mm long; lobes absent or 2, 0.1–0.4 mm long, glabrous; coma obscure, of few hairs 0.4–1 mm long. Callus 1–3.5 mm long, sturdy, weakly bent at the tip, densely sericeous with white hairs to 0.8 mm long. Awn 45–100 mm long, falcate, c. 0.3 mm wide near the base; column 7–15 mm long, 5–10 mm to the end of the straight portion, straw-coloured to brown, scaberulous to scabrous with stiff hairs to 0.3 (–0.4) mm long; bristle scabrous with hairs to 0.2 mm long. Palea ± equal to the lemma, acute to obtuse, smooth to slightly granular down the centre, sericeous down the centre back. Lodicules 3; 2 abaxial membranous, 1–2 mm long, oblong; paleal c. 0.7 mm long, acute. Anthers penicillate, 2–3 mm long. Caryopsis (2–) 3–4 mm long; embryo 20–30% the length; hilum 50–80% the length.

DISTRIBUTION: Widespread in all southern mainland States including New South Wales.

SELECTED SPECIMENS: QUEENSLAND: **Darling Downs:** roadside at Wallangarra, Qld. border, *Hilton*, 4.2.1945 (ADW 4404).

NEW SOUTH WALES: **Southern Tablelands:** Charnwood, c. 15 km NW. of Canberra, *Crisp* 2294, 31.10.1976 (CBG, NSW); Acton, Canberra, *Beeton* CBG 064049, 23.11.1970 (CBG); Kambah Pool, *Boden* CBG 041941, 1.1969 (CBG); Molonglo & Murrumbidgee Rivers, *Gauba* CBG 057374, 8.12.1954 (CBG); Bredbo, *Murray* NSW 117138, 12.1913 (NSW); Eucumbene, *Phillips* CBG 018931, 27.1.1965 (CBG); Cooma, *Vickery* NSW 117139, 2.1930 (NSW); 13 miles [21 km] from Maffra towards Ando, *Carrol* CBG 024816, 5.12.1965 (CBG); Bibbenluke district, *Cleland* NSW 117140, 5.1913 (NSW). **South Western Slopes:** Grong Grong, *Johnson* NSW 117145, 25.5.1947 (NSW); 7 miles [11 km] N. of Wagga Wagga, *Phillips* CBG 025458, 20.10.1965 (CBG); 4 miles [6 km] E. of Henty, *Flynn* 62, 6.11.1970 (NSW); Comer Reserve, 6 miles [10 km] SW. of Henty, *McBarron* 5623, 25.10.1951 (NSW); Walbundrie, *McBarron* 3193, 29.3.1949 (NSW); Walla Walla, *McBarron* 5563, 4.10.1951 (NSW); Burrumbuttock, *McBarron* 2738, 3.12.1948 (NSW); Balldale, *McBarron* 4791, 25.8.1950 (NSW); Jindera, *McBarron* 2652, 24.11.1948 (NSW); Wymah, *McBarron* 5770, 29.11.1951 (NSW); Albury, *McBarron* 2633, 21.11.1948 (NSW).

SOUTH AUSTRALIA: **Lake Eyre Basin:** Wintinna Creek, 18 miles [29 km] N. of Mt Willoughby, *Beaglehole* 20201, 7.10.1966 (NSW); Mt Livingston, *Langley* NSW 116663, 10.1897 (NSW, K). **Gairdner-Torrens Basin:** 'Oakden Hills' Station, *Gill* NSW 117117, 2.1904 (NSW). **Flinders Ranges:** c. 1 km N. of Nuclamutana Well, *Whibley* 2167, 26.10.1967 (AD, NSW); nr. Blinman, *Blake* 16900, 31.8.1946 (BRI); Oraparinna National Park, *Symon* 7579, 9.10.1971 (ADW, CANB); Wilpena to Bunyerroo, *Blackburn*, 3.10.1954 (ADW 44154); Wilpena Pound, *Cleland*, 10.11.1928 (AD); *Crisp*

917, 22.10.1974 (CBG); 22 miles [35 km] S. of Hawker, *Hilton*, 8.4.1955 (ADW 44086); 'Portacoona' Station Homestead, c. 18 miles [29 km] SW. of Hawker, *Tindale NSW 117072*, 24.8.1969 (NSW); Boolcunda East, *Hilton NSW 116662*, 1.10.1954 (ADW, NSW); Pichi Richi Pass, *Blake 16863*, 29.8.1946 (BRI); Quorn, *Crocker*, 18.9.1939 (ADW 4594); 10 miles [16 km] N. of Carrieton, *Hilton*, 1.10.1954 (ADW 44146); Horrocks Pass, *Hilton*, 12.1951 (ADW 44046); 16 km W. of Peterborough, *Crisp 589*, 9.9.1963 (CBG). **Eastern:** 'Bibliando' Station, c. 50 km E. of Hawker, *Crisp 888*, 19.10.1974 (BRI, CBG, NSW); Koonamore, *Crisp 594*, 15.9.1973 (CBG); Yunta to Koonamore, *Symon 19.12.1954* (ADW 28117); Winnininnie, near Manahill, *Reid*, 5.10.1954 (ADW 44160); 6 km NE. of Oodlawirra, *Lothian 1170*, 4.11.1962 (AD, NSW). **Eyre Peninsula:** Gawler Ranges nr. Waltinga Dam, *Symon 8176*, 5.10.1972 (ADW); 10 miles [15 km] N. of 'Nonning' Station, *Specht & Carrodus 27*, 14.11.1958 (AD); S. of Mt Gairdner, c. 55 km WNW. of Nonning, *Carrick 2382*, 29.9.1969 (BRI); Port Germein Gorge, *Burbidge*, 29.8.1946 (CANB 19551); Cleland, 20.10.1953 (ADW 44060); Port Germein, *Hilton*, 12.9.1951 (ADW 43990); Colton, *Crocker*, 11.10.1944 (CANB 11637); Cowell Flats, *French*, 12.1954 (ADW 28154); Mittalie, c. 10 miles [13 km] NW. of Cowell, *Pearce*, 28.1.1965 (ADW 44119); Cleve [as Cleeve], *Phillips 458*, 20.9.1965 (CBG); Port Lincoln, *Black NSW 117112, 117113*, 11.1903 (NSW). **Northern Lofty:** Port Pirie, *Koch NSW 116660*, 9.1901 (NSW); Deep Creek, 5 miles [8 km] E. of Burra, *Hilton*, 24.8.1946 (ADW 43928); 6 miles [10 km] N. of Bute on Wokurna road, *Tindale 408*, 10.9.1970 (NSW); Mortlock Experimental Station near Mintaro, *Symon 4447*, 9.11.1966 (ADW, CANB); 8 miles [13 km] S. of Port Wakefield at Inkerman, *Phillips CBG 043562*, 2.10.1965 (CBG); Oakley Hill, Owen, *Beck*, 2.1942 (ADW 4694); 2 miles [3 km] SW. of Mallala, *Moore*, 10.10.1969 (CANB 249734). **Murray:** Morgan, *Steward*, 16.10.1965 (ADW 37510); Black Hill, 18 miles [29 km] SE. of 'Sedan', *Hilton NSW 117076*, 22.9.1951 (ADW, NSW); 1 mile [1.6 km] E. of Kanmantoo, *Hilton*, 18.3.1954 (ADW 44053). **Yorke Peninsula:** Kadina, *Beck*, 2.1942 (ADW 4696); Melton, *Reid NSW 117075*, 30.9.1954 (ADW, NSW); Winulla Road, Arthurton, *Beck*, 2.1942 (ADW 4704); 1 mile [1.6 km] N. of Arthurton, *Phillips CBG 037669*, 17.10.1966 (CBG). **Southern Lofty:** Reeves Plain, *Beck*, 2.1942 (ADW 4701); Highbury, *Kraehenbuehl 822*, 22.10.1962 (BRI); Lockleys, c. 6 km W. of Adelaide, *Smith 1061*, 8.12.1967 (AD); 6 miles [10 km] SE. of Nairne, *Hilton*, 20.11.1953 (ADW 44037); Waterfall Gully, Adelaide Hills, *Hilton*, 12.10.1944 (ADW 37510); Belair Road, Adelaide Hills, *Hilton*, 13.10.1945 (ADW 43897); Plympton, *Hilton*, 5.9.1946 (ADW 43983); Torrens Gorge, *Hilton*, 8.10.1946 (ADW 44159); South Parklands, King William Road, Adelaide, *Cleland*, 25.10.1955 (ADW 13280); Brown Hill Creek, Adelaide Hills, *Hilton*, 13.10.1945 (ADW 43985); Forest Lodge, Verdun, 3 miles [5 km] SW. of Balhanna, *Hilton NSW 117073*, 5.12.1953 (ADW, NSW); N. of Willunga, *Hilton*, 20.10.1946 (ADW 43993); nr. Waterfall Creek, head of Yankalilla, *Hilton*, 25.11.1953 (ADW 44123). **South-eastern:** Devils Elbow, Mt Barker Road, E. of Glen Osmond, *Hilton* 8.10.1946 (ADW 44174).

***Stipa nullarborensis* J. Vickery, S.W.L. Jacobs & J. Everett, sp. nov.**

S. breviglumi affinis sed palea longitudine 4/5 lemmatis partes aequantia (*breviglumi*: 1/2–3/5), callo pungenti, lemmatibus usque ad apicem pilis relatis, collo lemmatis nullo, differt.

HOLOTYPE: WESTERN AUSTRALIA: Abrakurrie Cave, 18 miles [29 km] NW. of Eucla. Open depression near entrance to cave. *A.C. Beaglehole 13395*, 23.9.1965 (NSW; isotypes CANB, PERTH).

Perennial to c. 1 metre tall, with a short rhizome and usually with few basal leaves. Culms branched or simple, terete, 1(–3) mm wide near the base, not compressible, glabrous to scaberulous or scabrous, especially just below the nodes; nodes 4–5, glabrous, exserted. Leaf sheaths 5(–8) mm wide, loose, glabrous to pubescent, smooth to scaberulous or scabrous, upper sheaths generally less hairy; margins similar to adjacent surfaces. Ligule truncate, papery, easily torn, 2–3 mm long, glabrous; auricle glabrous. Leaf blade usually expanded, 2–5 mm wide, to 25 cm long; abaxial surface scaberulous, scabrous to sparsely pubescent; adaxial surface scabrous and/or sparsely pubescent; margins glabrous or with antrorsely hooked tubercles. Panicle to 30 cm long, to 3 cm wide (excluding awns), exserted, contracted, with distant fascicles of sparsely to densely flowered unequal compound branches; axis slightly angular, glabrous or scabrous; branches angular, 2–8 cm long, scabrous or pubescent; pedicels

flattened, 1–7 mm long, scabrous or pubescent. Spikelets gaping, 4–5.5 mm long (excluding awn). Glumes equal, obtuse to broad-acute, often purple-tinged, with stiff appressed hairs; tips ciliate, easily torn; lower glume 4–5.5 mm long, lower 50% 3-nerved; upper glume 4–5.5 mm long, lower 50% 5-nerved, the next 35% 3-nerved. Floret narrow-fusiform, 3–4 mm long (including callus), not tapering apically to a discernible neck. Lemma slightly granular, brown at maturity, with soft, spreading, white hairs right to and slightly overlapping the base of the awn; coma absent; lobes 2, c. 0.1 mm long, or absent. Callus sharp and strongly curved, 0.5–0.8 mm long, similarly hairy to the lemma. Awn c. 0.15 mm wide near the base, (14–) 20–30 mm long, slightly twice bent; column (6–) 9–13 mm long, (3–) 5–8 mm to the first and less-developed bend, light brown, scaberulous with hairs to 0.1 mm long; bristle scaberulous, often purple-tinged and darker than the column. Palea broad-acute, ciliate, 80% the length of the lemma with similar surface and indumentum. Lodicules 2–3, membranous; 2 abaxial, 0.7–0.9 mm long, obtuse; paleal acute, 0.3 mm long, or absent. Anthers 1.5–1.7 mm long, lightly penicillate. Mature caryopsis not seen, apparently 2 mm long.

DISTRIBUTION: Nullarbor Plain in Western Australia.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: **Eucla:** Abrakurrie Cave, 18 miles [29 km] NW. of Eucla, *Beaglehole* 13395, 23.9.1965 (CANB, NSW, PERTH); 'Madura' Homestead, *Willis*, 30.8.1947 (BRI 229382, MEL 59887); 3.5 miles [5.5 km] E. of Eucla, *George* 8512, 15.10.1966 (PERTH, 2 sheets); c. 1 km N. of Eucla, Nullarbor Plain, *Beaglehole* 49443, 30.8.1974 (CANB, NSW).

The specific epithet refers to the Nullarbor Plain where this species occurs.

Similar to *S. breviglumis* but differing in the longer palea (relative to the lemma), the sharp callus, the hairs of the lemma continued to its apex and the absence of a neck to the lemma. Differs from *S. acrociliata* in the smaller spikelet and in the equal glumes.

***Stipa nullanulla* J. Everett & S.W.L. Jacobs, *Telopea* 2(4): 398 (1983).**

HOLOTYPE: NEW SOUTH WALES: 'Nulla Nulla', 2 km south of gate at northern end of Bluff paddock. Saltbush, mallee, *Myoporum* sp. *Everett* 133 & *Jacobs*, 25.11.1980 (NSW; isotype AD).

Small caespitose perennial 0.4–0.5 metres high with a loosely contracted rootstock. Culms erect, 1–2 mm wide near the base, terete, smooth, mostly glabrous but pubescent just below the nodes; nodes 2, glabrous, rarely exserted. Leaf sheaths broad, loose around the culm, glabrous or the lower sheaths scaberulous to pubescent between the nerves; outer margin densely woolly especially on lower sheaths; inner margin sparsely woolly. Ligule 1–5 (–10) mm long, membranous, lacinate, with woolly cilia to 9 mm long on tips and back. Leaf blades linear, usually rolled, rigid, to 30 cm long and 2–3 mm wide; abaxial surface unribbed, very finely scaberulous; adaxial surface strongly ribbed, the ribs covered with short hairs; margins strongly scabrous. Panicle 13–19 cm long, delicate and spreading, axis very sparsely scabrous with distant fascicles of unequal compound branches; branches 4–60 cm long, scabrous, scaberulous or shortly pubescent; pedicels similar to the branches, 3–15 mm long. Spikelets narrowly gaping at maturity, widely gaping after floret disarticulation, 9–11 mm long (excluding awn). Glumes subequal, green at the base, chartaceous at the tip, 3 nerves visible for much of the length, acute to shortly acuminate; lower glume 9–11 mm long, the lower 75% 3-nerved; upper glume 8–10 mm long, the lower 25% 5-nerved, the next 50% 3-nerved. Floret cylindrical to narrow-

fusiform, 5–6 mm long (including callus). Lemma at maturity tightly convolute, smooth with an antrorsely scabrous neck, glabrous to very sparsely scattered with slightly spreading yellow hairs, dark brown with the 5 nerves pale yellow; coma sparse, 1–1.5 mm long in 2 tufts; lobes absent. Callus straight, 2.0–2.7 mm long, sericeous with yellow-brown hairs. Awn 0.25 mm wide near the base, 50–70 mm long, gently twice bent; column 18–25 mm long, 10–15 mm to the first bend, shortly pubescent with hairs to 0.2 mm long; bristle scabrous. Palea acute to obtuse, subequal to the lemma, glabrous or with a sparse apical tuft. Lodicules 3, membranous, oblong; 2 abaxial c. 1 mm long; paleal minute or rarely equal in size to the palea and then similar in texture to the palea. Caryopsis 2.7–3.0 mm long; embryo 25–35% the length; hilum 65–75% the length.

DISTRIBUTION: South Far Western Plains of New South Wales and west into South Australia.

SPECIMENS EXAMINED: NEW SOUTH WALES: **South Far Western Plains**; 'Nulla Nulla' unit 37, *Stanley 1784*, 3.12.1975 (NSW).

SOUTH AUSTRALIA: **Murray**: c. 32 miles [50 km] N. of Overland Corner, *Symon 3728* (ADW).

Apparently restricted to gypseous rises. Palatable to sheep and rabbits and now confined to the shelter of shrubs and similar protected places.

***Stipa oligostachya* Hughes**, Kew Bull. 1921: 12 (1921).

HOLOTYPE: VICTORIA: Wando Vale [as Wendu Vale], growing in tussocks, *Robertson 534* (K!).

Caespitose perennial to 1 metre high with conspicuously extravaginal shoots and a short rhizome. Culms erect, 1 (–) mm wide near the base, not compressible, scarcely ribbed, glabrous, scaberulous or puberulous, pubescent just below the nodes; nodes c. 3, just exerted or concealed, sericeous, to 25% wider than adjacent internodes. Leaf sheaths tightly enveloping the culms, 2 (–4) mm wide, ribbed, glabrous; basal sheaths lanate; outer margin shortly ciliate, densely ciliate near the orifice. Ligule ovate to truncate, coriaceous, 0.5–2 mm long, often continuous with the sheath margin, ciliate with long hairs, sericeous on the back; auricles thickened and spreading, with short hairs that usually continue as a line around the collar. Leaf blades usually tightly rolled, erect, to 20 cm long, 0.5–1.0 mm wide; abaxial surface unribbed or slightly ribbed, glabrous to minutely scaberulous, occasionally with widely scattered hairs; adaxial surface ribbed, minutely puberulous to hirsute. Panicle 10–25 cm long, exerted with distant fascicles of unequal few-flowered compound branches, spreading, 2–4 cm wide (excluding awns); axis terete, scaberulous to scabrous upwards; branches to 6 cm long, angled to flattened upwards, scabrous on the edges; pedicels 3–12 mm long, angled to flattened upwards, scabrous on the edges. Spikelets 11–17 mm long (excluding awn), gaping. Glumes slightly unequal, broad and slightly inflated at the middle (at least the lower), acuminate or acute, firm and purple-tinged at the base, hyaline at the tip, glabrous, or scaberulous towards the margins; lower glume 11–17 mm long, lower 50% 3-nerved; upper glume 10–15 mm long, lower 30% 5-nerved, next 20% 3-nerved. Floret 7–9 mm long (including callus), fusiform to cylindrical, with a well-defined neck, deep reddish brown at maturity, the surface glistening with translucent antrorsely hooked tubercles, the midrib thickened, glabrous on the upper half, but with sparse, stiff, spreading yellow hairs over the nerves and on the lower half; coma absent; lobes 1–2, 0.1–0.35 (–0.6) mm long. Callus sturdy, straight, 2–3 mm long, sericeous with hairs darker than the lemma. Awn 55–70 mm long, twice bent, 0.3–0.5 mm wide near the base; column 18–25 mm

long, 9–12 mm to the first and stronger bend, pubescent with hairs 0.25–0.4 (–0.8) mm long; bristle scabrous, very slightly curved. Palea \pm equal to the lemma, acute, coriaceous, hyaline on the edges, granular down the centre, glabrous or with sparse hairs down the centre and at the tip. Lodicules 3, membranous; 2 abaxial oblong to narrow-cuneate, 1.5–1.8 mm long; paleal oblong to triangular, 0.8–1.0 mm long. Anthers 2.5 mm long, penicillate. Mature caryopsis not observed, apparently 3–4 mm long.

DISTRIBUTION: South-western Victoria and the Southern Lofty Region of South Australia.

SPECIMENS EXAMINED: VICTORIA: **Region C:** Mt Arapiles, *Corrick 1407*, 24.11.1968 (NSW), *Beaglehole 7448*, 23.11.1964 (NSW). **Region D:** Northern end, E. of Dundas Range, *Beaglehole 29934*, 5.12.1968 (NSW, MEL); nr. Hamilton, *Corrick 1552*, 8.12.1968 (Corrick herb.). **Region J:** Creswick, c. 4 miles [6 km] NW. of township, *Willis*, late Nov. 1930 (MEL 59926); Cockajemmy Lakes, *Beaglehole 61605*, 17.11.1978 (NSW); Narrapumelap, *Beaglehole 61632* (NSW).

SOUTH AUSTRALIA: **Southern Lofty:** Belair, *Cleland*, 26.11.1932 (AD 97421208); Mt Barker, *Liebelt*, 1936 (AD 97420218); Myponga, *Hilton*, 10.10.1946 (ADW 44013); Callawonga Creek, *Hilton*, 25.11.1953 (ADW 44121, 44125, 44128).

Stipa petraea J. Vickery, *Telopea* 2: 15 (1980).

HOLOTYPE: SOUTH AUSTRALIA: **Flinders Ranges:** Brachina Gorge, Oraparinna National Park, western portion, *J.Z. Weber 2577*, 18.9.1971 (AD).

Caespitose perennial 0.5–1 metre high, shortly rhizomatous with a basal tuft to c. 60% the height. Culms erect, terete, 1.5–2 mm wide near the base, \pm compressible, slightly ribbed, glabrous; nodes 3–5, exserted with age, sericeous with hairs 0.2–0.5 mm long, 25–75% wider than the adjacent internodes. Leaf sheaths not inflated, slightly ribbed, glabrous; basal sheath c. 10 mm wide; upper sheath c. 5 mm wide; margins glabrous; collar glabrous. Ligule truncate, 0.1–1 mm long, membranous, densely ciliate with hairs 0.5–2 mm long; auricle absent. Leaf blade weakly rolled to folded, c. 1.5 mm wide, to 50 cm long; abaxial surface moderately ribbed, glabrous but strongly ribbed on the innovations with minute tubercles in the grooves; adaxial surface strongly ribbed, pubescent at the base with hairs 0.1–0.5 mm long, minutely scaberulous upwards. Panicle c. 25 cm long with distant fascicles of few-flowered branches (only immature specimens seen); axis slightly flattened with sparse hairs 0.05–0.1 mm long along the edges; branches 3–7 cm long, angled, scabrous along the edges with hairs 0.1–0.2 mm long; pedicels 1–2.5 cm long, angled, scabrous with hairs 0.1–0.3 mm long. Spikelets 11–15 mm long (excluding awn), gaping at maturity. Glumes equal to unequal, acute to acuminate, minutely scabrous; lower glume 11–15 mm long, lower 20–40% (4–) 6-nerved, upper 60–80% 5–1-nerved; upper glume 11–13 mm long, lower (25–) 35–50% 5 (–6)-nerved, upper 50–65 (–75)% (5–) 3–1-nerved. Floret fusiform, 7–9.5 mm long (including callus), without a neck. Lemma surface smooth to granular, densely sericeous with orange hairs 0.5–1.5 mm long; lobes 2, 1.5–2.5 mm long, acute, sericeous; coma to 2.5 mm long. Callus 1–1.5 mm long, weakly bent at the tip, densely sericeous with orange hairs 0.3–0.8 mm long. Awn 40–55 mm long, twice bent, 0.3 mm wide near the base; column 20–25 mm long, 10–15 mm to the first bend, straw-coloured, scabrous with hairs to 0.3 mm long; bristle straw-coloured, scabrous with hairs to 0.1 mm long. Palea equal to the lemma, bilobed, slightly depressed between the nerves, granular to smooth, densely sericeous with orange hairs 1–1.5 mm long, margins glabrous. Lodicules 3; 2 abaxial membranous, 1–1.3 mm long, obtuse; paleal membranous, 1–1.2 mm long, acute. Anthers 4.5–5 mm long, penicillate. Caryopsis not seen.

DISTRIBUTION: Apparently endemic to the Flinders Ranges and the Eastern Region close to the Ranges in South Australia.

SPECIMENS EXAMINED: SOUTH AUSTRALIA: **Eastern:** Mt Chambers Gorge, *Filson* 3476, 7.10.1960 (MEL). **Flinders Ranges:** Oratunga Ck., NNW. of Blinman, *Ising*, 1.10.1918 (AD); Oraparinna National Park, Brachina Gorge, *Symon* 2558, 8.10.1971 (ADW, CANB); Bunyeroo Gorge, *Everett* 262, 263, 16.9.1981 (NSW); Horrocks Pass, *Hilton*, 12.9.1951 (ADW 44045, 44044).

Very similar to *S. juncifolia* but differs in the slightly less rigid leaves; the shorter plants; the shorter, obtuse, densely ciliate ligule; the axis, branches and pedicels scabrous, the glumes lightly scabrous on the nerves; the rather longer and rather more broadly fusiform lemma covered with hairs that become distinctly orange.

***Stipa pilata* S.W.L. Jacobs & J. Everett, sp. nov.**

Differt a *S. trichophylla* foliis latioribus pungentibusque, arista et gluma inferiore brevior.

HOLOTYPE: SOUTH AUSTRALIA: **Murray:** Monarto City Centre site, Lake site area, growing under mallee, *D.E. Symon* 9072, 26.11.1974 (NSW; isotype ADW).

Caespitose perennial to 0.85 metres high with a sparse basal tuft of extravaginal shoots. Culms erect, scarcely compressible, terete, 0.8–1 mm wide near the base, smooth to slightly ribbed, densely pubescent to pilose just below the nodes; nodes 2–3, exserted, to 30% broader than adjacent internodes, pubescent to almost glabrous. Leaf sheaths tightly enveloping the culms, 2–4 mm wide; lowermost sheaths densely pubescent with long and short hairs with upper sheaths pubescent, finely scabrous or glabrous; inner margin glabrous; outer margin long-ciliate. Ligule 1–2 mm long, truncate or shortly lacinate, membranous, ciliate, densely pubescent on the back, auricles thickened and pilose with a tuft of long straight hairs 1–2 mm long. Leaf blades to 12 cm long, erect, pungent or almost so, tightly inrolled, coarse, 0.8–2 mm diameter; abaxial surface scarcely ribbed, densely scabrous with short stiff hairs and occasionally with longer stiff hairs; adaxial surface ribbed, densely pubescent with short hairs. Panicle to 20 cm long, exserted, contracted, 2–3 cm wide (excluding awns), moderately dense with close fascicles of few, many-flowered branches; axis terete, minutely scabrous to almost glabrous; pedicels to 8 mm long, very slender, flattened, scabrous to almost glabrous. Spikelets 8–10 mm long (excluding awn), slightly gaping after floret disarticulation. Glumes subequal, acuminate, yellow-cream, transparent and membranous; lower glume 8–10 mm long, the lower 30% 3-nerved; upper glume 7–9 mm long, the lower 30% 5-nerved, the next 20% 3-nerved. Floret linear to fusiform, 4–5 mm long (including callus). Lemma finely tuberculate, gold-brown at maturity, the nerves slightly paler, with white, erect hairs, sparse especially at the apex; coma in 2 tufts c. 1 mm long, although obscured by hairs on the awn; lobes absent. Callus 1–1.5 mm long, straight and fine, with dense white hairs. Awn 40–50 mm long, 0.2–0.25 mm wide near the base, falcate; column 7–11 mm long, densely pubescent with spreading hairs 0.2–0.5 mm long; bristle scaberulous. Palea c. 0.5 mm shorter than the lemma, obtuse, coriaceous down the centre with a line of white hairs; margins and tip hyaline and glabrous. Lodicules 2, abaxial, membranous, 1–1.5 mm long, slightly spatulate. Anthers not reliably observed. Caryopsis 2.7–3 mm long; embryo c. 30% the length; hilum c. 60% the length.

DISTRIBUTION: Flinders Ranges, Northern Lofty and Murray Regions of South Australia.

SPECIMENS EXAMINED: SOUTH AUSTRALIA: **Flinders Ranges:** 2 miles [3 km] E. of Parachilna, *Beaglehole* 20903 *p.p.*, 18.10.1966 (NSW); Brachina Gorge, *Symon* 7569, 8.10.1971 (NSW, dupl. of ADW 47740). **Northern Lofty:** Bundaleer Hills, *Black*, 3.11.1925 (AD 97422275). **Murray:** Monarto, *Symon* 9077, 26.11.1974 (NSW, ADW).

The specific epithet refers to the long hairs present on the leaves and awns.

Differs from other *Stipa* species with falcate awns in the pungent leaves. Differs from *S. trichophylla* in the broader, pungent leaves and in the shorter awn and lower glume.

***Stipa platychaeta* Hughes**, *Kew Bull.* 1921: 16 (1921), *ibid.* 1922: 17 (1922); *Black*, *Fl. S. Austral.* edn 2: 89 (1943); *Gardner*, *Fl. W. Austral.* 1, *Gram.*: 177–8 (1952); *Willis*, *Handb. Pl. Victoria* 1: 183 (1962), edn 2: 183 (1970).

HOLOTYPE: WESTERN AUSTRALIA: Lake Cowcowing, *Koch* 1133 *p.p.* (K!). The specimen at K is undated. There are two specimens at PERTH dated 9.1904, and two specimens at NSW bearing the same number but dated respectively 9.1904 and 10.1904 (NSW 116298, 116299) both having been separated from collections of *S. elegantissima* bearing the same number. All specimens match the Holotype at K but they cannot all be duplicates of the Type.

[*S. acrociliata* var. *minor* Reader, *Victorian Naturalist* 23: 25 (1906), *nomen nudum*. A specimen (MEL 60037) is so named in Reader's handwriting from 'mallee, Borung, F. M. Reader, 25.10.1901'.]

Diffuse or caespitose, wiry perennial 0.5–2 metres high, shortly rhizomatous, without a basal tuft of leaves. Culms erect or slightly geniculate at the base, occasionally branched, terete, 1–2.5 mm wide near the base, not compressible, smooth to strongly ribbed, glabrous; nodes 2–10, exserted, if swollen then to 50% larger than the adjacent internodes. Leaf sheaths not inflated, 3–10 mm wide; basal sheath slightly to strongly ribbed, glabrous to scabrous with minute tubercles; upper sheath strongly to moderately ribbed, glabrous to scabrous with minute tubercles or hairs to 0.2 mm long; margins glabrous; collar glabrous. Ligule membranous, obtuse to broadly laciniate, 1–6 mm long, glabrous; abaxial surface glabrous; auricles thickened, 1–1.5 mm long, glabrous. Leaf blade expanded or weakly rolled, 1–8 mm wide, to 25 cm long, linear to narrow-triangular; abaxial surface strongly ribbed, scabrous with minute tubercles to glabrous; adaxial surface strongly to moderately ribbed, glabrous or with sparse hairs 0.1 mm long; margins glabrous to minutely scabrous. Panicle 10–40 cm long, exserted at maturity, spreading, to 20 cm wide (excluding awns) at maturity with distant fascicles of unequal, few-flowered, compound branches, 1–2.5 cm wide (excluding awns); axis terete, strongly ribbed, glabrous; branches 3–10 cm long, angled, with sparse hairs minute–0.2 (–0.6) mm long to glabrous; pedicels 2–10 mm long, angled, with sparse hairs minute–0.2 mm long. Spikelets 7.5–15 mm long, gaping at maturity. Glumes unequal, acuminate, glabrous to minutely scabrous, straw-coloured; lower glume 7.5–15 mm long, lower 5–30% 3-nerved; upper glume 6–10 (–12) mm long, lower 45–60% 3-nerved. Floret cylindrical, 4.5–6 mm long (including callus), without a neck. Lemma granular, sericeous with hairs 0.05–0.3 mm long; lobes 2, 0.1–0.2 mm long or absent; coma absent. Callus 0.5–1 mm long, almost straight, densely sericeous with hairs (0.1–) 0.3–0.5 (–0.7) mm long. Awn 60–80 (–90) mm long, falcate, 0.1–0.2 mm wide near the base; column 10–15 mm long, brown, scabrous along the edges with hairs to 0.1 mm long; bristle delicate, strongly flattened, scabrous along the edges with hairs minute–0.2 mm long. Palea 60–80% the length of the lemma, acute, granular with hairs 0.2–0.4 mm long down the centre, margins glabrous.

Lodicules 3; 2 abaxial membranous, 0.5–2.5 mm long, acute; paleal membranous, 1–2 mm long, acute. Anthers 1.5–2 mm long, not penicillate. Caryopsis 3–3.5 mm long; embryo 20–25% the length; hilum 50–70% the length.

DISTRIBUTION: Plains of New South Wales and north-western Victoria, across all but the far north of South Australia to just into Western Australia. Usually on sandy soils in woodland or mallee.

SELECTED SPECIMENS: NEW SOUTH WALES: **Central Western Slopes:** 19 km from Bogan Gate towards Forbes, *Dunlop 1590*, 2.9.1969 (CBG). **North Western Plains:** Nyngan, *Blakely NSW 116239*, 10.1912 (NSW). **South Western Plains:** Mount Hope, *Holland*, 10.1964 (CANB 176853); 1 mile [1.6 km] W. of Condobolin on North Euabalong road, *Cunningham NSW 116233*, 12.12.1971 (NSW); 30 km N. of Garoolgan, *Mulham 1246*, 10.11.1977 (NSW); c. 17 km E. of Griffith, Binya State Forest, *Crisp 1637*, 20.11.1975 (CBG). **South Far Western Plains:** 56 km N. of Wentworth on road to Broken Hill, *Rodd NSW 116232*, 29.8.1969 (NSW); 8 km NW. of Bidura Homestead, *Crisp 1788*, 26.11.1975 (CBG, NSW); 'Nulla Nulla', *Stanley 1795*, 3.12.1975 (NSW).

VICTORIA: **Region A:** Mildura, *Williamson*, 10.1928 (MEL); Parish of Japaroo, c. 5 miles [8 km] S. of the 65-mile post on Sturt Highway, W. of Mildura, *Willis*, 3.9.1948 (MEL). **Region B:** Wyperfeld National Park, *Beaglehole 29446 & Finck*, 11.11.1968 (NSW). **Region C:** Little Desert, *Reader*, 27.10.1891 (MEL 60766, *p.p.*); Wimmera, N. of Mt Arapiles, *Dallachy*, (MEL). **Region F:** c. 25 km SSW. of Robinvale, *Beaglehole 56056*, 2.5.1977 (MEL); 9 km SSE. of Robinvale, *Beaglehole 56195*, 5.5.1977 (MEL). **Region G:** c. 12 km N. of Manangatang, *Beaglehole 55986*, 30.4.1977 (MEL); Leaghur Forest, 15 miles [24 km] SSW. of Kerang, *Beaglehole 40670*, 1.10.1972 (NSW, MEL).

SOUTH AUSTRALIA: **Lake Eyre Basin:** Upper Arkaringa Valley, *Helms NSW 116238*, 6.1891 (NSW). **Nullarbor:** Maralinga, *Hill 598*, 13.8.1956 (NSW); Knowles Cave, *Symon 4658*, 19.2.1967 (ADW, NSW). **Gairdner-Torrens Basin:** Bon Bon – Mount Eba netting on Stuart Highway, c. 80 km N. of Kingoonya, *Lay 466*, 21.9.1971 (AD). **Eastern:** Koonamore, *Osborn NSW 116314*, 19.5.1923 (NSW). **Eyre Peninsula:** Reserve near Ceduna, *Cleland*, 7.9.1968 (AD); S. side of Salt Lake on Chauceys Line, *Cleland*, 9.1962 (AD). **Northern Lofty:** Kulpara, *Blaylock 779*, 1.10.1967 (AD). **Murray:** Morgan to Burra Road, nr. Morgan, *Cleland*, 12.11.1964 (AD); c. 3.5 km S. of Monash, *Eichler 13729*, 19.4.1957 (AD); Swan Reach, Murray River, *Cleland NSW 116310*, 28.11.1913 (NSW); c. 8 km W. of Mannum, *Spooner 2721*, 24.2.1973 (AD). **Yorke Peninsula:** c. 6 km from Bute on Alford Road, *Copley 774*, 15.10.1966 (AD). **Southern Lofty:** 1 mile [1.6 km] from Kangaroo Flat on Kangaroo Flat-Mallala Road, *Harris 42*, 1.10.1959 (AD); c. 2.5 miles [4 km] WNW. of Gawler, *Smith 957*, 23.10.1967 (AD); Dry Creek, E. of Yatala Prison Farm, *Kraehenbuehl 469*, 13.9.1961 (AD); Northfield, *Smith 1057*, 3.12.1967 (AD).

WESTERN AUSTRALIA: **Austin:** Menzies, *Andrews*, 9.1902 (PERTH). **Coolgardie:** c. 80 km N. of Kalgoorlie, *Cleland*, 30.8.1948 (AD 97219052); Broad Arrow, *Fitzgerald*, 9.1898 (NSW 116312); near Paddington, *Gardner & Blackall*, 9.1927 (PERTH); Kalgoorlie, *Maiden*, 1909 (NSW 116313); 6 miles [10 km] W. of Southern Cross, *Aplin 1975*, 12.9.1962 (PERTH, K); 4 miles [6 km] W. of Eyre Hwy, on Hyden to Norseman Road, *George 4349*, 6.2.1968 (PERTH); 14 miles [24 km] N. of Norseman on Coolgardie Road, *Beaglehole 13519*, 21.9.1965 (PERTH). **Roe:** c. 23 miles [38 km] E. of Fraser Range, *Willis*, 6.9.1963 (PERTH, duplicate of MEL 515037). **Avon:** Cowcowing, *Koch 1133 p.p.*, 9.1904 (NSW 116299), 10.1904 (NSW 116298).

Stipa plumigera Hughes, Kew Bull. 1921: 20 (1921); Black, Fl. S. Austral. edn 2: 89 (1943).

HOLOTYPE: SOUTH AUSTRALIA: Elder Exploring Expedition, Camp 10 (c. 130°4'E, 27°16'S), *R. Helms*, 29.6.1891 (K!); probable isotypes NSW 151321, 16019, 16020, 16021, MEL 59969, AD 97434003, 97424088 in packet).

SYNONYM: *S. eremophila* var. *dodrantaria* J. Black, Trans. & Proc. Roy. Soc. S. Austral. 46: 565 (1922); Fl. S. Austral. 1: 66 (1922). HOLOTYPE: SOUTH AUSTRALIA: Camp 10, Birksgate Range, *R. Helms*, 29.6.1891 (AD 97424088 in part).

Caespitose perennial 0.4–0.6 metres high, with conspicuously extravaginal shoots and a short rhizome. Culms erect, terete, 1–1.5 mm wide near the base, scarcely compressible, unribbed, smooth, glabrous or puberulous; nodes 2–3, seldom exserted, sparsely pubescent, to 30% broader than adjacent internodes.

Leaf sheaths tightly enveloping culms. Ligule coriaceous, 0.5–2.5 mm long, broad-acute to truncate, densely ciliate; abaxial surface sericeous; auricles densely ciliate with 1 mm long straight hairs. Leaf blades to 35 cm long, usually expanded, 2–3 mm wide; abaxial surface slightly ribbed, glabrous to shortly pubescent with hairs to 0.5 mm long; adaxial surface deeply ribbed, pubescent with hairs 0.5–1 mm long; margin strongly antrorsely scabrous. Panicle sparse with close fascicles of uneven, few-flowered, compound branches, contracted to spreading, 15–20 cm long, 1.5–4 cm wide (excluding awns), exerted late; axis slender, terete, scabrous-pubescent; branches 3.5–7 cm long, angled, scaberulous; pedicels 4–18 mm long, angled to flattened, scaberulous. Spikelets 18–23 mm long (excluding awn), slightly gaping. Glumes pale yellow to purple, unequal, acuminate, membranous; lower glume 18–23 mm long, the lower 50% 3-nerved; upper glume 12–15 mm long, lower 30–50% 5-nerved, the next 10–30% 3-nerved. Floret narrow-cylindrical with a slightly narrowed neck, 7.5–8.5 mm long (including callus). Lemma granular to almost smooth, with golden hairs to within 1–0.5 mm of the apex, the upper 1–0.5 mm scabrous; coma 0.5–0.8 mm long; lobes 2, less than 0.1 mm long. Callus 2–3 mm long, with hairs similar to those of the lemma. Awn 70–110 mm long, 0.3–0.35 mm wide near the base, weakly twice bent, pale yellow; column 20–26 mm long, 15–20 mm to the first bend, densely pubescent with hairs 0.5–1 mm long; bristle often gently curved, villous for most of its length with hairs c. 1 mm long. Palea acute, 90% the length of the lemma, granular, ciliate, the very outer margin hyaline and glabrous. Lodicules 2, abaxial, membranous, narrow-oblong, 1 mm long. Anthers unequal, one 1.1 mm, and the other two 0.5 mm long; florets cleistogamous. Caryopsis 3.5–4 mm long; embryo 30% the length; hilum 60–75% the length.

DISTRIBUTION: North-western South Australia and the Nullarbor Plain, extending into Western Australia.

SPECIMENS EXAMINED: SOUTH AUSTRALIA: **North-western:** Elder Exploring Expedition, Camp 10, *Helms*, 29.6.1891 (K, NSW 151321, 16019, 16020, 16021; MEL 59969; AD 97434003, 97424088 in part); 10 miles [16 km] N. of Maralinga, *Forde* 592, 9.10.1956 (CANB); 69 miles [110 km] S. of Emu, *Forde* 528, 11.9.1956 (MEL, CANB, AD). **Nullarbor:** Maralinga, *Forde* 641, 12.10.1956 (CANB); within a mile [1 km] of Ooldea, *Caulfield* 130, 25.9.1955 (AD); limestone ridge behind Ooldea, *Hilton*, 24.8.1955 (ADW 19783); Ceduna, *Canning* 2339, 1.9.1968 (AD, CBG); Laura Bay, *Rogers* NSW 9323, 9.1907 (NSW).

WESTERN AUSTRALIA: **Eucla:** between Eucla & Fowlers Bay, *Richards* (MEL 60925).

***Stipa puberula* Steudel, Syn. Pl. Glum. 1: 128 (1854); Gardner, Fl. W. Austral. 1, Gram.: 183 (1952), excl. synonymy.**

HOLOTYPE: 'Hrbr. Drummond coll. IV nr. 379, N. Holl.' in Steudel's herbarium (P!); duplicates of the Type Number at K and MEL (MEL 59971, 59972 and 59973). The Holotype sheet at P also bears a packet containing loose florets of an entirely different, large-fruited species of *Stipa*, possibly *S. pubescens* R. Br. The foliage of the Type specimen is minutely puberulous in a manner more or less matched by only two or three of the specimens cited below, but we are convinced that this difference must be accepted as within the variability of indumentum of the species. The inflorescence of the Type is rather immature, and the hairs on the lemma are all white, whereas in the material here accepted as being conspecific the hairs on the lemma soon change to a characteristic tawny to dark brown. The size and shape of the lemma, however, with its characteristic scabrous neck, the delicate, rather short, twice bent awn, and the relatively short glumes, scarcely leave any doubt that these specimens must bear the name *S. puberula* however unsuitable the epithet may appear.

SYNONYM: *S. arachnopus* Pilger in Diels & Pritzel, Bot. Jahrb. Syst. 35: 70 (1904); Hughes, Kew Bull. 1921: 15 (1921); Gardner, Fl. W. Austral. 1, Gram.: 179 (1952) excluding synonymy.

LECTOTYPE: WESTERN AUSTRALIA: Cited in the protologue as 'Hab. in distr. Coolgardie pr. Bullabulling in silvis apertis lapidoso-lutosis fl. m. Oct. (D [Diels] 5954)'. Prof. H. Scholz of the Botanischer Garten und Botanisches Museum, Berlin-Dahlem, has advised us that the Holotype is no longer in existence at B. There is a duplicate specimen labelled 'W. Australia: Dist. Coolgardie, Bullabulling, Diels n. 5954' in Diels' handwriting in MEL (MEL 59877) and we here designate this specimen as the **Lectotype** of *S. arachnopus* Pilger.

Caespitose perennial to c. 0.8 metres high with a sparse basal tuft of leaves to half the total height. Culms erect, c. 2 mm wide near the base, simple or occasionally branching, terete, compressible, ribbed, glabrous and smooth to puberulous, especially on the upper internodes and just below the nodes; nodes c. 3, densely to sparsely pubescent, exerted, to 50% wider than adjacent internodes. Leaf sheaths tight around the culms, c. 5 mm wide (although the uppermost a little broader), densely hirsute or puberulous to glabrous upwards; inner margin glabrous; outer margin densely woolly. Ligule firm, 0.2–0.5 mm long, truncate, ciliate; abaxial surface pubescent; auricles thickened, densely woolly. Leaf blades mostly rolled, flexuose, 1–2 mm wide, to 25 cm long; abaxial surface not ribbed, scaberulous, densely pubescent and sparsely to densely hirsute; adaxial surface strongly ribbed, sparsely hirsute to glabrous. Panicle spreading, exerted with distant fascicles of uneven branches bearing spikelets mainly at the ends, 15–30 cm long, 1.5–3 cm wide (excluding awns); axis terete, scaberulous; branches angular, to 8 cm long, scaberulous; pedicels 1.5–8 mm long, flattened, scaberulous. Spikelets 8–14 mm long (excluding awn), gaping. Glumes subequal, broad and inflated in the middle, firm and green to purple at the base, membranous and hyaline at the tip, glabrous or scaberulous on the nerves; lower glume 8–14 mm long, acuminate, lower 50% 3-nerved; upper glume 6–12 mm long, acute, lower 30% 5-nerved, the next 10–30% 3-nerved. Floret turbinate to oblong-cylindrical, 4–6 (–6.5) mm long (including callus), usually with a neck. Lemma deep brown at maturity, the surface smooth, sericeous with dense fulvous hairs, the upper 0.5 mm glabrous to scabrous, hairy on the margins; coma of sparse stiff hairs 0.4–0.7 mm long; lobes less than 0.1 mm long. Callus 0.7–1.5 (–1.8) mm long, curved. Awn 0.2–0.25 mm wide near the base, 25–65 mm long, twice bent, pale throughout its length; column 15–20 mm long, 8–10 mm to the first bend, scabrous with hairs 0.05–0.10 mm long; bristle scabrous. Palea acute, subequal to the lemma (to 0.05 mm shorter), granular, sericeous with fulvous hairs down the centre. Lodicules 2, abaxial, membranous, oblong, 0.6 mm long. Anthers 0.6–2.0 mm long, penicillate. Caryopsis 2–5 mm long; embryo 30% the length; hilum 90% the length.

DISTRIBUTION: South-western New South Wales and north-western Victoria, the Eyre Peninsula and Nullarbor Plain in South Australia, extending into Western Australia.

SELECTED SPECIMENS: NEW SOUTH WALES: **South Far Western Plains:** E. of Balranald, Moulamein road, *Henderson* 422, 5.10.1947 (NSW); NE. of Lake Tooim, *Henderson*, 5.11.1947 (NSW 116973); Merran Ck., between Swan Hill & Moulamein, *Henderson* 434, 16.11.1947 (NSW); Mellool, *Henderson* 433, 28.10.1947 (NSW).

VICTORIA: Region A: 5 miles [8 km] S. of 65-mile post on Sturt Hwy, *Willis*, 3.9.1948 (MEL 60693). **Region H:** County of Borung, *Reader*, 30.10.1904 (MEL 60712).

SOUTH AUSTRALIA: Nullarbor: Hughes National Park, *Ising* 1636, 9.1920 (MEL, NSW, ADW, AD, BRI); nr. Koonalda Cave, *Symon* 4490, 16.2.1967 (K, CANB); 15 miles [24 km] from 'Nullarbor', Nundroo road, *Phillips* CBG 039487, 31.8.1968 (CBG). **Eyre Peninsula:** c. 20 km WNW. of 'Nonning', *Carrick* 2310, 26.9.1969 (AD); 1 mile [1.5 km] N. of 'Nonning', *Specht & Carrodus* 18, 20, 14.11.1958 (AD). **Murray:** Mt Mary, 22 miles [35 km] E. of Eudunda, *Ising*, 4.10.1922 (ADW 43881).

WESTERN AUSTRALIA: **Eucla**: c. 115 miles [185 km] NW. of Reid, *George 8478*, 13.10.1966 (PERTH); 60 miles [96 km] N. of Loongana, *Mitchell 86*, 5.10.1974 (PERTH); 7 miles [11 km] W. of Deakin, *Calaby*, 24.10.1947 (CANB 15001); Reid, *McCrumm*, 7.1959 (PERTH); 8 km SW. of Loongana, *Mitchell 68*, 11.9.1974 (PERTH); 19 km W. of Eucla, *Beauglehole 49420*, 30.8.1974 (CANB); Eucla, *Batt*, 1899 (MEL 60713). **Coolgardie**: c. 81 km W. of Cocklebidy, Eyre Hwy., *Willis*, 6.9.1963 (PERTH). **Roe**: SE. of Lake King (33°13'S, 119°50'E), *George 10494*, 12.11.1970 (PERTH, NSW).

S. puberula is closely related to *S. eremophila* but can generally be readily distinguished by its shorter floret, shorter and finer awn and shorter glumes.

***Stipa pubescens* R. Br.**, Prodr.: 174 (1810); Bentham, Fl. Austral. 7: 569 (1878); Moore & Betche, Handb. Fl. N.S.W.: 484 (1893); Hughes, Kew Bull. 1921: 21 (1921), at least in part; *ibid.* 1922: 18 (1922); Willis, Handb. Pl. Victoria 1: 187 (1962), edn 2: 187 (1970); Beadle, Evans & Carolin, Fl. Sydney Region: 657 (1972).

LECTOTYPE, here designated: NEW SOUTH WALES: Port Jackson, *R. Brown*, 1802-5 (BM!, sheet II). The Type collection consists of three sheets. Sheets I and III contain mixtures of *S. rudis* and *S. pubescens*. Sheet II bears a good unmixed specimen that matches the description of *S. pubescens*; isolecotype (Iter Australiense 1802-5, *R. Brown*, no. 6203) at K.

SYNONYM: *S. commutata* Trin. & Ruprecht, Mém. Acad. Imp. Sci. Saint-Pétersbourg, ser. 6, Sci., Math., Seconde Pt. Sci. Nat. 5: 49 (1842). HOLOTYPE: 'Nova Hollandia ad Portum Jackson, Sieber Agrostoth. n. 59' (LE, not seen). There is a duplicate of *Sieber no. 59* in MEL (MEL 59974); it lacks fertile florets, but the long glumes, together with the stated locality, leave no doubt that it is a specimen of *S. pubescens* R. Br. Another duplicate of *Sieber no. 59* is at K: it agrees completely with *S. pubescens* in glume length and foliage characteristics but lacks lemmas except for an imperfect one.

Caespitose perennial to 1.5 metres high with conspicuously extravaginal shoots from a short rhizome forming a loose tuft to half the height. Culms erect or occasionally geniculate near the base, not compressible, terete, 1-4 mm wide near the base, scarcely ribbed, finely pubescent for varying lengths below the nodes or the upper internodes glabrous to just below the nodes; nodes 2-3, exserted, to 60% broader than adjacent internodes, densely sericeous. Leaf sheaths often purple-tinged, tight around the culms, c. 4 mm wide (occasionally the uppermost slightly inflated and to 8 mm wide), slightly ribbed, densely and finely pubescent or upper sheaths almost glabrous, the collar often hirsute; inner margin glabrous; outer margin densely ciliate with long hairs to sparsely ciliate especially on upper sheaths. Ligule coriaceous, 0.4-1 (-1.5) mm long, truncate or occasionally slightly obtuse, glabrous or ciliolate; auricles scarcely thickened, similar in pubescence to the sheath. Leaf blades tightly rolled or expanded, to 4 mm wide, to 50 cm long; abaxial surface scarcely ribbed, pubescent with minute hairs, or glabrous; adaxial surface ribbed, scarcely to densely pubescent with minute hairs; margins similar to adjacent surfaces. Panicle to 30 cm long, to 4 cm wide (excluding awns), exserted, loosely contracted to spreading, sparse with distant fascicles of few-flowered branches; axis slightly angular, densely and shortly scabrous; branches to 7 cm long, angular, scabrous to pubescent, especially on the angles, pedicels to 30 mm long, angular, scabrous to pubescent, especially on the angles. Spikelets (15-) 17-24 mm long (excluding awn), gaping widely. Glumes unequal, linear, often inrolled, firm, with nerves heavily overlaid with sclerenchyma, usually purple-tinged, occasionally pale green, pubescent overall or glabrous between the nerves and scabrous on the nerves, the margins ciliate; lower glume 17-24 mm long, the lower 95% 3-nerved, the tip narrowly truncate and firm or occasionally slightly acute and

chartaceous; upper glume 15–20 mm long, the lower 30–60% 5-nerved, the next 65–35% 3-nerved, the tip narrowly truncate and firm, rarely slightly acute and chartaceous. Floret cylindrical with a slight neck, (9.5–) 11–15 mm long (including callus). Lemma reddish brown at maturity, finely tuberculate, especially upwards, with sparse slightly fulvous hairs on the lower 50–60%, glabrous upwards; coma absent; lobes absent. Callus (2.5–) 3–4.5 mm long, straight, the tip weakly bent with slightly fulvous hairs. Awn (60–) 70–100 mm long, 0.5–0.6 mm wide near the base, twice bent; column 45–70 mm long, 30–55 mm to the first bend, scaberulous to softly pubescent with dense hairs 0.05–0.15 mm long; bristle scabrous. Palea 50–70% the length of the lemma, obtuse or rarely acute, glabrous, granular down the centre, margins and apex hyaline to pale and chartaceous. Lodicules 2–3, membranous; 2 abaxial 1.5–2 mm long, oblong; paleal acute, c. 1 mm long, or absent. Anthers 2–6 mm long, not penicillate. Caryopsis 5–8 mm long; embryo 15–20% the length; hilum c. 90% the length.

DISTRIBUTION: Sandstone areas of south-eastern Queensland and eastern New South Wales.

SELECTED SPECIMENS: QUEENSLAND: **Moreton:** Mt Gravatt, *Henderson 147*, 20.11.1966 (BRI, CANB), *Smith 316*, 15.2.1938 (BRI); nr. Moggill, *Hubbard 8596*, 3.4.1931 (K, NSW); 4 km SW. of Victoria Point, *Stanton*, 10.11.1971 (BRI); 3 km E. of Plunkett, *Simon & Sharpe NSW 117038*, 18.11.1974 (NSW, BRI); Sunnysbank, *Blake 5108*, 20.1.1934 (BRI, K); *Bailey & White*, 12.1916 (BRI). **Darling Downs:** Wyberba, *Blake 4638*, 23.1.1933 (BRI).

NEW SOUTH WALES: **North Coast:** Clarence River, *Wilcox, s.d.* (MEL); Woolgoolga, *Vickery NSW 8552*, 1.1.1935 (NSW); c. 5 miles [8 km] N. of Wingham, *Salasoo 2744*, 31.12.1963 (NSW). **Central Coast:** Morisset, *Boorman NSW 8544*, 11.1914 (NSW, BRI, MEL, CANB); Silverwater, Lake Macquarie, *Jacobs 637*, 10.11.1973 (NSW); Awaba, *Boorman NSW 8554*, 11.1914 (NSW, BRI, AD, CANB); Putty Road, between Colo River & Howes Valley, *Phillips & Vickery CBG 001266*, 20.2.1961 (CBG); Kulnurra, *White 0241*, 5.12.1935 (NSW); Calga & Mooney, *Goode 261*, 27.12.1954 (NSW); Narrabeen, *Mair*, 20.11.1952 (BRI); Hornsby, *Blakely NSW 8549*, 4.1914 (NSW); 1–2 miles [1–3 km] W. of Wahroonga, *Salasoo 604*, 10.12.1950 (NSW); Epping, *Johnson NSW 116175*, 10.11.1946 (NSW); Cheltenham, *Vickery NSW 8551*, 4.6.1929, *NSW 4772*, 23.12.1949 (NSW); Middle Head, Sydney, *Bryant 11617*, 15.11.1974 (NSW); Lane Cove, *Crisp 2409*, 13.12.1976 (CBG); Gladesville, *Deane NSW 8564*, 7.1884 (NSW); Parramatta, *Woolfs, s.d.* (MEL); Long Bay, *Hilton*, 22.11.1944 (ADW 43952); Rookwood, *Cheel NSW 8553*, 25.12.1900 (NSW); Kogarah, *Camfield NSW 8534*, 12.1896 (NSW), *Cheel NSW 8555*, 28.10.1899 (NSW); Peakhurst, *Cheel NSW 8546*, 1.1900 (NSW); Hurstville to Tom Uglys Point, *Camfield NSW 8535*, 1.1.1903 (NSW); National Park, *Betche NSW 8542*, 11.1889 (NSW), *Hilton*, 11.1944 (ADW 43953); between Stanwell Park & Otford, *Salasoo 1268*, 27.12.1954 (NSW); Casula, *Coveny 5354*, 30.11.1974 (NSW); 3 miles [5 km] NW. of Nowra, *Rodway NSW 116178*, 12.11.1934 (NSW); Nowra North, *Constable NSW 16577*, 8.12.1950 (NSW). **South Coast:** Nowra Hill, *Rodway NSW 116192*, 1.1921 (NSW); 9 miles [14 km] S. of Nowra, *Rodway NSW 116176*, 1.12.1929 (NSW); 10 miles [15 km] SW. of Nowra, *Rodway NSW 116180*, 7.2.1943 (NSW), *Salasoo 3118*, 9.1.1966 (NSW); Jervis Bay, *Rodway NSW 116177*, 12.1919 (NSW); S. of Milton, *Hadley NSW 116181*, 13.11.1937 (NSW); Wadbilliga Fire Trail, 4 km ENE. of Tuross River, *Tindale 4036*, *Pariss & Wimbush*, 18.1.1975 (NSW). **Northern Tablelands:** New England, *Stuart NSW 8537, s.d.* (NSW); Gibraltar Range, *Jessup & Gray*, 4.12.1953 (CANB 97472); Glen Elgin, *Boorman NSW 8539*, 12.1913 (NSW); 4.5 miles [8 km] W. of Tingha, *Jessup & Gray*, 8.12.1953 (CANB 97460). **Central Tablelands:** Blue Mountains, *Betche NSW 8543*, 12.1882 (NSW), *Woolfs, s.d.* (K); Hassans Walls *McKie NSW 8561*, 12.2.1940 (NSW); Mt Victoria, *Cheel NSW 8548*, 12.1900 (NSW); Blackheath, *Constable NSW 11412*, 17.1.1950 (NSW, K); Mt Boyce, *Constable 4160*, 6.2.1963 (NSW, BRI, CANB); Medlow, *Griffith NSW 8545*, 10.12.1914 (NSW); Narrow Neck road, *Crisp 4002*, 12.5.1978 (CBG); Edith Falls, *Coveny 4072 & Bisby*, 25.3.1972 (NSW); Woodford, *Henderson NSW 116195*, 3.1945 (NSW); Lawson, *Carne NSW 8541*, 3.1912 (NSW); Wentworth Falls, *Coveny 40462 & Bisby*, 24.3.1972 (NSW, CANB); Hill Top, *Cheel NSW 8594*, 6.1.1912 (NSW); Fitzroy Falls, *Gauba CBG 003943*, 7.1.1953 (MEL). **Southern Tablelands:** c. 5 miles [8 km] E. of Nerriga, *Pullen 2033*, 8.12.1959 (CANB).

In the occasional occurrences of slightly obtuse ligules 1–1.5 mm long, and of acute paleas, some specimens of *S. pubescens* approach *S. pubinodis*. However, the distributions are quite disjunct and the palea of *S. pubescens* is always much shorter than the lemma, whereas in *S. pubinodis* it is equal or subequal.

***Stipa pubinodis* Trin. & Rupr.**, Mém. Acad. Imp. Sci. Saint-Pétersbourg, ser. 6, Sci., Math., Seconde Pt. Sci. Nat. 5: 50 (1842); Townrow, Pap. & Proc. Roy. Soc. Tasmania 107: 26 (1974).

HOLOTYPE: 'Tasmania: Hooker' (LE!; isotype K [negative no. Kew 11758]). In K(!) there is a specimen 'Van diemens Land, *Gunn no. 588*' (also CANB photo 237005) derived from the herbarium of General W.M. Munro. The sheet was annotated by C.E. Hubbard in July 1939, 'Represents the same species as the type of *Stipa pubinodis* Trin. et Rupr. (V.D.L. 11) in the Leningrad Herbarium'. The specimen accords well with the description provided by Trinius and Ruprecht. Hughes, Kew Bull. 1921: 21 (1921), refers to this specimen under *S. pubescens* R. Br. but notes the more acuminate, hyaline tips of the glumes, and again, on p. 28, under *S. pubinodis* Trin. et Rupr., which she places amongst 'Species Dubiae vel Excludendae'. There is a further sheet at K — Tasmania, Mt Direction, *Gunn*, 6.12.1841 — that has been similarly annotated by Hubbard.

SYNONYM: *S. pubescens* var. *semiglabra* Reader, Victorian Naturalist 17: 155 (1901). HOLOTYPE: VICTORIA: 'Dec. 1899. Billabong of Wimmera [River], Lowan, *F.M. Reader*'. There are two sheets in MEL, 'Banks of 'Billabong', Antwerp, 10.12.1899, *F.M. Reader*' (MEL 59981) and 'Billabong, Lowan, *F.M. Reader* 10.12.1899' (MEL 60788); the latter is presumably the Holotype.

Caespitose perennial c. 0.5–1 metre high, with conspicuously extravaginal shoots from a short rhizome forming a loose tuft of leaves quarter to half the height. Culms erect, slightly compressible, 1–2 mm wide near the base, scarcely ribbed, sparsely pubescent just below the upper nodes with hairs 0.1–0.3 mm long, glabrous elsewhere; nodes 2–3, exserted, to 50% wider than adjacent internodes, densely sericeous with hairs 0.1–0.4 mm long. Leaf sheaths at first tightly enveloping the culm, later slightly loose, glabrous to scaberulous, 5–10 mm wide, smooth to strongly ribbed on upper sheaths; inner margin glabrous; outer margin ciliate with hairs 0.1–0.4 mm long to glabrous, especially on the lower sheaths. Ligule coriaceous, 0.6–2 mm long, obtuse, ciliate; auricles absent. Leaf blade tightly rolled, 1–2 mm wide, to 35 cm long; abaxial surface smooth to slightly ribbed, glabrous or on the innovations sparsely scabrous; adaxial surface strongly ribbed, densely pubescent with hairs minute–0.3 mm long; margins minutely scabrous. Panicle (11–) 15–25 cm long, contracted, 1.5–2 cm wide (excluding awns), exserted, with distant fascicles of unequal, few-flowered, compound branches; axis terete to slightly angular, scabrous with hairs minute–0.4 mm long; branches 2.5–4 cm long, slightly flattened, scabrous with hairs 0.1–0.3 mm long; pedicels 7–20 mm long, slightly flattened, scabrous with hairs 0.15–0.3 mm long. Spikelets 18–26 (–29) mm long (excluding awn), gaping widely. Glumes unequal, acute, tip hyaline, nerves heavily overlaid with sclerenchyma, margins ciliate; lower glume 18–26 (–29) mm long, lower 70–80% 3-nerved, scabrous on the nerves with hairs minute–0.1 mm long; upper glume 15–20 mm long, lower 30–50% 5-nerved, the next 50–70% 4–1-nerved, scabrous with hairs minute–0.2 mm long. Floret cylindrical with a slight neck, 10–13 mm long (including callus). Lemma pale reddish brown at maturity, smooth to finely tuberculate upwards, with sparse white hairs (0.4–) 0.6–0.9 (–1.3) mm long on the lower 50–60%, glabrous upwards; lobes absent; coma absent. Callus 2.7–3.5 mm long, ± straight, the tip weakly bent, with hairs 0.2–1 mm long, white to slightly fulvous at maturity. Awn 55–95 mm long, with 2 (–3) bends, c. 0.5 mm wide near the base; column 30–60 mm long, 25–40 mm to the first bend, scabrous with hairs 0.1–0.2 mm long; bristle scabrous with hairs minute–0.2 mm long. Palea ± equal to the lemma, acute, smooth and glabrous, hyaline on the margins. Lodicules 2, abaxial, membranous, oblong, 1.5–2 mm long. Anthers 4.5–6 mm long, not penicillate. Caryopsis 6–7.5 mm long; embryo c. 30% the length; hilum equal to the length.

DISTRIBUTION: Sandstone and sandy areas of Tasmania and southern Victoria, extending into South Australia.

SELECTED SPECIMENS: VICTORIA: **Region C:** Billabong, Antwerp, *Reader*, 10.12.1899 (MEL 59975). **Region D:** Grampians, track from The Sundial to Macheys Peak, *Corrick 1624*, 28.12.1968 (Corrick herb.); Grampians, S. side of Major Mitchell Plateau, *Beaglehole 16530*, 10.12.1967 (NSW); c. 3 km WNW of Hamilton, *Milne 331*, 13.11.1979 (NSW). **Region E:** Hawkesdale, *Williamson*, 2.5.1899 (MEL 60776). **Region J:** Moyston, *Sullivan*, 12.1880 (MEL 60849); 4 km SSE. of Creswick, *Beaglehole 61721*, 22.11.1979 (NSW). **Region N:** proposed Warrandyte State Park, *Corrick 3722*, 3.12.1973 (Corrick herb.); Ringwood, *Morrison NSW 150583*, 21.10.1891 (NSW); c. 1 mile [1.5 km] SE. of Montrose, *Muir 308*, 28.12.1957 (MEL); Mt Dandenong, *Muir 283*, 8.12.1957 (MEL, CANB). **Region P:** French I., *Ramsay*, 25.11.1904 (MEL); 10 km NNW. of Anglesea, *Beaglehole 63347*, 17.1.1979 (NSW). **Region R:** Mt Buffalo, *Blake 7369*, 25.1.1935 (BRI). **Region S:** c. 6 miles [10 km] ENE. of Mallacoota, *Beaglehole 31572 & Willis*, 6.11.1969 (NSW).

TASMANIA: Waterhouse Estate, W. of Tomahawk, *Townrow 111*, 12.1967 (JEST); Devonport, *Curtis*, 20.2.1948 (BRI); 4 miles [6 km] NW. of St Helens, Goshen rd., *Townrow 193*, 1.1968 (NSW); 10 miles [15 km] E. of Launceston, *Burbidge 2945*, 8.1.1949 (CANB); Mathinna, *Phillips CBG 001268*, 29.1.1962 (CBG); 1.5 miles [2 km] SE. of Pouranna, *Townrow 130*, 12.1967 (JEST); Pieman River bridge, *Davis NSW 116231*, 7.1.1937 (NSW); East Coast Highway at Coles Bay turnoff, *Townrow 178*, 1.1968 (JEST); 3 miles [5 km] N. of Triabunna, *Townrow 173*, 1.1968 (JEST); 5 miles [8 km] E. of Buckland, *Townrow 67*, 11.1967 (JEST); 3.5 miles [6 km] W. of Runnymede, *Townrow 62*, 11.1967 (JEST); New Norfolk, *Gunn 996*, 18.11.1840 (K, NSW 116229); Copping, *Blake 18278*, 15.1.1949 (BRI, CANB, NSW); *Vickery NSW 116226*, 15.1.1949 (NSW); W. side of Dunalley bridge, *Townrow 102*, 12.1967 (JEST); Mt Wellington, *Burbidge*, 19.1.1949 (CANB 25116); Huon Hwy., c. 10 miles [16 km] S. of Mt Wellington, *Vickery NSW 116223*, 19.1.1962 (NSW); Mt Nelson, *Cleland*, 17.1.1928 (AD 96805112, 96805122); Tarroona, *Townrow 5A*, 11.1966 (JEST); nr. Longley, *Phillips & Vickery CBG 001267*, *NSW 116228*, 19.1.1962 (CBG, NSW); Kingston Beach, *Rodway NSW 116232*, 23.11.1935 (NSW); Eaglehawk Neck, *Vickery NSW 8565*, 15.1.1949 (NSW); Margate to Snug Plains, *Vickery NSW 116224*, 21.1.1962 (NSW); South Arm, *Townrow 58*, 11.1967 (JEST); North Bruny I., *Townrow 135, 138, 146*, 1.1968 (JEST, NSW); nr. Police Point, *Phillips CBG 032260*, 25.11.1965 (CBG); nr. Randalis Bay, *Phillips CBG 032272*, 27.11.1965 (CBG); Channel Hwy. opp. Allonah, *Townrow 27*, 1.1967 (JEST).

SOUTH AUSTRALIA: **Southern Lofty:** Lenswood, *Cleland*, 16.11.1946 (AD 96324026); *Spooner 4330*, 6.11.1975, 4372, 16.11.1975 (AD); Mt Lofty Range, *Ising*, 13.10.1924 (AD 966081490); Swanport, *no collector*, no. 1555 [?] 12.1855 (MEL 60802). **South-eastern:** Penola, *Tate*, s.d. (AD 97742568); Carpenter Rocks, S. end of Lake Bonney (37°56'S, 140°26'E), *Spooner 5514*, 5.11.1977 (AD).

Hooker, Fl. Tasman. 2: 110 (1856), treated *S. pubinodis* as a synonym of *S. pubescens* R. Br., as noted by Bentham, Fl. Austral. 7: 570 (1878).

Rodway, Tasman. Fl.: 262 (1903), doubtless placed *S. pubinodis* (probably together with other species) under *S. pubescens* R. Br.

Townrow, Pap. & Proc. Roy. Soc. Tasmania 107: 26 (1974), recognized *S. pubinodis* as the species she had previously (*ibid.* 104: 81–96 (1970)) misidentified as *S. pubescens* R. Br.

Stipa pycnostachya Benth., Fl. Austral. 7: 568 (1878); Hughes, Kew Bull. 1921: 18 (1921); Gardner, Fl. W. Austral. 1, Gram.: 177 (1952).

HOLOTYPE: WESTERN AUSTRALIA: Int. S.W. Australia, *Drummond No. 121*, 1849 (K!; isotypes MEL 59978, CANB 237004).

Caespitose perennial to c. 0.6 metres high, with a short rhizome and with conspicuously extravaginal shoots from a third to almost the total height. Culms erect, not compressible, terete, 0.7–2 mm wide, unribbed, puberulous to pubescent just below the nodes; nodes 2–3, up to 25% wider than adjacent internodes, exserted, sericeous. Leaf sheaths tightly enveloping culm; basal sheaths and cataphylls very woolly; upper sheaths puberulous to scaberulous; margins glabrous. Ligule firmly membranous, 3–5 (–7) mm long (but much shorter in leaves of the basal tuft), acute or lacinate, continuous with sheath margin, glabrous; auricles glabrous. Leaf blade strongly rolled or folded, c. 1 mm diameter, stiff; abaxial surface unribbed, minutely sparsely scaberulous to

glabrous and smooth; adaxial surface deeply ribbed, densely pubescent and hirsute; margins glabrous or scabrous. Panicle exerted, short, 6–14 cm long, contracted, c. 1 cm wide (excluding awns), very dense and spike-like, with very close fascicles of unequal, compound, densely-flowered branches; axis terete, scabrous; branches to 40 mm long, angular, scaberulous; pedicels 2–7 mm long, angular, scaberulous. Spikelets 11–15 mm long (excluding awn), scarcely gaping. Glumes subequal, acuminate, purple at the base, hyaline at the tip, glabrous, scabrous on the nerves; lower glume 11–15 mm long, the lower 30% 3-nerved; upper glume 10–14 mm long, the lower 25% 5-nerved, the next 25% 3-nerved. Floret turbinate, 4–6 mm long (including callus). Lemma granular, brown, with hairs to the apex, the hairs white and slightly spreading at maturity; coma absent; lobes 2, to 0.2 mm long. Callus straight, 1.3–2 mm long, with white hairs. Awn 35–50 mm long, delicate, 0.1–0.2 mm wide near the base, \pm falcate; column 8–15 mm long, scaberulous, with hairs to 0.05 mm long; bristle scaberulous, straight or slightly curved. Palea subequal to the lemma (to 0.3 mm shorter), acute, with a band of white hairs down the middle. Lodicules 3, membranous; 2 abaxial 1.0–1.2 mm long, broadly spatulate; paleal 0.25–0.6 mm long, acute. Anthers c. 1.5–1.75 mm long, not penicillate. Caryopsis 2–2.7 mm long; embryo 25–30% the length; hilum 60–80% the length.

DISTRIBUTION: Confined to the south-west of Western Australia in the Coolgardie, Roe, Eyre and Darling districts.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: **Coolgardie:** Shire of Oldfield, *Orchard 1719*, 21.10.1968 (AD). **Roe:** Lake King (c. 33°05'S, 119°33'E), *George 10467*, p.p. 11.11.1970 (PERTH, NSW). **Eyre:** c. 8 km NNW. of Young River crossing, Ravensthorpe–Esperance road, *Jackson 1463*, 18.10.1968 (PERTH); Desmond nr. Ravensthorpe, *Maiden NSW 116842*, 11.1909 (NSW, K); 10 km N. of Needilup, *Newbey 4890*, 29.10.1975 (PERTH); Fitzgerald River Reserve, *Royce 9190*, 21.10.1920 (PERTH). **Darling:** Upper Kalgan, *Mueller*, 10.1867 (MEL 60774).

A Lake King collection (*A.S. George 10467*) consists of one plant of *S. pycnostachya* as described, and another plant that differs from typical *S. pycnostachya* in having slightly shorter, broader and denser panicles, in a more cylindrical lemma, and in a thicker column that is pubescent to villous with hairs 0.40–0.75 mm long. In these characters it is reminiscent of *S. hemipogon* (which also occurs in the area) but differs in the narrow, thick and folded leaves, long ligule, shorter inflorescence, short column hairs and slightly shorter lemma. The atypical specimen from Lake King is intermediate between *S. pycnostachya* and *S. hemipogon* and is of possible hybrid origin despite having fully developed caryopses.

***Stipa ramosissima* (Trin.) Trin.**, Mém. Acad. Imp. Sci. St.-Pétersbourg, ser. 6, Sci., Math. 1: 74 (1830); Vickery, Contrib. New South Wales Natl. Herb. 2: 77 (1953); Beadle, Evans & Carolin, Handb. Vasc. Pl. Sydney Distr.: 532 (1963), Fl. Sydney Region: 657 (1972); Veldkamp, Blumea 22: 10 (1974). Based on *Urachne ramosissima* Trin., Gram. Unifl.: 173 (1824) (Trinius cites it as Diss 1: 173).

HOLOTYPE: Cited as: 'V sp. e Nov. Holl.' (LE?, not seen). We have been unable to obtain the Type of *Urachne ramosissima* on loan from LE. There is a specimen at K, '*Sieber Agrostotheca* No. 82', that C.E. Hubbard has compared with the Type of *U. ramosissima* at LE that he regarded as a good match. The only species likely to be confused with *S. ramosissima* is *S. verticillata*; Hubbard, from his determinations of the specimens at K, was well aware of the distinction between these two species. Consequently we are using the *Sieber Agrostotheca* no. 82 specimen at K as the basis for our concept of this species.

SYNONYMS: *Stipa micrantha* Sieber ex Trin., Mém. Acad. Imp. Sci. St.-Pétersbourg, ser. 6, Sci. Math. 1: 74 (1830); non Cav. 1799. HOLOTYPE: Cited as 'Sieb. Agrostoth. No. 82 V spp. nov. Holl.' The duplicate at K(!) is our basis for the application of this name as well as for *Urachne ramosissima*.

Stipa rugulosa Mez, Feddes Repert. Spec. Nov. Regni Veg. 17: 207 (1921). HOLOTYPE: Cited as [New South Wales:] 'Blue Mts. Herb. Hort. Sydney' (not seen). The Type is no longer extant at Berlin-Dahlem (B). The description of this reed-like perennial 1.5 metres high with the characters of the glumes, lemma and awn as given by Mez, from the Blue Mountains of New South Wales, leaves no doubt as to the identity of the plant Mez named.

[MISAPPLIED NAMES: Bentham, Fl. Austral. 7: 566 (1878) incorrectly treated *S. ramosissima* as a synonym of *S. micrantha* Cav. (= *Dichelachne micrantha* (Cav.) Domin) and cited specimens of it under that name. F.M. Bailey, Queensland Fl. 6: 1876 (1902), did likewise. Maiden, Manual Grasses N.S.W.: 112 (1898), appears to have identified both *S. ramosissima* and *S. verticillata* as *S. micrantha* Cav. *S. ramosissima* was tentatively regarded as *S. micrantha* Cav. by Hughes, Kew Bull. 1921: 28 (1921).]

Caespitose perennial to c. 2.5 metres high, shortly rhizomatous, without a basal tuft of leaves. Culms erect, with numerous branches at each node, 0.5–7 mm wide near the base, terete, scarcely compressible, weakly ribbed, glabrous; nodes (3–) 6–9, exserted, glabrous, c. 50% wider than the adjacent internodes. Leaf sheaths at first tightly enveloping the culm, later becoming loose, 3–3.5 mm wide, glabrous; margins glabrous. Ligule membranous, erose, 0.25–0.5 mm long, glabrous; auricles absent. Leaf blade expanded, linear, 1–10 mm wide, 35–40 (–80) cm long, readily deciduous; both surfaces scabrous, slightly ribbed, margins scabrous. Panicle 8–20 (–50) cm long, exserted, spreading, 2–4 (–5.5) cm wide (excluding awns); axis, branches and pedicels terete, scabrous; branches (0.3–) 3.5–5.5 (–10) cm long; pedicels 2–10 mm long. Spikelets 2.3–5 mm long (excluding awn), gaping at maturity. Glumes subequal, acute, erose, inflated, straw-coloured; lower glume 2.3–3.0 (–4.0) mm long, scabrous, lower 95% 3-nerved; upper glume 2.4–2.8 mm long, glabrous, lower 60% 3-nerved, the next 40% 3–2-nerved. Floret broad-cylindrical without a neck, 1.8–2.5 mm long (including callus). Lemma very dark brown at maturity, tuberculate, glabrous or with few white hairs at the very base; lobes and coma absent. Callus 0.2 mm long, bent, with white hairs 0.25–0.5 mm long. Awn (14–) 17–30 mm long, strongly once bent, 0.05–0.1 mm wide near the base, scabrous with minute hairs; column 4–7 mm long; bristle darker than the column. Palea c. 1/3 the length of the lemma, acute, scabrous with minute hairs, margins glabrous. Lodicules 2, abaxial, membranous, 0.3 mm long, oblong. Anthers 1.0–1.3 mm long, penicillate. Caryopsis (1.2–) 1.5–1.6 mm long; embryo 25% the length; hilum 30% the length.

DISTRIBUTION: Usually in moist, well-drained gullies, near forest or woodland margins in eastern mainland States.

SELECTED SPECIMENS: QUEENSLAND: **Burke:** Mt Mistake, *Simmonds* 649, 6.1887 (BRI). **North Kennedy:** Ravenshoe, *Blake* 9870, 14.10.1935 (NSW, BRI); near The Crater on Atherton – Ravenshoe Road, *Webb & Tracey* 6444, 6.12.1962 (BRI). **Leichhardt:** c. 15 miles [22 km] N. of Wandoan, *Johnson* 757, 15.4.1949 (BRI); Hillview, 3 miles [5 km] W. of Injune, *Johnson* 2122, 16.4.1961 (BRI). **Port Curtis:** Mt Dromedary, *Craven* 2590, 30.3.1974 (CANB). **Burnett:** Kingaroy, *Smith* 3031, 15.4.1947 (BRI, CANB); Taalbinga, *White* NSW 116667, 6.1912 (NSW). **Maranoa:** 20 miles [32 km] W. of Mitchell, *Blake* 10954, 31.3.1936 (BRI). **Darling Downs:** Toowoomba, *Maiden* NSW 116668, 1.1909 (NSW); Mt Ballow, McPherson Range, *Blake* 13095, 25.7.1937 (NSW, BRI); Palardo, W. of Miles, *Blake* 5831, 9.5.1934 (NSW, BRI); near Yarraman, *Phillips* CBG 001276, 6.6.1961 (CBG); South Durong, *Smith*, 12.1932 (BRI); Wooroolin, *Simmons*, 4.1914 (BRI); Bunya Mts, *White*, 10.1919 (BRI); Mt Mitchell, *White*, 19.7.1930 (BRI); Laidley Hills, *Clemens*, 25.1.1944 (BRI); Chinchilla, *Beasley*, 12.1930 (BRI); Lapunya, 42 miles [66 km] NW. of Goondiwindi, *Johnson* 515, 27.7.1958 (BRI); Ballandean, *Blake* 13229, 30.1.1938 (BRI); Forest Reserve 400, a little S. of E. of Warwick, *Smith* 11472, 12.4.1962 (BRI); Wilsons Peak, Qld/NSW border, *Telford* 487, 15.5.1969 (CBG); Canungra, *White*, 5.1917 (BRI); Morans Creek, Robert Plateau, *Goy & Smith* 95, 6.1.1938 (BRI).

NEW SOUTH WALES: **Lord Howe Island:** Anderson Road, *Pickard 1409*, 16.9.1970 (NSW). **North Coast:** Toonumbar S.F., *Jones 3377*, 12.1966 (CANB); Grafton, *Squire NSW 115887*, 4.1947 (NSW); Grafton to Dalmorton, *Maiden & Boorman NSW 115901*, 11.1903 (NSW); Nymboida River between Grafton & Dorrigo, *Melville 3350, Smith & Moore*, 19.3.1953 (NSW); Brushy Mtn, *Maiden NSW 115927*, 9.1897 (NSW); Chappmans Plain, c. 15 miles [24 km] NNW. of Dorrigo, *Hayes & McGillivray 2512*, 10.1966 (NSW); Thora to Dorrigo, *Salasoo 1911*, 1.1960 (NSW); top of Dorrigo Mtn., *Jessup & Gray*, 17.9.1954 (CANB 97470); Port Macquarie, *no collector NSW 115898*, 4.1845 (NSW); Dyers crossing via Nubiack, *Noonan NSW 115896*, 9.1950 (NSW); Allyn River, *Boorman NSW 115903*, 8.1906 (NSW); Upper Wallis Creek, Brunkerville district, *Earp NSW 115900*, 7.1953 (NSW). **Central Coast:** Horse-Shoe Bend, Grose Vale, *Carne NSW 115926*, 3.1910 (NSW); Eastwood, *Johnson NSW 115905*, 4.1949 (NSW); Gordon, *Blakely NSW 115909*, 4.1914 (NSW); Nepean River, *Maiden NSW 115916*, 9.1906 (NSW); Cabramatta, *Woolfs NSW 115911*, (NSW); Georges River, Casula, *McBarron 12546*, 6.1966 (NSW); Central Burragorang Valley, *Holford NSW 115907*, 2.1957 (NSW); Bargo district, *Price NSW 115906*, 10.1947 (NSW); Rocky Creek, Hill Top, *Cheel NSW 115915*, 1.1912 (NSW); Lake Illawarra, *Carne NSW 115910*, 5.1912 (NSW); Broughton Creek on Coolangatta road, Shoalhaven, *Rodway NSW 115920*, 5.1929 (NSW). **South Coast:** Yalwal Creek between Yalwal & Burrier, *Rodway NSW 115922*, 12.1933 (NSW); Yalwal, c. 15 miles [24 km] WSW. of Nowra, *Coveny 3991 & Bisby*, 3.1972 (NSW, CANB); Shoalhaven River, *Monaghan NSW 115919*, 12.1927 (NSW); Clyde River, *Anderson & Harasymiw 22*, 7.12.1976 (CANB 261856). **Northern Tableland:** Armidale district, *Ingram NSW 115892*, 12.1939 (NSW). **Central Tablelands:** Upper Colo River, *Vickery NSW 11001*, 29.3.1950 (NSW, CANB, K); Kowmung River, *Johnson NSW 115893*, 3.1951 (NSW); Barbers Creek, *Rumsey NSW 115894*, 3.1899 (NSW). **North Western Slopes:** Warrumbungle National Park, *Dunlop 539*, 21.8.1969 (CBG). **Central Western Slopes:** Mt Dangar, Gungal, *Boorman NSW 115932*, 10.1904. **North Western Plains:** Pallamallawa, *Gall NSW 115929*, 1916 (NSW); Coolabah, *Maiden & Boorman NSW 115928*, 8.1910 (NSW); Boppy Mtn, near Cobar, *Boorman NSW 115930*, 7.1903 (NSW).

Very similar to *S. verticillata* but often rather more robust and with glabrous lemmas.

***Stipa rudis* Sprengel**, Syst. Veg. Cur. Post 4: 31 (1827); Everett & Jacobs, *Telopea* 2(4): 394 (1983).

HOLOTYPE: AUSTRALIA: 'Nov. Holl., Sieber, *Agrost.* n. 66'. There are two sheets of *Sieber no. 66* in MEL (MEL 59980, 59982) and we have used these as our basis for typification. Another sheet of *Sieber, Agrost.* n. 66, is at K but lacks lemmas.

Mueller (*Fragm.* 8: 104 (1873)) and Bentham (*Fl. Austral.* 7: 570 (1878)) treated *S. rudis* as a synonym of *S. pubescens* R. Br. Hughes (*Kew Bull.* 1921: 21 (1921)) reinstated the name *S. rudis* Sprengel and provided an amended description. However, in addition to the Type (from New South Wales) and a specimen from Victoria (not seen), she cites four specimens from Western Australia that are unlikely to be *S. rudis* Sprengel and may be *S. eremophila* (*vel aff.*). It appears that her amended description was substantially based on the Western Australian specimens and hence does not apply to *S. rudis* Sprengel (notably in respect of the fulvous hairs of the lemma).

Caespitose perennial to 1.2 metres high with conspicuously extravaginal shoots, often from a short rhizome. Culms usually geniculate near the base, slightly compressible, terete, (1-) 2-4 mm wide near the base, slightly ribbed, mainly glabrous or finely scaberulous, but finely pubescent for varying lengths below the nodes; nodes 2-4 exserted, to 50% broader than adjacent internodes, sericeous. Leaf sheaths inflated and falling loose from the culms, slightly ribbed, glabrous to finely and sparsely pubescent, more densely pubescent on the margins just below the orifice, hirsute around the collar; inner margin glabrous; outer margin ciliate just below the orifice of lower sheaths; uppermost sheaths glabrous; cataphylls glabrous, pubescent or shortly villous. Ligule coriaceous, 0.5-2 mm long, ovate to ovate-truncate, slightly lacinate, long- to short-ciliate, abaxial surface pubescent; auricles slightly thickened, with tufts of long to short spreading hairs. Leaf blades to 40 cm long, 2-5 mm wide near the base, erect, usually inrolled, the basal leaves more tightly rolled; abaxial surface scarcely

ribbed or smooth, very densely to sparsely scabrous with minute rigid tubercles or hairs, or almost glabrous; adaxial surface ribbed, densely pubescent or hirsute to sparsely scabrous with minute short hairs; margins similar to abaxial surface. Panicle to 50 cm long, 1.5–5 cm wide (excluding awns), exerted or the base concealed, loosely contracted to spreading with distant fascicles of few, few-flowered branches; axis terete, almost glabrous at the base to scabrous upwards; branches to 15 cm long, terete, scabrous with short to long hairs; pedicels to 15 mm long, angular, scabrous. Spikelets 8–15 mm long (excluding awn), gaping. Glumes unequal to subequal, linear to broadly oblong, with nerves heavily overlain with sclerenchyma, pale green to yellow or purple-tinged, glabrous between the nerves, scaberulous over the nerves and the margins often ciliate, or pubescent overall; lower glume 8–15 mm long, the lower 85–90% 3-nerved, the tip narrowly truncate and firm or broadly obtuse, membranous and erose; upper glume 7–14.5 mm long, the lower 75–90% 3-nerved or 4–5 nerves present in the lower 25–75%, the tip truncate and firm to membranous, or broadly obtuse, membranous and erose. Floret linear or lanceolate, 5.0–11.5 mm long (including callus). Lemma brown to purple-brown at maturity, granular at the base, tuberculate upwards, with sparse fulvous to white hairs at the base, thinning to usually glabrous at the apex; coma obscure, of few hairs to 1 mm long, or absent; 1 lobe 0.05–0.25 mm long, obtuse, or absent. Callus 0.8–3.2 mm long, gently curved with fulvous to white hairs, darker than those of the lemma. Awn 20–90 mm long, 0.15–0.4 mm wide near the base, gently to strongly twice bent; column 8–45 mm long, 4.5–30 mm to the first bend, scabrous to pubescent with hairs 0.05–0.3 mm long; bristle scabrous. Palea 0.5–1.2 mm shorter than the lemma, acute to broadly acute, granular down the centre with hairs similar to those of the lemma, or almost glabrous; margins firm, smooth and glabrous. Lodicules 2–3, membranous; 2 abaxial 0.8–1.7 mm long, oblong to spatulate; paleal acute, c. 1 mm long, or absent. Anthers 2.0–4.0 mm long, pencillate. Caryopsis 3–6 mm long; embryo 20–25% the length; hilum 70–80% the length.

Key to the Subspecies

1. Awn 60–90 mm long, column 32–45 mm long; both glumes broadly obtuse with 1–2 mm of delicately membranous tip, upper glume 11–14.5 mm long
S. rudis subsp. **australis**
- 1*. Awn usually <60 mm long, occasionally to 65 mm long, column usually <25 mm long, occasionally to 30 mm long; glumes firm to the tip or, especially the upper, membranous at the very tip 2
2. Callus 1.5–2.5 mm long, usually >20% the length of the floret (excluding awn); column 20–25 mm long; lower glume narrowly truncate and firm or membranous at the tip, upper glume membranous at the tip, 9–12.5 mm long **S. rudis** subsp. **rudis**
- 2*. Callus 0.8–1.7 mm long, usually <20% the length of the floret (excluding awn); column <20 mm long; glumes narrowly truncate, firm at the tip, the upper glume 7–10 mm long **S. rudis** subsp. **nervosa**

Stipa rudis subsp. **rudis**.

SYNONYM: *S. nervosa* var. *neutralis* J. Vickery, Contrib. N.S.W. Natl. Herb. 1: 335 (1951).
HOLOTYPE: NEW SOUTH WALES: Katoomba, S.T. Blake NSW 13915, 22.1.1939 (NSW).

Nodes to 50% broader than internodes. Cataphylls glabrous or pubescent. Leaf blades to 40 cm long; adaxial surface pubescent to sparsely scabrous with

minute hairs. Panicle to 40 cm long, 1.5–4 cm wide (excluding awns); pedicels to 10 mm long. Spikelets 10–15 mm long (excluding awn). Glumes unequal, glabrous with minute scabrous hairs over the nerves, the margins often ciliate; lower glume 10–15 mm long, the lower 90% 3-nerved, the tip narrowly truncate and firm or membranous; upper glume 9–12.5 mm long, the lower 90% 3-nerved, 4–5-nerved in the lower 25–50%, the tip obtuse and membranous. Floret 7.2–10 mm long (including callus). Coma absent. Callus 1.5–2.5 mm long. Awn (35–) 40–60 (–65) mm long, 0.15–0.4 mm wide, gently to strongly twice bent; column 20–25 mm long, 10–20 mm to the first bend. Caryopsis 3–3.5 mm long.

DISTRIBUTION: On sandstone in higher areas of south-eastern Queensland and eastern New South Wales and Victoria.

SELECTED SPECIMENS: QUEENSLAND: **Darling Downs:** Wallangarra, *Smith 757*, 29.1.1940 (BRI); Wyberba, *Blake 4638A*, 23.1.1933 (NSW). **Moreton:** Moggill nr. Brisbane, *White 7590*, 3.4.1931 (BRI).

NEW SOUTH WALES: **Central Coast:** Blue Mountains, *Calvert, s.d.* (MEL 60678); Woodford, *Henderson 419*, 10.1.1948 (NSW); Pennant Hills, *Vickery NSW 26351*, 6.12.1953 (NSW); Milperra, Georges River, *Vickery*, 26.10.1930 (BRI 250632). **South Coast:** 5 km NE. of NSW/Vic. border on Princes Hwy, *Everett 442 & Jacobs*, 22.10.1981 (NSW); Lyons Road, Currowan State Forest, *Pullen 3968*, 6.12.1963 (CANB). **Northern Tablelands:** Yooroonah, *McKie NSW 8584*, 12.1.1940 (NSW); Glen Elgin, *Paltridge 211*, 3.12.1931 (CANB). **Central Tablelands:** Wentworth Falls, *Henderson f55*, 3.1945 (NSW); Blackheath, *Constable NSW 16356*, 22.1.1948 (NSW). **Southern Tablelands:** Crookwell, *Hewitt NSW 8566*, 9.2.1948 (NSW).

VICTORIA: **Region N:** 8 miles [13 km] from Anakie Junction towards Ballan, *Carroll CBG 024810*, 4.1.1966 (CBG); Christmas Hills, *Aston 457*, 2.12.1959 (MEL, NSW); Heatherdale, *Muir 583*, 11.12.1958 (MEL). **Region P:** c. 5 km NW. of Aireys Inlet, *Carr & Adair 7428*, 6.1.1977 (NSW). **Region T:** 4 miles [6 km] SE. of Willow Grove, toward Moe, *Carroll CBG 024809*, 20.12.1965 (CBG). **Region Z:** Bidwell, *Hunter*, 1.1941 (MEL); Warburton, *Blake 7219*, 19.1.1935 (NSW, BRI); c. 5 miles [8 km] NE. of Mallacoota, *Beaughole 32495 & Finck*, 16.12.1969 (NSW); 4 miles [6 km] E. of Marlo, *Henshall*, 3.1.1968 (NT 43327).

See Everett & Jacobs (*loc. cit.*) for reasons for recognising this and the other two taxa as subspecies.

***Stipa rudis* subsp. *australis* J. Everett & S.W.L. Jacobs**, *Telopea* 2(4): 396 (1983).

HOLOTYPE: TASMANIA: Risdon Vale, *J. Vickery NSW 108620*, 18.1.1949. Robust coarse grass, spreading panicle. Abundant (NSW).

Cataphylls glabrous or pubescent. Nodes to 40% broader than internodes. Ligule 0.5–2 mm long. Leaf blades to 20 cm long; adaxial surface densely pubescent or hirsute. Panicle to 40 cm long, 4–5 cm wide (excluding awns); pedicels to 15 mm long. Spikelets 12–15 mm long (excluding awn). Glumes subequal, glabrous between the nerves, scaberulous over the nerves, the margins ciliate, or pubescent overall; lower glume 12–15 mm long, the lower 85% 3-nerved, the tip broadly obtuse, membranous and erose; upper glume 11–14.5 mm long, the lower 75–90% 3-nerved, 4–5-nerved in the lower 50–75%, the tip broadly obtuse, membranous and erose. Floret 8.6–11.5 mm long (including callus). Coma absent. Lobes absent. Callus 2.0–3.2 mm long. Awn 60–90 mm long, 0.3–0.4 mm wide, gently to strongly twice bent; column 32–45 mm long, 20–30 mm to the first bend. Caryopsis c. 6 mm long.

DISTRIBUTION: Sandstone in higher areas of eastern Victoria, and Tasmania.

SELECTED SPECIMENS: VICTORIA: **Region E:** 22 km N. of Nelson, *Beaughole 55344*, 6.12.1976 (NSW, ACB). **Region N:** Heatherdale, *Muir 582*, 11.12.1958 (MEL). **Region P:** Cranbourne, *Ross*

2660 & *Corrick*, 15.12.1981 (NSW); Frankston, *Corrick 6182*, 28.11.1978 (NSW). **Region S:** Healesville, *Willis*, 27.2.1972 (MEL). **Region V:** Berrima River, *Calvert 23*, s.d. (MEL 60677). **Region W:** 3 km NE. of Metung, *Everett 428 & Jacobs*, 21.10.1981 (NSW). **Region Z:** Buchan, *Verdon 493*, 21.11.1970 (CBG); 2.5 miles [4 km] W. of Genoa, *Beaglehole 32767*, 24.12.1968 (NSW).

TASMANIA: Launceston, *Cheel NSW 108621*, 1.1928 (NSW); Risdon Vale, *Vickery NSW 108620*, 18.1.1949 (NSW); Kingston, junction of main road with Lesleyvale Road, *Townrow 165*, 1.1968 (JEST); 1 mile [2 km] W. of Dunalley Bridge, *Townrow 103*, 1.1967 (JEST); Hobart, *Black 290*, 8.10.1921 (AD); Mt Wellington, *Martin NSW 108622*, 3.1933 (NSW); Mathinna, *Phillips*, 29.1.1962 (NSW 108619, duplicate of CBG 001268); Evandale, beside South Esk Bridge, *Townrow 114*, 19.12.1967 (UTAS); c. 10 miles [16 km] W. of Copping, *Vickery NSW 117311*, 15.1.1949 (NSW); 0.5 mile [1 km] E. of O'Connors Peak/Campbelltown road Junction, *Townrow 124*, 12.1967 (JEST).

***Stipa rudis* subsp. *nervosa* (J. Vickery) J. Everett & S.W.L. Jacobs**, *Telopea* 2(4): 396 (1983). Based on *S. nervosa* var. *nervosa* J. Vickery, *Contrib. N.S.W. Natl. Herb.* 1: 335 (1951).

HOLOTYPE: NEW SOUTH WALES: **Central Coast:** Epping, *W.F. Blakely NSW 8491*, 10.1913 (NSW).

Nodes to 25% broader than internodes. Cataphylls pubescent, shortly villous or glabrous. Ligule 0.5–1.5 mm long. Leaf blades to 40 cm long; adaxial surface pubescent to sparsely scabrous with minute hairs. Panicle to 50 cm long, 1.5–3 cm wide (excluding awns); pedicels to 10 mm long. Spikelets 8–12 mm long (excluding awn). Glumes unequal, glabrous between the nerves, scaberulous over the nerves, the margins often ciliate; lower glume 8–12 mm long, the lower 90% 3-nerved, the tip narrowly truncate and firm; upper glume 7–10 mm long, the lower 90% 3-nerved or 4–5-nerved in the lower 50–60%, the tip truncate and firm. Floret 5–7.5 (–8.5) mm long (including callus), with white hairs. Coma usually present but obscure, of few hairs up to 1 mm long. Callus 0.8–1.7 mm long. Awn 20–45 mm long, 0.15–0.25 mm wide, gently twice bent; column (8–) 11–18 (–20) mm long, 4.5–11 mm to the first bend. Caryopsis 3–4.5 mm long.

DISTRIBUTION: Sandstone in higher areas of south-eastern Queensland, eastern New South Wales and Victoria.

SELECTED SPECIMENS: QUEENSLAND: **Darling Downs:** between Bald Mountain & Wyberba, *Blake 4522*, 16.1.1933 (BRI); Wallangarra, *Hilton NSW 11691*, 22.12.1944 (NSW, dupl. AD).

NEW SOUTH WALES: **Central Coast:** Epping, *Blakely NSW 8491*, 10.1913; Nepean River, c. 4 miles [6 km] S. of Wallacia, *Salasoo 2678*, 1.12.1963 (NSW). **South Coast:** Yalwal, *Rodway NSW 116189*, 2.1.1933 (NSW); Milton, *Cambage NSW 8499*, 23.12.1908 (NSW); c. 7 km WNW. of Cobargo, *Austin 265*, 14.4.1973 (CANB). **Northern Tablelands:** 3 miles [5 km] towards Glencoe from Yarrow Creek, *Jessup & Gray 2622*, 6.1954 (CANB); Moredun Creek Dam, *McKie NSW 8494*, 30.12.1947 (NSW); The Devils Pinch, Armidale to Guyra, *McKie W126*, 6.12.1931 (BRI); SW. of Guyra, *Youman NSW 116200*, 24.12.1931 (NSW). **Central Tablelands:** 15 miles [24 km] ENE. of Capertee, *Vickery NSW 116204*, 6.1.1975; Katoomba, *Blake 13932*, 23.1.1934 (NSW). **Southern Tablelands:** Conder Creek, A.C.T., *Gauba NSW 116187*, 11.1.1959 (NSW).

VICTORIA: **Region R:** Little Paradise Falls, c. 27 miles [43 km] SW. of Myrtleford, *Beaglehole 43767 & Cameron*, 5.12.1973 (NSW). **Region V:** Suggan Buggan, *Willis*, 16.1.1948 (MEL 1509510). **Region W:** c. 20 km NNW. of Omeo, *Beaglehole 68689*, 19.1.1981 (NSW); Orbost, *Prove*, 1904 (MEL 60745); Tostaree, *Hunter*, 12.1951 (MEL 60746); 6 km NE. of Lakes Entrance, *Everett 435 & Jacobs*, 21.10.1981 (NSW); c. 6 miles [9 km] W. Lakes Entrance, Metung road, *Muir 1957*, 27.11.1960 (MEL). **Region X:** Sale, *Vickery NSW 8530*, 26.1.1935 (NSW). **Region Z:** Mt Drummer, *Willis*, 25.1.1947 (MEL 60718).

Stipa scabra Lindley in Mitchell, Journ. Trop. Australia: 31 (1848); Bentham, Fl. Austral. 7: 570 (1876), in part; Hughes, Kew Bull. 1921: 18 (1921) in part, *ibid.* 1922: 17 (1922).

HOLOTYPE: 'Moora, on the Bogan R., 1846, Mitchell 125' (CGE!). The holotype was collected by Mitchell in New South Wales 'Along the Bogan River'. The specimen label cites 'Moora, on the Bogan R., 1846, Mitchell 125' and also bears Lindley's handwriting. A specimen at NSW (NSW 116442) is a duplicate of the Holotype collection. At K there is a drawing plus fragments of spikelets identified by D.K. Hughes as *Stipa scabra* Lindl., which bears the locality '32°S 147°E', which is south of Nyngan and close to the Bogan River; the sheet also bears a further attached drawing of the spikelet and lemma with annotations by Hughes and the label 'Mitchell 125, Bogan River' (see CANB photo 237002).

Caespitose perennial to c. 0.5 metres high, without rhizomes, with a basal tuft of fine leaves about half the height. Culms erect or slightly geniculate at the base, terete, 0.6–1.2 (–1.6) mm wide near the base, \pm compressible, smooth to moderately ribbed upwards, glabrous, scaberulous or pubescent with hairs minute–0.1 mm, densely and shortly pubescent just below the nodes; nodes 2–3 (–5), exserted, glabrous, slightly swollen. Leaf sheaths at first tightly enveloping the culm, later becoming slightly loose, (2.5–) 3.5–5 (–6) mm wide, (smooth-) slightly to moderately (or on the upper sheath strongly) ribbed, glabrous, scabrous or scaberulous or pubescent; inner margin glabrous; outer margin glabrous or ciliate with hairs to 0.2 (–0.5) mm long. Ligule truncate, membranous, 0.3–1 (–1.5) mm long, ciliate with hairs minute–0.1 (–0.3) mm long (upper ligules may be asymmetrical with one lobe to 4 mm or more long); abaxial surface glabrous; auricles, when present, c. 0.2 mm, glabrous, or with hair tufts to 1 mm long. Leaf blade folded or inrolled, 0.7–1.5 (–2) mm wide, to 25 cm long; abaxial surface smooth to strongly ribbed, with minute tubercles and/or hairs to 0.15 (–0.5) mm long; adaxial surface strongly ribbed, puberulous with hairs minute (–0.3 mm) long; margins glabrous, scabrous or ciliate. Panicle to 30 cm long, exserted, with moderately distant fascicles of few to many few-flowered branches, contracted or expanded, (0.5–) 1–2 (–3) cm wide (excluding awns); axis terete to slightly angular, glabrous or scabrous with hairs minute (–0.1 mm) long; branches (0.5–) 1.5–3.5 (–7) cm long, angular, scabrous or pubescent along the edge with hairs minute–0.1 (–0.2) mm long; pedicels (1.5–) 3.5 (–8) mm long, angular, scabrous or scaberulous with hairs minute–0.1 mm long, sometimes only along the edges. Spikelets (8–) 9–15 mm long (excluding awn), scarcely to moderately gaping at maturity. Glumes unequal, acute to acuminate, glabrous to scabrous upwards; lower glume (8–) 9–10 (–15) mm long, lower (10–) 20–30% (1–) 3 (–5)-nerved; upper glume (6–) 9–13 mm long, lower (10–) 20–25 (–30)% 5–3 (–1)-nerved glabrous to scabrous upwards. Floret narrow-turbinate, without a neck, (4–) 5–6 (–6.5) mm long (including callus). Lemma smooth to granular upwards, densely sericeous with white hairs 0.2–0.4 (–0.6) mm long; lobes (minute–) 0.2–0.25 (–0.5) mm long, ciliate with hairs minute–0.1 mm long; coma obscure, of few hairs (0.1–) 0.2–0.4 (–0.6) mm long or absent. Callus (1–) 1.4–2 mm long, straight, weakly bent at the tip, densely sericeous with white hairs 0.1–0.5 (–0.8) mm long. Awn 30–70 mm long, falcate, with 2 bends, c. 0.2 mm wide near the base, straw-coloured to brown; column (5.5–) 8–15 mm long, (2.5–) 4–7 mm to the first bend, scabrous with hairs (minute–) 0.1–0.2 (–0.3) mm long; bristle scabrous to scaberulous with hairs minute–0.15 mm long. Palea (75–) 90–95% the length of the lemma, obtuse (–acute), often erose, granular along the centre, smooth at the edges, sericeous along the centre back with hairs (0.1–) 0.2–0.3 (–0.4) mm long; margins glabrous. Lodicules 2, abaxial, membranous, (0.7–) 1.2 mm long, oblong. Anthers (0.5–) 1 (–2.5) mm long, penicillate. Caryopsis (2.5–) 3 (–4.5) mm long; embryo 20–35% the length; hilum (55–) 70 (–80)% the length.

The identity and circumscription of *S. falcata*, treated here as *S. scabra* subsp. *falcata*, have been a source of considerable confusion in Australian herbaria where many other species have been misdetermined under this name, a confusion doubtless initiated by Hughes in her citation (Kew Bull. 1922: 16 (1922)) of a Western Australian specimen with her description, by her citation of three additional specimens that we suspect (but have been unable to verify) may be *S. scabra* Lindl., and by her comments (*loc. cit.*) under *S. variabilis*. J.M. Black, Fl. S. Austral. edn 2: 87 (1943), certainly included other species of the Falcatae group under this name, including *S. nodosa* S.T. Blake. It seems certain that Bentham, Fl. Austral. 7: 568 (1878), incorrectly referred specimens of *S. falcata* and other species of the Falcatae group to *S. setacea* R. Br.

Discrimination between *S. scabra* and *S. falcata* is difficult and their distributions overlap. Because of their similarity and the tendency for the distributions to polarize, we feel that it is best to regard *S. falcata* as a subspecies of *S. scabra*. Subspecies *scabra* reaches its maximum abundance in the predominantly summer rainfall zone of northern New South Wales, extending into Queensland and northern South Australia, but scattered plants may be found over a wider area. Subspecies *falcata* reaches its maximum abundance in the winter rainfall zones of southern New South Wales, Victoria and southern South Australia, but plants occur as far north as Dubbo and the New England region.

In foliage, appearance of the rootstock, glumes, indumentum and dimensions of the lemma and column, the two subspecies are much alike. In subsp. *scabra* the ligule is membranous, long (especially in uppermost leaves) and more or less glabrous. The inflorescence is narrow with more or less erect branches and spikelets. In subsp. *falcata* the membranous ligule is shorter and has few to many erect cilia on the back of the auricular lobe. The inflorescence tends to be rather more spreading with more divergent branches and spikelets.

Key to subspecies

- | | |
|---|-----------------------|
| Inflorescence narrow; ligules (0.3–) 0.6–1 (–1.5) mm long, asymmetrical auricular lobe of upper leaves to 4 mm or more long, usually glabrous | subsp. <i>scabra</i> |
| Inflorescence spreading; ligules 0.3–0.6 mm long, asymmetrical lobe of upper nodes usually <1 mm long, usually with a row of hairs | subsp. <i>falcata</i> |

Stipa scabra subsp. *scabra*

Caespitose perennial c. 0.5 metres high. Upper leaf sheaths 2–4 mm wide. Ligule truncate, membranous, (0.3–) 0.6–1 (–1.5) mm long, ciliate; auricular lobes on upper culm leaves usually asymmetrical with one lobe to 4 mm long or more, glabrous. Leaf blades folded or inrolled, 0.6–1.2 mm wide, to 25 cm long; abaxial surface smooth to slightly ribbed. Panicle to 30 cm long, contracted, 1–2 cm wide. Lower glume (8–) 9–10 (–15) mm long; upper glume (6–) 9–13 mm long. Callus (1–) 1.4–1.7 mm long. Awn 30–70 mm long. Anthers (0.5–) 1 (–2.5) mm long; penicillate. Caryopsis (2.5–) 3 (–3.5) mm long.

DISTRIBUTION: Widespread through southern Queensland, New South Wales and South Australia; extending into Victoria, Western Australia and Tasmania.

SELECTED SPECIMENS: QUEENSLAND: **Burnett:** South Durong, *Smith*, 12.1932 (BRI). **Warrego:** Chesterton, *Blake 11097*, 7.4.1936 (NSW); Gilruth Plains, *Mackerras*, 11.1939 (CANB 1254). **Maranoa:** 130 km SE. of Charleville, *Pressland*, 11.3.1976 (BRI); Morven, *McComb*, 4.1918 (BRI); Hodgson, near Roma, *Lewington*, 11.1933 (BRI); Roma, *Blake 10836*, 29.3.1936 (BRI); Coolibah, *Haywood 1930* (BRI); 60 miles [96 km] W. of St George, *Whitehouse*, 12.1933 (BRI); 35 miles [56 km] SW. of Eulo, *Law 49*, 8.1967 (BRI); Cashel Vale, S. of Bollon, *Everist 3669*, 28.4.1949 (BRI); Nindingully, *Allen 641*, 21.10.1944 (CANB 10953). **Darling Downs:** Palardo, W. of Miles, *Blake 5832*, 9.5.1934 (NSW); Bunya Mts., *White*, 10.1919 (BRI); Hampton, *Scattine*, 5.11.1975 (BRI); 2 miles [3 km] S. of Pittsworth, *Everist & Webb 1222*, 20.11.1946 (CANB, BRI); Pittsworth, *White*, 4.2.1930 (K, BRI); 'Kindon' Station, 54 miles [86 km] NNE. of Goondiwindi, *Smith 513*, 5.12.1938 (BRI); 20 km from Warwick on Stanthorpe road, *Simon & Henderson 2511*, 9.12.1974, (CANB, BRI, NSW); Warwick, *Beckler* (MEL 60855); Bybera, *White 12223*, 3.9.1934 (BRI); 46 km from Inglewood on Warwick road, *Simon, Pedley & McDonald 2861*, 3.9.1975 (BRI, NSW); Goondiwindi, *Blake 10505*, 25.2.1936 (NSW); 30 miles [48 km] from Goondiwindi on Milmerran road, *Johnson 505*, 12.7.1958 (BRI, CANB); 'Ballandean' Cattle Station, *Smith 720*, 28.1.1940 (BRI); near Wallangarra, *Clemens*, 10.1944 (BRI). **Moreton:** Brisbane, *Bailey*, 3.1873 (MEL 60853); Mt Cordeaux, *Blake 13869*, 20.11.1938 (NSW).

NEW SOUTH WALES: **North Coast:** Singleton, *Boorman NSW 116407*, 11.1914 (NSW, BRI); Rutherford, *Hilton*, 19.10.1944 (ADW 43981, 43917, 43911, NSW 116441). **Central Coast:** Concord, *Coveny NSW 116419*, 7.9.1966 (NSW); Menangle Park, *McBarron 16208*, 8.1.1969 (NSW); Nepean River, *McBarron 12376*, 12.4.1966 (NSW). **Northern Tablelands:** 16 miles [26 km] W. of Guyra, *McKie*, 2.1.1947 (BRI); Kelso, 30 miles [48 km] NW. of Guyra, *McKie NSW 116414*, 4.4.1930 (NSW); Dundee, *Bellert NSW 116415*, 7.2.1966 (NSW); 9.6 miles [15 km] W. of Yarrowyck, *Jessup & Gray 2249*, 3.11.1953 (CANB); Chiswick, c. 10 miles [16 km] S. of Armidale, *Jessup & Gray 1711*, 23.10.1952 (CANB); Blue Hole, *Davis NSW 116401*, 31.4.1949 (NSW); Rimbanda, New England, *Jessup & Gray 2324*, 10.11.1953 (CANB); Timor, 15 miles [24 km] E. of Murrurundi, *Story 7482*, 9.10.1960 (BRI). **Central Tablelands:** Lucknow, *Henderson NSW 116648*, 4.1.1948 (NSW); Bathurst, *Ingram NSW 116409*, 28.2.1942 (NSW); Gap Creek, Mittagong, *De Nardi 471*, 2.11.1970 (NSW). **Southern Tablelands:** Lake George, *Blake 7560*, 3.2.1935 (NSW); Molonglo R., *Gauba CBG 003571*, 6.12.1949 (CBG); Lake Burley Griffin, *Solling 73*, 18.2.1972 (NSW); Canberra, *Mair 10*, 11.1932 (BRI). **North Western Slopes:** 30 miles [48 km] S. of Yetman, *Jessup & Gray 1634*, 4.10.1952 (CANB); Warialda, *Vickery NSW 18447*, 1.1932 (NSW); 6 miles [10 km] from Warialda, Moree road, *Roe 204*, 8.10.1949 (CANB); 10 miles [16 km] W. of Inverell, *Hely NSW 116382*, 9.11.1949 (NSW); Inverell, *Thomas NSW 116435*, 11.1912 (NSW); Pilliga district, *Eastburn NSW 116434*, 11.1948 (NSW); Razorback Range, *Pickard & Coveny 1125*, 4.6.1969 (NSW); Woods Reef, *Rupp NSW 116383*, 6.1913 (NSW); Barraba, *Hay NSW 116396*, 9.1903 (NSW); Crow Mt road, *Rupp NSW 116413*, 4.1914 (NSW); Boggabri, *Cambage 2449*, 11.1909 (NSW); between Somerton & Manilla, *Hely NSW 116412*, 6.11.1949 (NSW); nr. Baradine, *Forsyth NSW 116427*, 10.1899 (NSW); 7 miles [11 km] E. of Gunnedah, *Hely NSW 116375*, 29.10.1949 (NSW); Tamworth, *Rodway NSW 116420*, 10.1924 (NSW); 13 miles [21 km] ENE. of Tambar Springs, *De Nardi 180*, 29.9.1968 (NSW); Loomberah district, c. 20 miles [32 km] S. of Tamworth, *Goode 170*, 17.11.1954 (NSW); 10 miles [16 km] NW. of Girilambone, *Thompson NSW 116847*, 8.9.1959 (NSW); Burrumbuckle Rock, Warrumbungle Range, *Crisp 3236 & Verdon*, 4.10.1977 (CBG). **Central Western Slopes:** 8 miles [13 km] SE. of Murrurundi, *Story 6911*, 25.11.1959 (CANB, NSW); above Murrurundi railway tunnel, Hunter Valley, *Story 6919*, 25.11.1959 (CANB, BRI); Wingen, *Cambage 2502*, 30.10.1909 (NSW); Belltrees via Scone, *White NSW 116417*, 2.1920 (NSW, BRI); 2 miles [3 km] N. of Burroway, *Biddiscombe NSW 116398*, 13.3.1954 (NSW); 9 miles [14 km] SE. of Merriwa, *Story 6788*, 8.10.1959 (CANB, NSW); Upper Hunter River, *Jackson*, 4.1913 (CANB 1239); 8 miles [13 km] NE. of Dubbo, *Coveny 2479*, 26.11.1969 (NSW); c. 3 miles [5 km] from Dubbo, *Phillips CBG 067325*, 13.9.1963 (CBG); Dubbo, *Vickery NSW 116625*, 13.1.1934 (NSW); Gungah, *Boorman NSW 116426*, 9.1904 (NSW); Denman, *Braithwaite NSW 116425*, 11.1949 (NSW); Burrendong, nr. Wellington, *Herrington NSW 116405*, 1950 (NSW); Mudgee, Wollar road, *Constable NSW 11493*, 5.6.1950 (NSW); Young, *Paterson NSW 116432*, 12.1917 (NSW); Temora, *Dwyer NSW 116623*, 11.1915 (NSW). **South Western Slopes:** Galong, *Murphy NSW 116399*, 2.1962 (NSW); Wagga Wagga, *Wenholz NSW 116424*, 1.1913 (NSW). **North Western Plains:** Bulli Ridge, Collarenebri, *Waterhouse NSW 116385*, 29.10.1950 (NSW); Collarenebri to Walgett, *Vickery NSW 116438*, 21.12.1934 (NSW); Burrigillo, Merrywinebone, *Waterhouse NSW 116403*, 2.11.1956 (NSW); Mt Oxley, nr. Bourke, *Ingram NSW 116386*, 13.7.1958 (NSW); Tarcoona, *Keane NSW 116446*, 10.1972 (NSW); S. of Coolabah, *Jacobs 7*, 2.11.1971 (NSW); 29 miles [46 km] NNW. of Wilcannia, *De Nardi 255*, 20.5.1969 (NSW); 18 miles [29 km] NW. of Nyngan, *Thompson NSW 116846*, 8.9.1969 (NSW); Nyngan, *Forbes NSW 116411*, 21.4.1947 (NSW); Collie to Gilgandra, *Vickery NSW 116429*, 5.1.1936 (NSW). **South Western Plains:** 'Bundure' Station, N. of Mt Hope, *Mariensz 141*, 21.5.1969 (NSW); Waranary Hill, W. of Roto, *Jacobs 509*, 25.10.1972 (NSW); Condobolin, *Kidston NSW 116380*, 9.1894 (NSW); 1.5 km W. of Mt Binya, c. 25 km NE. of Griffith, *Crisp 1424*, 12.1.1975

(CBG, NSW); Griffith, *Giltinan NSW 116655*, 27.8.1939 (NSW). **South Far Western Plains:** spur of Manfred Mountain, *Fox 8006051*, 8.6.1980 (NSW).

VICTORIA: **Region D:** 8.75 miles [14 km] NNW. of Dergholm, *Beaglehole 37950*, 25.11.1971 (ACB). **Region J:** Stawell, *Williams 380*, 2.1955 (AD). **Region M:** c. 50 km NW. of Bendigo, *Beaglehole 69411*, 23.10.1981 (NSW). **Region V:** NE. of Bendigo, *Beaglehole 33210*, *Rogers & Finck*, 6.1.1970 (NSW). **Region W:** Monument Ridge, *Beaglehole 37241 & Rogers*, 6.3.1971 (ACB); Jingallala R., *Beaglehole 35747*, 3.1.1971 (NSW); Devils Backbone, *Beaglehole 37270*, 8.3.1971 (NSW); between Ensay North & Ensay South, *Beaglehole 37032*, 24.2.1971 (NSW); Bairnsdale district, *Hart*, 20.10.1933 (MEL 60022). **Region Z:** 8 miles [13 km] from Tubbutt towards McKillops Bridge, *Carroll NSW 116439*, 17.12.1965 (NSW, CBG); N. of Wulgulmerang, *Beaglehole 36151 & Rogers*, 6.1.1971 (NSW).

TASMANIA: 2 miles [3 km] W. of Sorrell-Orielton road along road to Richmond, *Townrow 72*, 11.1967 (JEST).

NORTHERN TERRITORY: Central Australia, *Forde 1575*, 1960 (CANB).

SOUTH AUSTRALIA: **North-western:** Piltardi, Mann Ranges, *Cleland*, 21.8.1954 (ADW 44135); Watarunya Rockhole, Mt Lindsay 27°02'S, 129°52'E, *Barker 3076*, 31.8.1978 (AD); Everard Ranges, c. 25 km WSW. of 'Everard Park', *Eichler 17527*, 15.9.1963 (AD); Cheesman Peak summit, *Weber 5316*, 28.8.1978 (AD). **Flinders Ranges:** Mt Lyndhurst, *Hilton 1398*, 9.4.1955 (ADW); Gammon Ranges, *Eichler 12683*, 17.9.1956 (ADW); Wilpena Pound, 31°31'S, 138°34'E, *Everett 270*, 17.9.1981 (NSW); Central Chase Range, *Crisp 836*, 1.9.1974 (AD). **Eastern:** 'Mt Victor', *Crisp 440*, 4.9.1971 (AD). **Eyre Peninsula:** Red Rock, 'Roopena', *Cleland*, 5.11.1936 (AD 96323285); Iron Knob, *Copley 2308*, 12.10.1968 (AD); Whyalla West, *Hilton 160*, 6.9.1952 (ADW). **Southern Lofty:** Highbury, *Kraehenbuehl 823*, 22.10.1962 (AD); Manningham, *Cleland*, 9.1946 (AD 96323269); Encounter Bay, *Cleland*, 15.8.1940 (AD 95713076).

WESTERN AUSTRALIA: **Giles:** NE. of Cavanagh Ranges, *George 12164*, 26.7.1974 (PERTH). **Austin:** 154 km from Mt Magnet, Geraldton road, *Goodall 2204*, 2.11.1963 (PERTH); nr. Hampton Hill, *Lipinski 206*, 10.1975 (PERTH). **Helms:** 65 km NE. of Laverton, *Beaglehole 59950 & Ertz*, 16.9.1978 (NSW).

***Stipa scabra* subsp. *falcata* (Hughes) J. Vickery, S.W.L. Jacobs & J. Everett, comb. et stat. nov.**

BASYNYM: *Stipa falcata* Hughes, Kew Bull. 1921: 14 (1921).

HOLOTYPE: NEW SOUTH WALES: 'Murrumbidgee, McArthur 141*' (K!), the asterisk indicating its status as Type. 'Murrumbidgee' [River] is a rather indefinite locality name encompassing a wide range of habitats; however, it is known that other plant collections by McArthur from the Murrumbidgee were obtained from the vicinity of Yass, about 1850 (McGillivray, pers. com.).

Caespitose perennial c. 0.5 metres high. Upper leaf sheaths 2.5–4.5 mm wide. Ligule truncate, membranous, 0.3–0.6 mm long, minutely ciliate; auricular lobes usually less than 1 mm long with a row of ciliate hairs (0.1–) 0.5–0.9 mm long at the base. Leaf blade expanded, folded or inrolled, 0.6–1.2 mm wide, to 15 cm long; abaxial surface strongly ribbed. Panicle 10–25 cm long, usually open, 2–3 cm wide. Lower glume 10–13 (–15) mm long, upper glume 8–10 (–13) mm long. Callus 1.5–2 mm long. Awn 55–65 mm long. Anthers 2–3 mm long, ± penicillate. Caryopsis 3–3.5 mm.

DISTRIBUTION: Mainly Tableland and southern areas of N.S.W., Victoria and South Australia.

SELECTED SPECIMENS: QUEENSLAND: **Darling Downs:** Stanthorpe, *Blake 4412*, 12.1.1933 (BRI, NSW).

NEW SOUTH WALES: **North Coast:** Rutherford Camp, *Hilton*, 10.1944 (ADW 43910). **Central Coast:** Homebush, *Vickery NSW 116647*, 3.11.1929 (NSW); Rookwood, *Vickery NSW 116646*, 21.9.1930 (NSW). **Central Tablelands:** Little Bald Hill, c. 4 miles [6 km] N. of Hill End, *Pickard 479*, 23.10.1969 (NSW); Peel via Bathurst, *Constable NSW 16573*, 11.10.1950 (NSW); Rydal, *Boorman*, 12.1900 (NSW). **Southern Tablelands:** Goulburn, *Phillips CBG 001273*, 18.4.1961 (CBG); ESE. of Murrumbateman, *De Nardi 486*, 3.11.1970 (NSW); 8 miles [13 km] SW. of Bungendore, *Story 7897*, 17.4.1967 (CANB); Black Mountain, Canberra, A.C.T., *Pullen 2310*, 3.11.1960 (CANB,

(NSW); Mt Ainslie, A.C.T., *Gauba CBG 003569*, 29.10.1949 (CBG); Mt McDonald, Uriarra area, A.C.T., *Pullen 2343*, 15.11.1960 (NSW); Uriarra Crossing, Murrumbidgee River, A.C.T., *Burbidge 1817*, 13.1.1948 (CANB); Kambah Pool, A.C.T., *Gauba CBG 046361*, 2.12.1954 (CBG, BRI); Tinderry Mountains, *Hartley*, 21.11.1971 (CANB 243679, NSW); Tumberumba district, *Morland NSW 116642*, 4.3.1948 (NSW); on Snowy Mountains Highway near Rhine Falls, *Muir 2419*, 26.10.1961 (NSW, MEL); Cooma, *Mueller NSW 116606*, 10.11.1952 (NSW). **Central Western Slopes:** Dubbo, *Boorman NSW 116614*, 10.1907 (NSW); 1 mile [1.6 km] E. of Cooyal, *Coveny 2461*, 9.11.1969 (NSW); South Mudgee, *Tindale NSW 116640*, 16.10.1953 (NSW); Bowan Park near Cudal, *Blakely NSW 116612*, 10.1906 (NSW); Cowra, *Breakwell NSW 116615*, 9.1913 (NSW); Maimura, *Robinson NSW 116644*, 6.11.1934 (NSW); Young, *Maiden NSW 116638*, 12.1899 (NSW); Ardlethan, *Boorman NSW 116628*, 12.1917 (NSW); Temora, *Elliot NSW 116608*, 10.1912 (NSW); Wallendbeen, *Breakwell NSW 116629*, 11.1913 (NSW). **South Western Slopes:** Demondrille, *Cheel NSW 116618*, 13.11.1925 (NSW); Cootamundra, per *Glenfield Veterinary Research Station NSW 116611*, 5.10.1932 (NSW); S. of Wagga Wagga, *Phillips CBG 054399*, 18.10.1971 (CBG); The Rock, *Phillips CBG 024977*, 19.10.1965 (CBG); 4 miles [6 km] E. of Henty, *Flynn 63*, 6.11.1970 (NSW); Howell Reserve, 4 miles [6 km] W. of Burrumbuttock, *McBarron 4733*, 3.8.1950 (NSW); Corowa, *Moore 474*, 5.12.1946 (CANB); Albury, *Blake 7416*, 27.1.1935 (NSW). **South Western Plains:** Milewa State Forest, 25 miles [40 km] S. of Deniliquin, *Leigh NSW 151532*, 3.12.1964 (NSW).

VICTORIA: **Region H:** 5 miles [8 km] from Wedderburn towards Inglewood, *Phillips CBG 003139*, 31.10.1963 (CBG); Inglewood, *Williamson (MEL 60911)*. **Region M:** Eaglehawk, *Canning 3009*, 14.11.1969 (CBG). **Region N:** Port Phillip, *Mueller (CANB 249744)*. **Region R:** Warby Range, *Canning 4163*, 28.12.1976 (CBG); Yarrowonga Road, 6 miles [10 km] north of Wangaratta, *Muir 1691*, 1.11.1960 (MEL); Mount Pilot Scenic Reserve, c. 8 miles [13 km] N. of Beechworth, *Beaughole 43819 & Cameron*, 8.12.1973 (NSW); Euroa, *Meebold 21577*, 11.1936 (NSW).

SOUTH AUSTRALIA: **Flinders Ranges:** Wilpena, *Symon 635*, 15.9.1960 (ADW); Mt Remarkable National Park, *Donner 4907*, 6.8.1974 (AD). **Eyre Peninsula:** Mt Wudinna, *Ising*, 7.9.1938 (AD 97650093). **Northern Lofty:** nr. Burra, *Field*, 10.1894 (AD 95811205); Tothill Range, *Kraehenbuehl 1152*, 27.10.1963 (AD). **Murray:** Peebinga, c. 80 km SSE. of Renmark, *Cleland*, 14.10.1960 (AD 968061297); 3 miles [5 km] W. of Murray Bridge, *Crocker*, 23.10.1943 (CANB 12174); c. 5 km S. of Monarto South, *Spooner 3120*, 21.10.1973 (AD). **Southern Lofty:** Saddleworth, *Symon 788*, 27.10.1960 (ADW); c. 16 km N. of Nuriootpa, *Kraehenbuehl 1689*, 23.10.1966 (AD); Altona via Lyndock, *Hilton 188*, 22.10.1952 (ADW); Highbury, *Smith 720*, 1.10.1967 (AD); Waite Institute, *Hilton*, 20.9.1944 (ADW 43907); Sleeps Hill, *Hilton*, 20.9.1944 (ADW 43901); Belair, *Koch 934*, 10.1902 (PERTH); Kinchina, *Cleland*, 15.10.1955 (AD 95705079); Hackham, *Ising*, 10.10.1928 (ADW 43914); c. 5 km W. of Victor Harbor, *Cleland*, 16.8.1940 (AD 95713077); Encounter Bay, *Cleland*, 9.1927 (AD 96324033). **Kangaroo Island:** nr. Harriet River, *Symon*, 8.1954 (ADW 4405). **South-eastern:** Scorpion Spring National Park, c. 15–40 km S. of Pinaroo, *Simon 8640*, 22.10.1973 (ADW); nr. Narrung, *Cleland*, 17.11.1953 (AD 96323314); Box Flat, 34 km SSW. of Lameroo, 35°37'S, 14°24'E, *West 2452*, 9.10.1977 (AD); Tintinara, *Hilton*, 12.11.1935 (ADW 43900); c. 10 km SE. of Naracoorte, *Alcock 28*, 12.1976 (AD); Big Heath National Park, *Alcock 3120*, 11.11.1969 (AD); Carpenter Rocks, *Spooner 5513*, 5.11.1977 (AD).

There are some intermediates between the subspecies that have the inflorescence type of one subspecies but the ligule type of the other. Some examples are:

QUEENSLAND: Goodiwindi, *Blake 1050*, 25.2.1936 (NSW). NEW SOUTH WALES: Warialda, *Vickery NSW 18447*, 1.1932 (NSW); N. of Gunnedah, *Hely NSW 117372*, 30.10.1949 (NSW); 'Iolanthe', 26 km W. of Garah, *Solling NSW 117374*, 21.2.1971 (NSW); Collarenebri, *Waterhouse NSW 116385*, 29.10.1950 (NSW); Girilambone, *Thompson NSW 116847*, 8.9.1969 (NSW). VICTORIA: Suggan Buggan, *Willis NSW 117373*, 16.1.1948 (NSW); Keilor, *Meebold 21812*, 12.1936 (NSW). SOUTH AUSTRALIA: Sandergrove, *Menzel NSW 117375*, 10.1896 (NSW).

Stipa semibarbata R. Br., Prodr.: 174 (1910); Hook. f., Fl. Tasman. 2: 110 (1860), in part; Kunth, Enum. Pl. 1: 183 (1833); Bentham, Fl. Austral. 7: 568 (1878), in part but excluding at least the N.S.W. citations; Hughes, Kew Bull. 1921: 20 (1921), at least as to the Tasmanian citations; Rodway, Tasmanian Fl.: 262 (1903); Black, Fl. S. Austral. 1: 66 (1922), probably only in part, edn 2: 89, fig. 109 (1943); Gardner, Fl. W. Austral. 1, Gram.: 179 (1952), probably only in part.

HOLOTYPE: TASMANIA: Port Dalrymple, *R. Brown 6204* (BM!)

Caespitose perennial to c. 1 metre high, not rhizomatous, with a basal tuft of leaves to about half the height. Culms erect or geniculate at the base, terete, 1–3 mm wide near the base, not compressible, smooth, pubescent to scaberulous or glabrous upwards but pubescent near the nodes; nodes 2–3, exserted, sericeous with hairs 0.3–0.5 mm long, 25–50% wider than the adjacent internodes. Leaf sheaths at first tightly enveloping the culm, later becoming slightly free, 5–10 mm wide, slightly to strongly ribbed, minutely pubescent to glabrous or scaberulous with minute tubercles; inner margin glabrous; outer margin ciliate with hairs minute–0.7 mm long to glabrous; collar ciliate with hairs (0.2–) 0.5–0.8 mm long. Ligule truncate, coriaceous, 1–1.5 mm long, ciliate with hairs 0.2–0.5 mm long; abaxial surface sericeous with hairs c. 0.5 mm long; auricles thickened, 0.5–1 mm long. Leaf blade loosely rolled, 1–3 (–7) mm wide, to 30 cm long; abaxial surface moderately ribbed, slightly scabrous with minute tubercles, to glabrous; adaxial surface strongly ribbed, pubescent with hairs minute–0.2 (–0.5) mm long; margins glabrous to scaberulous. Panicle 5–30 cm long, exserted, with moderately distant fascicles of unequal, few- to many-flowered, compound branches, contracted, 2–4 cm wide (excluding awns); axis, branches and pedicels terete, scabrous or pubescent with hairs minute–0.6 mm long; branches 2–6 cm long; pedicels 5–15 mm long. Spikelets 20–25 mm (excluding awn), gaping. Glumes unequal, acuminate, straw-coloured, hyaline at the edges, scabrous with hairs to 0.1 mm long along the nerves, scaberulous between the nerves; lower glume 18–25 (–27) mm long, lower 60–75% 3-nerved, upper 25–40% 2-nerved, upper glume 15–25 mm long, lower 20–45% 5–7-nerved, upper 55–80% 6-nerved. Floret cylindrical without a neck, 9–11.5 mm long (including callus). Lemma almost black at maturity, the surface smooth to granular upwards, sericeous with white hairs 0.6–0.8 mm long; coma absent; lobes absent. Callus 3–3.5 mm long, weakly bent at the tip, densely sericeous with white hairs 0.2–1 mm long. Awn 70–110 mm long, twice bent, c. 0.5 mm wide near the base; column 30–40 mm long, 20–30 mm to the first bend, brown, pubescent with hairs 0.3–1 mm long; bristle brown, scabrous with hairs 0.1 mm long. Palea ± equal to the lemma, acute, granular down the centre, smooth on the edges, sericeous down the centre with hairs 0.4–0.7 mm long. Lodicules 3; 2 abaxial membranous, 1.5–2.5 mm long, obtuse; paleal membranous, c. 0.7 mm long, obtuse. Anthers 3.5–5 mm long, ± penicillate. Caryopsis 5.5–6.5 mm long; embryo 20% the length; hilum 90% the length.

DISTRIBUTION: Widespread in Victoria, Tasmania and South Australia, extending into southern Western Australia.

SELECTED SPECIMENS: NEW SOUTH WALES: **Southern Tablelands:** nr. Delegate, *Phillips CBG 018003*, 14.11.1961 (CBG).

VICTORIA: **Region C:** 35 miles [56 km] SW. of Horsham, *Beaglehole 30958*, 25.9.1969 (NSW). **Region D:** on Coleraine railway line, c. 3 km WNW. of Hamilton, *Milne 331*, (MEL); Wannon, *Corrick 1560*, 8.12.1968 (Corrick herb.). **Region H:** Campbells Creek, *Mason*, 12.1886 (MEL 59991). **Region J:** Ararat, *Beaglehole 21726*, 15.11.1966 (NSW); Ben Major State Forest, *Farrington 2*, 17.12.1963 (MEL 59993). **Region M:** 7 miles [11 km] S. of Axedale, *Young*, spring 1974 (MEL 1509524). **Region N:** Studley Park, Melbourne, *Melville 2081*, *Willis & Chattaway*, 20.11.1952 (MEL); Port Phillip, *Luehmann NSW 116472* (NSW). **Region P:** Frankston, 145°10'E, 38°10'S, *Corrick 6192*, 28.11.1978 (MEL). **Region W:** c. 6 miles [10 km] W. of Lakes Entrance on the Metung rd., *Muir 1956*, 27.11.1960 (NSW).

TASMANIA: 1 mile [1.6 km] NW. of St Helens, Goshen road, *Townrow 190*, 19.1.1968 (JEST); 1 mile [1.6 km] S. of Scamander, *Townrow 185*, 1.1968 (JEST); 10 miles [16 km] N. of Orford, *Townrow 175*, 1.1968 (JEST); New Norfolk, *Gunn 996*, 15.11.1840 (NSW); 1 mile [1.6 km] W. of Sorrel on Orielton road, *Townrow 59*, 11.1967 (JEST); Risdon, *Burbidge 3184*, 18.1.1949 (CANB);

Hobart, *Lucas NSW 116468*, 12.1923 (NSW); Mt Wellington, *Martin NSW 116471*, 3.1933 (NSW); North Bruny I., *Townrow 134*, 1.1968 (JEST).

SOUTH AUSTRALIA: **Eyre Peninsula:** Marble Range, *Weber 6025*, 30.9.1979 (AD). **Murray:** Braendlers Scrub, 139°07'E, 35°10'S, *Spooner 4324*, 2.11.1975 (AD); Monarto, *Spooner 4303*, 25.10.1975 (AD). **Yorke Peninsula:** Hundred of Ramsay, *Blaylock 1610*, 10.10.1970 (AD). **Southern Lofty:** c. 8 km E. of Tanunda, 34°32'S, 138°58'E, *Kraehenbuehl 2853*, 29.10.1978 (AD); Mt Crawford Flora Reserve, 34°42'S, 138°58'E, *Boomsma*, 11.12.1976 (AD 97702520); Chain of Ponds, 34°49'S, 138°48'E, *Penning 102*, 27.11.1976 (AD); Torrens Gorge West, *Spooner 530*, 8.10.1969 (AD); nr. Tea Tree Gully Quarry, 34°50'S, 138°44'E, *Penning 21*, 13.10.1975 (AD); c. 12 km ENE. of Adelaide, *Whibley 2801*, 21.11.1968 (AD); Morialta Conservation Park, *Clarke 19*, 11.11.1977 (AD); c. 6 km E. of Adelaide, *Smith 1999*, 27.10.1970 (AD); Stonyfell, *Preiss 122*, 14.10.1972 (AD); between Basket Range & Uraidla, *Cleland*, 20.11.1943 (AD 98140420); Glenelg Golf Course, *Smith 552*, 3.10.1967 (AD); Loftian Park, Adelaide Hills, *Hilton*, 26.10.1953 (ADW 43956); Mt Lofty, *Ising*, 7.10.1924 (AD 97421225); nr. Blackwood, *Black*, 20.10.1913 (AD 97420208); Belair, *Koch NSW 15066*, 8.1902 (PERTH); 2 miles [3 km] S. of Mt Barker, *Crisp 4711*, 24.12.1978 (CBG); Hardys Scrub, McLaren Vale, *Boomsma*, 30.11.1978 (AD 97911351); 2 km S. of Meadows, *Czornij 55*, 27.10.1966 (AD); Kuitpo, *Cleland*, 3.1932 (AD 97421225); Mt Moon, Nangkita, *Tindale 7.11.1941* (AD 97739142); Myponga, *Whibley 442*, 10.12.1958 (AD); Finiss Scrub, *Spooner 962*, 18.11.1970 (AD); Fleurieu Peninsula, *Cleland*, 11.11.1967 (AD 93315073). **South-eastern:** Lake Albert, on Coorong, *Cleland*, 8.11.1958 (AD 96806198).

WESTERN AUSTRALIA: **Darling:** Midland Junction, *Roe*, 20.10.1934 (CANB 1248); Glen Forrest, *Aplin 1034*, 10.10.1961 (PERTH); Lake Banganup, *Weston 9790*, 2.11.1974 (PERTH); Hamel, *Blake 18043*, 31.8.1947 (PERTH); Harvey to Waroona, *Aplin 1196*, 30.10.1961 (PERTH); Harvey, *Gardner*, 10.1931 (PERTH); Boyanup, *Carne*, 27.11.1923 (PERTH); 12 miles [19 km] NE. of Busselton, *Beauglehole 12449*, 6.9.1965 (NSW, PERTH); Augusta, *Galbraith*, 28.9.1965 (MEL 59936); between Augusta & Nannup, *Phillips CBG 027108*, 18.10.1962 (CBG); Big Brook, Pemberton, *Hart 33*, 14.11.1962 (PERTH); Mt Barker, *Hay*, 12.1924 (PERTH); 3 miles [4 km] W. of Mt Barker, *Fairall 2238*, 5.10.1967 (PERTH).

S. semibarbata has been confused with *S. mollis*, *S. densiflora* and *S. hemipogon*, and references to *S. semibarbata* may be to any of the above species.

***Stipa setacea* R. Br.**, Prodr.: 174 (1810); Bentham, Fl. Austral. 1: 568 (1878), in part; Vickery, Contrib. New South Wales Natl. Herb. 2: 78 (1953); Beadle, Evans & Carolin, Handb. Vasc. Pl. Sydney Dist.: 532 (1963), Fl. Sydney Region: 656 (1972); Hughes, Kew Bull. 1921: 25 (1921).

LECTOTYPE, here designated: NEW SOUTH WALES: Port Jackson, *R. Brown*, 1802-1805 (BM!). Brown cites regions J and D (i.e. Port Jackson and Tasmania) in the protologue. Townrow (Pap. & Proc. Roy. Soc. Tasmania 104: 85 (1970)) suggests that *S. setacea* does not occur in Tasmania and we have seen no specimens from that State. We therefore here designate the Port Jackson specimen as Lectotype. The plant described and figured as *S. setacea* by Hooker (Fl. Tasman. 2: 110, pl. 157 (1860)) with 'a silky, short, membranous ligule' is a different species not in accord with Brown's description of *S. setacea*.

SYNONYMS: *Dichelachne setacea* (R. Br.) Nees in Lehmann, Pl. Preiss. 2: 98 (1846). **TYPIFICATION:** Nees cites *Stipa setacea* R. Br. as the basionym. Nees also cites the collection *Preiss 1854*. Veldkamp (Blumea 22: 11 (1974)) considers a specimen of *Preiss 1854* at BM to be the Holotype of *D. setacea*. Nees and identifies it as *Stipa stipoides* (Hook. f.) Veldk. We have not been able to locate the specimen at BM, but a specimen of *Preiss 1854* at MEL is not *S. stipoides*, differing in the shorter glumes and lemmas, but is entirely consistent with *S. junctifolia* Hughes (see notes under *S. stipoides*).

S. setacea var. *latiglumis* J. Black, Trans. & Proc. Roy. Soc. S. Austral. 46: 565 (1922), Fl. S. Austral. 1: 65 (1922). **LECTOTYPE, here designated:** In AD there are three syntypes from Black's herbarium mounted together on one sheet, from Belair, Minnipa and Telowie Gorge (see also CANB photo 237003). The specimen from Minnipa bears a single very long inflorescence scarcely emerging from the sheath. The specimen from Belair bears one panicle, and that from Telowie Gorge two panicles, all in an old condition with the glumes expanded. We here designate the Telowie Gorge specimen as **Lectotype**. We can find no justification for maintaining var. *latiglumis*.

The glumes of *S. setacea* are hyaline and long-acute when complete but they are susceptible to damage. When the glumes are damaged at the apex they expand and flatten, causing the appearance that caused Black to name the variety. Repeated sorting has revealed no characters correlated with this appearance.

Stipa brachystephana S. T. Blake, Proc. Roy. Soc. Queensland 62: 90, pl. 6 (1952). HOLOTYPE: SOUTH AUSTRALIA: Flinders Ranges: Port Germein Pass, S.T. Blake 16858, 29.8.1946 (BRI!; isotype ADW). In this specimen, though the spikelets are well developed, they are still relatively young and the glumes appear firmer than they do in more mature specimens.

Caespitose perennial to c. 0.8 metres high, with a basal tuft of leaves to about half the height, without rhizomes. Culms erect or geniculate at the base, terete, c. 1 mm wide near the base, \pm compressible, moderately to slightly ribbed, glabrous to puberulous, sometimes scaberulous upwards; nodes 2–4, exserted, glabrous, if swollen then to 50% wider than the adjacent internodes. Leaf sheaths tight around the culm, 3–7 mm wide, strongly to slightly ribbed, glabrous to scaberulous; margins glabrous. Ligule obtuse, membranous, 2–9 mm long, not ciliate; abaxial surface glabrous to sparsely puberulous; auricles mostly on lower leaves, thickened, c. 1 mm long, glabrous. Leaf blade firmly folded to inrolled, 0.5–1.5 mm wide, linear, to 30 cm long; abaxial surface strongly ribbed on innovations, smooth to moderately ribbed elsewhere, glabrous to scabrous with minute tubercles; adaxial surface strongly ribbed, densely pubescent with hairs minute–0.1 mm long; margins glabrous to scabrous with minute tubercles. Panicle 10–20 cm long, exserted, with distant fascicles of unequal, few-flowered branches, contracted, 1.5–3 cm wide (excluding awns); axis, branches and pedicels scabrous along the edges with hairs minute–0.1 mm long; branches 1.5–4.5 cm long; pedicels 1.5–7.5 mm long. Spikelets 9–15 (–16) mm long (excluding awn), gaping at maturity. Glumes unequal, acuminate, straw-coloured, hyaline and often erose at the tip, margins glabrous; lower glume glabrous to scaberulous at the tip, 9–15 (–16) mm long, lower 15–50% 3-nerved; upper glume glabrous to scaberulous at the tip, 7–10 mm long, lower 30–50% 5-nerved, upper 50–70% (3–)1-nerved. Floret turbinate with a neck, slightly gibbous, with the awn eccentric, 5.5–7 mm long (including callus). Lemma black at maturity, the surface scaberulous with minute tubercles, not convolute, the margins tightly incurved into a groove down the palea, densely sericeous with white hairs 0.4–0.8 mm long; lobes absent; coma obscure, to 0.8 mm long. Callus 1.7–2.5 mm long, straight, weakly bent at the tip, densely sericeous with white hairs 0.1–1 mm long. Awn 25–40 mm long, twice bent, 0.3–0.5 mm wide near the base; column 10–15 mm long, 5–8 mm to the first bend, dark brown, scabrous with hairs minute–0.1 mm long; bristle paler than the column, scaberulous. Palea subequal to the lemma, obtuse to acuminate, smooth, deeply grooved down the adaxial surface, glabrous to sericeous in the groove with hairs minute–0.5 mm long, margins glabrous. Lodicules 3; 2 abaxial membranous, 0.5–1.5 mm long, oblong to acute; paleal membranous, 0.4–0.8 mm long, oblong. Anthers 2.1–2.3 mm long, not penicillate. Caryopsis 2.5–3 mm long; embryo 20–40% the length; hilum 70–80% the length along the centre of the wide groove corresponding to the groove on the palea.

DISTRIBUTION: Widespread but not common in southern Queensland, New South Wales, southern Victoria and southern South Australia.

SELECTED SPECIMENS: QUEENSLAND: **Maranoa**: 20 miles [32 km] W. of Mitchell, Blake 10953, 31.3.1936 (NSW); nr. Amby, Smith 6307, 22.5.1955 (BRI); Chinchilla, Beasley 156, 4.1931 (BRI). **Darling Downs**: nr. Meandarra, Blake 13277, 13.2.1938 (BRI); Killawarra, Moonie River, Everist 1792, 30.4.1939 (BRI); between Inglewood & Milmerran, White, 20.1.1934 (BRI, K); Inglewood, Wicks, 11.1933 (BRI, K); Kingsford Ridge, Hermitage Research Station, Simon & Henderson 2500, 9.12.1974 (BRI); nr. Wyberba, Blake 4641, 23.1.1933 (BRI); Bald Mt, nr. Wallangarra, Blake 4481, 14.1.1933 (BRI).

NEW SOUTH WALES: **North Coast:** Maitland, *Hilton*, 10.1944 (ADW 43968); Rutherford Camp, 1 mile [1.6 km] from West Maitland, *Hilton*, 9.1944 (ADW 43969). **Central Coast:** Hillview, 3 miles [5 km] SW. of Liverpool, *Coveny NSW 116039*, 19.3.1967 (NSW); Glenfield, *McBarron 13699*, 14.2.1966 (NSW, BRI, CANB, MEL); Cobbitty, *Vickery NSW 116038*, 6.10.1930 (NSW); Camden, *Price NSW 1876*, 7.1946 (NSW); Picton, *McBarron 10087*, 6.12.1964 (NSW). **Northern Tablelands:** New England, *Stuart, s.d.* (MEL); Green Valley, via Guyra, *no collector*, 21.12.1934 (NSW 116036); Crow Mountain, E. of Barraba, *Williams NSW 127933*, 21.12.1972 (NSW). **Central Tablelands:** 2 miles [3 km] N. of Burrawang, *Biddiscombe NSW 116030*, 13.4.1954 (NSW). **North Western Slopes:** Warialda district, *no collector*, 5.12.1952 (NSW 116031); Gunnedah, *Bridge NSW 116028*, 2.11.1956 (NSW); Warrumbungle National Park, *Dunlop 636*, 21.8.1969 (CBG); Binnaway, *Little NSW 116033*, 12.1950 (NSW). **Central Western Slopes:** 8 miles [13 km] SW. of Cassilis, *Story 7025*, 5.12.1959 (CANB); Trangie, *Huchins*, 3.1947 (CANB 13229, K); Guigong, *Williardt NSW 116048*, 23.11.1956 (NSW); Forbes, *Crosby NSW 116032*, 16.7.1952 (NSW). **South Western Slopes:** Wagga, *Newman NSW 116042*, 1955 (NSW); Howlong, *McBarron 2602*, 19.11.1948 (NSW). **North Western Plains:** Coolabah, *Cunningham NSW 116041*, 15.7.1968 (NSW); Cobar Reserve, 5 miles [8 km] N. of Cobar, *Dumbleton NSW 116040*, 15.6.1969 (NSW); Boppy Mt, nr. Cobar, *Boorman NSW 116035*, 7.1903 (NSW); Mt Grenfell, Cobar, *Cunningham & Milthorpe 2916*, 26.10.1974 (NSW). **South Western Plains:** Mt Binya, c. 25 km ENE. of Griffith, *Crisp 1476*, 12.11.1975 (CBG, NSW).

VICTORIA: **Region C:** Mt Arapiles, *Beauglehole 7446* (in part), 23.11.1964 (NSW), 29689, 21.11.1968 (NSW). **Region M:** c. 50 km NW. of Bendigo, *Beauglehole 69435*, 24.10.1981 (NSW). **Region N:** 3.5 miles [6 km] N. of Sunbury, *Pitt 17.1.1974* (MEL).

SOUTH AUSTRALIA: **Flinders Ranges:** Oraparinna National Park, *Symon 7570*, 8.10.1971 (ADW); Mt Brown, *Cooper*, 21.9.1954 (AD 968020459); Melrose, *Hilton*, 12.9.1951 (ADW 44047); Gammon Range (30°25'S, 139°05'E) *Williams 11634*, 30.10.1980 (AD). **Northern Lofty:** Upper Telowie Gorge, *Spooner 6613*, 7.10.1979 (NSW); Tothill Range, *Kraehenbuehl 1083*, 27.10.1963 (AD). **Murray:** Kinchina, *Cleland*, (AD 97420190). **Southern Lofty:** Anstey Hill, *Cleland*, 14.9.1946 (AD 96324083); Hope Valley, nr. reservoir, *Spooner 1517*, 9.9.1971 (AD); Torrens Gorge West, *Spooner 535*, 537, 4.10.1969 (AD); Highbury, *Smith 1975*, 13.10.1969 (AD); c. 11 km NE. of Adelaide, *Spooner 324*, 27.9.1968 (AD); Holden Hill, *Spooner 2749*, 2.3.1973 (AD); Stonyfell Hills, *Cleland*, 21.9.1952 (AD 95705073); Mitcham, *Harris 30*, 26.9.1959 (AD); Eden Hills, *Purdie 92*, 11.9.1966 (AD); Belair, *Cleland*, 20.10.1935 (AD 96324081, 96324084); 42 km SE. of Adelaide (35°12'S, 139°00'E), *Williams 189*, 13.10.1952 (AD); Finnis River, *Black*, 10.1929 (AD 97420190); Halls Creek, *Cleland* 16.11.1930 (AD 98110407), 5.1.1940 (AD 96324082); Encounter Bay, *Cleland* 1.1924 (AD 96324080, 97420192). **South-eastern:** Bordertown, *Black* 25.11.1917 (AD 97420190).

S. setacea appears to be closely related to species of the genus *Piptochaetium* and resembles them in having: (i) the palea grooved on the adaxial surface between the two nerves (Fig. 4d); (ii) the floret \pm turbinate and slightly gibbous high up on the back; and (iii) the sulcate fruit with insertion of stigmas at one side of the obtuse to truncate apex, above the furrow.

We are retaining *S. setacea* (and the closely related *S. feresetacea*) in *Stipa* because of: (i) the membranous palea (rigid, crustaceous or coriaceous in *Piptochaetium*); (ii) the fully enclosed palea tip (exposed and projecting in *Piptochaetium*); and (iii) the lack of a corona (usually present in *Piptochaetium*).

The grooved back of the palea is also developed to a much lesser degree in *S. juncifolia*, *S. petraea* and *S. stipoides*, none of which possesses any other features of *Piptochaetium*, and also in *S. gibbosa*, which has as well, a turbinate, gibbous floret and a projecting palea tip.

On balance, the morphological characters appear slightly to favour the retention of *S. setacea* and *S. feresetacea* in *Stipa*. Biogeographic arguments would also favour the retention of these two species in *Stipa*. Species of *Piptochaetium* s. str. are otherwise confined to the American Continent.

***Stipa stipoides* (Hook. f.) Veldkamp**, *Blumea* 22: 11 (1974); Townrow, *Pap. & Proc. Roy. Soc. Tasmania* 112: 261 (1978). Based on *Dichelachne stipoides* Hook. f., *Fl. Nov.-Zel.* 1: 294, t. 66 (December 1853).

LECTOTYPE (Townrow 1978): NEW ZEALAND: Bay of Islands, *Hooker* (K!). Veldkamp (*ibid.*) cites a Banks and Solander specimen from Mercury Bay and Bay of Islands (BM) as the Holotype. Townrow (*ibid.*) stated that, as Hooker's citation included three specimens, the selection of a lectotype was required and, following the recommendations of the Code, the most appropriate specimen was the Hooker specimen from the Bay of Islands (K). We have followed her lectotypification.

SYNONYM: *S. teretifolia* Steudel, *Syn. Pl. Glum.* 1: 128 (March 1854); Bentham, *Fl. Austral.* 7: 567 (1878); Rodway, *Tasman. Fl.*: 262 (1903); Hughes, *Kew Bull.* 1921: 12 (1921); Black, *Fl. S. Austral.* 1: 65 (1922), edn 2: 86 (1943); Willis, *Handb. Pl. Victoria* 1: 182 (1962), edn 2, 1: 182 (1970). HOLOTYPE: cited in the protologue as 'Legit Urville ad Western Port' (Victoria). The Holotype from the Steudel Herbarium (P) bears a ticket annotated 'Stipa teretifolia Steudel! Port Western (Australia) 9bre 1826. Chauvin 49.' We are therefore unable to understand why Veldkamp (*ibid.*) has cited the Holotype as being: 'Lesson s.n. (P)' which can surely not be the same specimen.

Caespitose perennial to c. 1.2 metres high with an erect basal tuft of pungent-tipped leaves. Culms erect, 0.6–1 mm wide near the base, \pm compressible, smooth and shiny; nodes c. 3, not exserted. Leaf sheaths \pm inflated at the base, the upper sheaths not inflated, weakly ribbed, glabrous to shortly pubescent between the nerves with hairs 0.05–1 mm long; margins glabrous, lower sheaths 4–10 mm wide, upper sheaths 2.4–5 mm wide. Ligule obtuse, membranous, papery, 4–9 mm long, glabrous; auricles absent. Leaf blade subterete, permanently folded, 0.6–1.1 mm wide, to c. 70 cm long with a needle-like point; abaxial surface smooth and shiny; adaxial surface slightly ribbed, with hairs 0.05–0.2 mm long; margins glabrous or scabrous with stiff hairs 0.1–0.2 mm long. Panicle 10–25 cm long, exserted, 1–3.5 cm wide (excluding awns); axis slightly flattened, smooth, glabrous; branches to c. 4.5 cm long, glabrous or with a few scattered hairs c. 0.7 mm long; pedicels to 1 cm long, glabrous. Spikelets (12–) 15–20 mm long (excluding awn), laterally compressed, gaping. Glumes equal to subequal, rounded on the back, acute, straw-coloured, sometimes purplish at the base, glabrous; lower glume (12–) 14–20 mm long, lower 50% 1–3-nerved; upper glume (12–) 14–18 mm long, lower 60% 3–5 (–6)-nerved, remainder 1–2-nerved. Floret cylindrical, 8–13 mm long (including callus). Lemma very faintly granular, pilose with hairs 0.5–2.5 mm long; lobes 2, (0.5–) 1.5–2.0 (–3.0) mm long, ciliate; coma obscure, of few hairs 2–3.5 mm long. Callus 1.0–2.5 mm long, \pm straight, with dense white to light brown hairs to c. 1.2 mm long. Awn 20–40 mm long, weakly twice bent, (0.1–) 0.2 mm wide at the base; column 10–15 mm long, 4–10 mm to the first bend, scabrous with hairs 0.05–0.25 mm long; bristle scabrous with hairs less than 0.1 mm long. Palea equal to the lemma, slightly depressed between the nerves, acute, pilose down the centre with hairs similar to those on the lemma, margins smooth and glabrous, 2-nerved. Lodicules 3; 2 abaxial 1.2–2.0 mm long, tips acute to \pm erose; paleal 1.5–3 mm long, acute. Anthers 5.5–8.5 mm long, penicillate. Caryopsis 4 mm long; embryo 25% the length; hilum 75–90% the length.

DISTRIBUTION: Coastal areas of southern New South Wales, Victoria, Tasmania, South Australia and New Zealand.

SELECTED SPECIMENS: NEW SOUTH WALES: **South Coast:** Devils Hole, 2 miles [3 km] NE. of Pt Perpendicular, Jervis Bay, *Constable NSW 115818*, 2.1960 (NSW); Cave Beach, 3 miles [5 km] SW. of Jervis Bay, *Coveny 3682*, 10.1971 (NSW, CANB, BRI, MEL); 27 km NNE. of Batemans Bay, *Crisp 6736*, 4.10.1980 (CBG); Camel Beach, Wallaga, *Everett 451 & Jacobs*, 22.10.1981 (NSW); Boydtown, *Everett 443 & Jacobs*, 22.10.1981 (NSW); Towamba River, nr. Kiah, *Gauba CBG 003956*, 16.11.1954 (CBG, MEL).

VICTORIA: **Region E:** Lower Glenelg River, *Beauglehole* 5891, 28.12.1963 (NSW, AD, MEL). **Region N:** Altona Saltworks, *Corrick* 2903, 11.11.1972 (Corick herb.). **Region P:** shores of Port Phillip, *French*, s.d. (CANB 134047); c. 10 km E. of Lara, *Allen*, 7.10.1977 (MEL 522361); Tooradin, *Blake* 7301, 20.1.1935 (BRI); Swan Bay, *Jacobs* 3667, 31.10.1979 (NSW); Mornington Peninsula, *Muir* 6436, 23.11.1978 (MEL); Western Port Bay, *Muir* 948, 16.11.1959 (NSW, AD, MEL, CANB). **Region X:** 90 Mile Beach, *Jacobs* 2396 & *Williams*, 16.11.1975 (NSW). **Region Z:** Mallacoota, *Gauba* CBG 003957, 16.11.1954 (CBG); c. 8.5 miles [14 km] SSW. of Mallacoota, *Beauglehole* 31125, 9.10.1969 (NSW).

TASMANIA: nr. George Town, *Stuart* NSW 116692, s.d. (NSW); hill above Derwent Estuary, *Burbridge* 3183, 18.1.1949 (CANB); Marion Bay, *Hemsley* 6687, 3.1.1972 (NSW); Clairmont, *Lucas* NSW 116688, 12.1923 (NSW); Risdon, *Vickery* NSW 7491, 18.1.1949 (NSW), *Blake* 18322, 18.1.1949 (BRI, NSW); Sandy Bay, *Rodway* NSW 116693, 11.1898; Taroon Beach, *Townrow* 6, 11.1966 (JEST); Kingston Beach, *Rodway* NSW 116694, 25.11.1935 (NSW); Eaglehawk Neck, *Blake* 18280, 15.1.1949 (BRI, NSW); Ralphs Bay, *Townrow* 54, 54a 22.11.1967 (JEST); Premaydena, *Jacobs* 2016, 2.2.1975 (NSW); Bond Bay, Port Davey, *Davis* 1268, 14.3.1954 (MEL); Partridge Island, *Townrow*, 12.2.1975 (JEST); Southport, *Phillips & Vickery* NSW 116698, 20.1.1962 (NSW, CBG).

SOUTH AUSTRALIA: **Eyre Peninsula:** Hundred of Flinders, *Specht* 2670, 10.11.1960 (AD). **Murray:** edge of Lake Alexandrina, *Hilton*, 9.10.1954 (ADW 28120). **Yorke Peninsula:** Royston Head, *Weber* 4266, 11.10.1974 (AD); Stenhouse Bay, *Symon* 9549, 6.10.1974 (ADW, NSW). **Southern Lofty:** Waitpinga, *Cleland*, 25.1.1932 (AD 97421168). **Kangaroo Island:** Kangaroo I., *Tate*, 16.11.1883 (MEL, AD); Kingscote, *H.H.D.G.* [?], 28.10.1908 (AD), *Eichler* 15250, 6.11.1958 (AD); Peneshaw, *Hilton* 3.12.1945 (ADW 43980); Hog Bay, *Cleland*, 15.11.1924 (AD); Dudley Peninsula, *Tate* 21.11.1883 (AD 97427497, 97427496); Pennington Bay, *Cleland*, 6.3.1926 (AD); South-West River, *Cleland* 7.11.1934 (AD); Remarkable Rocks, *Phillips* CBG 042830, 2.9.1965 (CBG). **South-eastern:** Vivonne Bay, *Latz*, 11.2.1972 (NT 62993); Woods Well, *Cleland*, 15.10.1955 (AD); Coorong, *Cleland* NSW 116677, 12.1922 (AD, NSW); S. of Banff, *Symon* 10508a, 11.10.1975 (NSW, dupl. of ADW); Lower Coorong, *Symon* 10469, 4.10.1975 (NT); between Kingston & Naracoorte, *Riceman*, 1.1936 (ADW); Robe, *Eardley*, 1.1938 (ADW); Dombey Cape, *Symon*, 26.11.1959 (ADW 21800); Beachport, *Black*, 30.11.1917 (AD 97421167); Rivoli Bay, *Cleland*, 5.3.1944 (AD); E. of Port MacDonnell, *Eardley* 3.2.1942 (ADW 4942).

Veldkamp (*ibid.*) cites *Dichelachne setacea* Nees in Lehmann, Pl. Preiss. 2: 98 (1846), as a synonym of *Stipa stipoides* (Hook. f.) Veldkamp, citing a specimen of *Preiss 1854* in BM as the Holotype of *Dichelachne setacea*. This specimen seems to have been subsequently misplaced and cannot now be found. Two specimens of *Preiss 1854*, one in LD and one in MEL, are *S. juncifolia* Hughes. Veldkamp was not aware that *S. stipoides*, always with a contracted panicle, is confined to littoral habitats, and would not be present 'In regionibus interioribus Australiae meridionale - occidentalis' as cited by Nees. *S. juncifolia* does have long lemma lobes, similar to *S. stipoides*, but differs in having an effuse panicle, elongate ligule, smaller glumes and floret, and a longer awn.

***Stipa stiposa* Hughes**, Kew Bull. 1921: 20 (1921); Townrow, Pap. & Proc. Roy. Soc. Tasmania 112: 259 (1978).

HOLOTYPE: TASMANIA: New Norfolk, *Gunn* 1480, 5.1.1840 (K!, also CANB photo 235994). The Holotype sheet bears, in addition to the main specimen, some fibrous material resembling partially unravelled twine that *Gunn* has annotated 'Produce I believe of 1480'. It is doubtless this material that caused Hughes to describe the base of the plant as finally breaking up into very long twisted fibres. This condition is believed to be pathological. Similar material is known to be caused by the fungal pathogen *Tolyposporium restifaciens* (Ropey Smut) in other species of *Stipa* (J. Walker, pers. comm.).

Caespitose perennial to c. 1 metre high, without rhizomes, with a basal tuft of leaves to about a third the height. Culms erect or geniculate at the base, terete, 1.5–6 mm wide near the base, not compressible, slightly ribbed, glabrous, scaberulous to pubescent with hairs minute–1 mm long; nodes c. 3, exserted, densely sericeous with hairs c. 0.2 mm long, to 50% wider than adjacent

internodes. Leaf sheaths at first tightly enveloping the culm, later becoming loose, 4–10 mm wide, slightly ribbed to strongly ribbed on upper sheaths, glabrous to hirsute with hairs minute–0.4 mm long; inner margin glabrous; outer margin glabrous to sparsely ciliate with hairs 0.1–0.3 mm long, rarely longer on upper sheaths; collar glabrous or ciliate with hairs minute–0.6 mm long. Ligule truncate, membranous to coriaceous, 0.5–1 mm long, ciliate with hairs minute–0.2 mm long; abaxial surface densely sericeous with hairs to 0.4 mm long; auricles thickened, ciliate at the base with hairs minute–1.5 mm long. Leaf blade loosely rolled, 2–4 mm wide, to 35 cm long; abaxial surface smooth to moderately ribbed, glabrous to scaberulous with minute hairs and tubercles or pubescent with hairs 0.1–0.5 mm long; adaxial surface strongly ribbed, scaberulous to pubescent with hairs minute–0.3 mm long; margins scaberulous to ciliate with hairs c. 1 mm long, or similar to the abaxial surface. Panicle 20–35 cm long, exerted, with moderately distant fascicles of unequal, few- to many-flowered branches, \pm contracted or slightly expanded, 2.5–5 cm wide (excluding awns); axis terete to slightly flattened, scaberulous to scabrous with hairs minute–0.1 mm long; branches and pedicels angular to terete, scabrous along the edges with hairs minute–0.3 mm long; branches 3–6 cm long; pedicels 0.2–1 cm long. Spikelets 15–23 mm long (excluding awn), gaping. Glumes unequal, acuminate, straw-coloured, scaberulous along the ribs with hairs minute–0.2 mm long, puberulous elsewhere; lower glume 5–23 mm long, lower 50–85% 3-nerved; upper glume 12–19 mm long, lower (20–) 40–50% (7–) 5–3-nerved, upper (80–) 60–50% (5–) 3–1-nerved. Floret narrowly turbinate without a neck, 7–12 mm long (including callus). Lemma smooth to granular, sericeous with white hairs 0.5–1.5 mm long turning gold at maturity; lobes 2 when present, 0.1–0.2 mm long, ciliate with minute hairs; coma of dense, erect hairs, 1–3 mm long. Callus 1.5–2.5 mm long, densely sericeous with white hairs 0.1–1 (–1.5) mm long turning gold at maturity. Awn 45–70 mm long, with 2 bends, 0.2–0.4 mm wide near the base; column 20–25 mm long, 6–10 mm to the first bend, brown, pubescent to villous with hairs 0.5–1 mm long; bristle straw-coloured, scabrous with hairs minute–0.2 mm long. Palea equal to the lemma, acute, smooth along the edges, slightly granular down the centre, glabrous to sericeous down the centre back with hairs 0.2–1 mm long. Lodicules 2, membranous, abaxial, acute or obtuse, 1.5–2 mm long. Anthers c. 1 mm long, penicillate. Caryopsis 4–5 mm long; embryo 20–35% the length; hilum 70–90% the length.

DISTRIBUTION: Scattered through southern New South Wales and Victoria, common in Tasmania.

SELECTED SPECIMENS: NEW SOUTH WALES: **South Coast:** Eden, 37°04'S, 149°55'E, *Everett 449 & Jacobs*, 22.10.1981 (NSW); Twofold Bay, *Davis NSW 115820*, 27.12.1952 (NSW); Boydtown, Nullica Bay, 37°06'S, 149°53'E, *Everett 445 & Jacobs*, 22.10.1981 (NSW). **South Western Plains:** Lake Cargellico, *Boorman NSW 117408*, 10.1906 (NSW); Mt Melongel, *Gauba CBG 067328*, 19.11.1950 (CBG); Griffith, *Jacobs 4161*, 24.9.1981 (NSW).

VICTORIA: Region C: Wimmera, *Reader*, 1892 (MEL). **Region D:** 2.5 miles [4 km] W. of Dergholm, *Beaglehole 38079*, 24.2.1971 (ACB). **Region H:** Western Highway, NW. of Dadsells Bridge, *Beaglehole 30100A*, 18.12.1968 (NSW). **Region N:** Observatory grounds, S. Yarra, *Morris*, 14.11.1946 (MEL). **Region P:** Moorabool River, *Carr & Adair 7285*, 18.1.1981 (NSW). **Region R:** 5 miles [8 km] S. of Buckland, *Townrow*, 24.11.1962 (BRI). **Region W:** NE. of Omco, *Beaglehole 36852*, 20.2.1971 (NSW); between Ensay N. & Ensay S., *Beaglehole 37030*, 24.2.1971 (ACB); c. 6 miles [9 km] W. of Lakes Entrance, Metung road, *Muir 1956*, 29.11.1960 (MEL); Kalimna Bluff, *Wakefield 2525*, 3.1948 (MEL).

TASMANIA: Big Green I., *Whinray 334*, 25.10.1968 (AD); Launceston, *no collector*, 12.1888 (MEL 60821); Evandale, *Townrow 115*, 12.1967 (JEST); Cressy, *Townrow 120*, 20.12.1967 (NSW); Poatina, *Townrow 7*, 5.4.1967 (HO); nr. O'Connors Peak, *Townrow 116*, 19.12.1967 (NSW); 3 miles [5 km] W. of Orford, *Townrow 69*, 24.11.1967 (JEST); nr. Runnymede, *Phillips 577*, 4.11.1960

(NSW); Risdon, *Burbidge 3185*, 18.1.1949 (CANB); Cambridge side of Warrane, *Townrow*, 5.4.1967 (HO); N. of Lindisfarne, *Townrow 100*, 13.12.1967 (JEST); Hobart, *Blake 18268*, 14.1.1949 (BRI, NSW); Derwent Valley, *Martin NSW 116801*, 12.1933 (NSW); Mt Nelson, *Curtis*, 1.2.1947 (BRI); Slopen I, *Townrow 86*, 12.1967 (JEST); Bonnet Hill, *Townrow 164*, 1.1968 (JEST); 3 miles [5 km] S. of Opossum Bay, *Townrow 50*, 11.1967 (JEST); North Bruny I., *Townrow 159*, 4.1.1968 (JEST); South Bruny I., *Phillips CBG 046199*, 29.11.1965 (CBG).

SOUTH AUSTRALIA: **Southern Lofty**: Black Hill, *Spooner 1691*, 18.11.1971 (AD).

***Stipa tenuifolia* Steudel**, Syn. Pl. Glum. 1: 128 (1854); Hughes, Kew Bull. 1921: 12 (1921); Gardner, Fl. W. Austral. 1, Gram.: 180 (1952).

HOLOTYPE: *Drummond Coll. IV, 391* N. Holl. (P!; presumed isotypes K, MEL 59997). Gardner (*loc. cit.*) states that *Drummond 220* is the Type, but this number was not cited in the protologue.

SYNONYMS: *S. eriopus* Benth., Fl. Austral. 7: 570 (1878); Hughes, Kew Bull. 1921: 12 (1921); Gardner, Fl. W. Austral. 1, Gram.: 179 (1952). HOLOTYPE: WESTERN AUSTRALIA: Swan River, *Drummond 962* (K!, isotype MEL 59927, CANB photo 237024). The Type specimen is exceptionally woolly-hairy at the base (though scarcely bulbous) and the leaves are strongly curved. Similar hairs are present, but less conspicuous, on numerous other specimens, and the leaves often tend to curve on drying.

S. scabra var. *occidentalis* Benth., Fl. Austral. 7: 571 (1878). LECTOTYPE, **here designated**: WESTERN AUSTRALIA: *Drummond 391* (K). In the protologue Bentham cites three synonyms: *S. flavescens* Nees non Labill., *S. tenuifolia* Steud. and *S. puberula* Steud., and cites a number of specimens from Western Australia including *Drummond 391* (the Holotype number of *S. tenuifolia*), *Drummond 220, 960 and 963* and Murchison River, *Oldfield*, Frasers Range, *Dempster* and *Champion Bay*, *C. Gray* (which are all *S. tenuifolia*) and *Drummond 379* (the Holotype number of *S. puberula* Steud.). Examination of duplicates of the 'Type' of '*S. flavescens* Nees non Labill.' (*Preiss 1826*) in LD and HBG (no specimen now extant at B) has shown that it does belong to *S. flavescens* Labill. though excluded from that species by Bentham, perhaps on account of its unusually spreading inflorescence (see notes under *S. flavescens*). Bentham's brief description of var. *occidentalis*: 'Spikelets usually rather larger and fewer' [than *S. scabra* Lindl.] appears to fit *S. tenuifolia* Steud. much more aptly than *S. puberula* Steud. We therefore agree with Hughes in treating *S. scabra* var. *occidentalis* as a synonym of *S. tenuifolia* Steud. Hughes also cites the variety under *S. puberula* Steud.

S. scabra var. *pubescens* Benth., Fl. Austral. 7: 571 (1878). LECTOTYPE, **here designated**: WESTERN AUSTRALIA: *Drummond 375* (K). Bentham cites *Drummond 375* (K!, dupl. MEL 59943) and *973* (K!, dupl. MEL 59944). Hughes cites *Drummond 375* as the Holotype of *S. incurva* Hughes and cites *S. scabra* var. *pubescens* as a synonym. She also cites *Drummond 973* under *S. incurva*. Both specimens are *S. tenuifolia*.

S. leptophylla Hughes, Kew Bull. 1921: 14 (1921). HOLOTYPE: WESTERN AUSTRALIA: Swan River, *Drummond 381* (K!, CANB photo 237017).

S. incurva Hughes, Kew Bull. 1921: 16 (1921); Black, Fl. S. Austral. edn 2: 87 (1943), *p.p.* HOLOTYPE: WESTERN AUSTRALIA: Swan River, *Drummond 375* (K!, isotype MEL 59943), indicated as such by Hughes with an asterisk. Hughes also cites *Drummond 973* (K!, dupl. MEL 59944) and *S. scabra* var. *pubescens* Benth. as synonyms. The foliage of the two *Drummond* specimens is rather more hirsute than the majority of the specimens of *S. tenuifolia*, and the pubescence on the column is sparse in *Drummond 375*.

Caespitose perennial 0.6–1 metre high with a sparse basal tuft of usually conspicuously extravaginal shoots to 40 cm high. Culms erect or occasionally geniculate, compressible, terete, 0.8–2 (–2.5) mm wide near the base, slightly ribbed, puberulous, especially just below the nodes, or scaberulous or glabrous upwards; nodes 2–3, rarely exserted, to 60% wider than adjacent internodes, glabrous or occasionally very sparsely pubescent. Leaf sheaths tightly enclosing the culm, ribbed; lowermost sheaths villous with long, appressed hairs, or rarely pubescent; upper sheaths puberulous, scaberulous, or glabrous; inner margin glabrous; outer margin sparsely to densely ciliate especially just below the

nodes. Ligule thinly coriaceous, 0.8–1 mm long in the middle, to 4 mm long where continuous with sheath-margin lobes, ovate to obliquely truncate, minutely ciliate or \pm glabrous, occasionally densely pubescent on the back; auricles thickened, spreading; sheath margin lobes with a dense line of long and thick hairs. Leaf blades to 30 cm long, flexuous or sinuous, usually inrolled, 0.5–1.5 mm diameter, occasionally expanded and to 3 mm wide; abaxial surface unribbed to slightly ribbed, scabrous with short or long stiff hairs or densely hirsute and scabrous; adaxial surface strongly ribbed, hirsute or pubescent, occasionally glabrous; margins similar to abaxial surface. Panicle to 35 cm long, exserted, spreading, to 5 cm wide (excluding awns), usually sparse, occasionally denser, with moderately close fascicles of usually few-flowered branches; axis terete, strongly scabrous; branches to 8 cm long, terete, scabrous; pedicels to 25 mm long, terete, minutely scaberulous or scabrous. Spikelets 13–20 mm long (excluding awn), usually gaping after floret disarticulation. Glumes unequal to almost equal, acuminate, usually purple-tinged; lower glume 13–20 mm long, membranous and translucent, the lower 30–50% 3-nerved; upper glume 12–18 mm long, membranous and translucent at the tip, firmer and green or yellow at the base, the lower 25–35% 5-nerved, the next 35–25% 3-nerved. Floret linear, 7–8 (–9) mm long (including callus), with a well-defined neck, the 3 main nerves slightly thickened at the apex. Lemma finely granular, except tuberculate over the apex of the midvein, black-brown at maturity; hairs white, erect and spreading, sparse especially at the apex; coma obscure, of few hairs in two lateral tufts to 1.5 mm long, or absent; lobes usually 2, to 0.4 mm long. Callus 2.1–3.1 mm long, straight, with dense white to pale yellow hairs. Awn 70–85 (–120) mm long, 0.25–0.45 mm wide near the base, falcate; column 11–16 (–20) mm long, 7–12 mm to the end of the straight portion, densely pubescent or villous with slightly spreading hairs 0.2–0.4 (–0.6) mm long; bristle scaberulous. Palea 0.3–1.3 mm shorter than the lemma, broadly acute to obtuse, coriaceous down the centre with a line of white hairs; margins and tip membranous and glabrous. Lodicules 2, membranous, abaxial, 1.4–1.8 mm long, long-spathulate. Anthers 2.5–3.5 mm long, penicillate. Caryopsis 3–5 mm long; embryo 30% the length; hilum 80% the length.

DISTRIBUTION: Southern regions of Western Australia and east to the Yorke Peninsula in South Australia.

SPECIMENS EXAMINED: SOUTH AUSTRALIA: **Eyre Peninsula:** Reserve near Mt Verran, *Cleland*, 9.11.1960 (AD 968061284); Flora and Fauna Reserve, Hundred of Hincks, c. 85 km N. of Port Lincoln, *Specht* 2563, 11.11.1960 (AD); S. of Coorabie, *Cleland*, 18.10.1953 (ADW 44063 in part). **Northern Lofty:** Kalimna Scrub, 1 mile [1.6 km] NW. of Nuriootpa, 20 miles [32 km] NE. of Gawler, *Hilton*, (ADW 44097); Miananga, Barossa Valley, *Hilton*, 5.7.1951 (ADW 44107). **Yorke Peninsula:** Port Pirie, *Koch NSW 116954*, 9.1901 (NSW). **Southern Lofty:** Vine Vale, Barossa Valley, *Hilton*, 1.7.1951 (ADW 44106); c. 1 mile [1.6 km] N. of Tanunda, *Kraehenbuehl 1655*, 23.10.1966 (AD); Altona, via Lyndoch, 9 miles [14 km] E. of Gawler, *Hilton*, 11.1952 (ADW 44098, 44099); near Highbury Hotel, *Kraehenbuehl 882*, 22.10.1962 (AD, NSW); Halletts Cove, c. 25 km S. of Adelaide, *Cleland*, 9.10.1920 (AD); Port Noarlunga, *Crisp 633*, 14.10.1973 (CBG); Kuitpo Forest, *Spooner 720*, 28.9.1969 (AD). **Kangaroo Island:** Kingscote, at Reeves Point, *Jackson 75*, 8.10.1960 (AD).

WESTERN AUSTRALIA: **Austin:** Murchison River, *Oldfield*, (MEL 59948). **Coolgardie:** Mt Malcolm, *Fitzgerald NSW 116943*, 7.1899 (NSW). **Roe:** Frasers Range, *Dempster NSW 116831*, [1876] (NSW). **Irwin:** Buller River, N. of Geraldton, *Blake 18080*, 2.9.1947 (BRI, PERTH, K); Champion Bay, *Gray*, 1873 (MEL 60027, 60028); 22 miles [35 km] N. of Geraldton in Oakabella Hills, *Burbidge 2074*, 2.9.1947 (CANB); Mingenew, *Holms*, 20.8.1934 (PERTH). **Avon:** Upper Irwin, *Gwerin*, (MEL 60004); 27.1 miles [35 km] from Carnamah towards Mingenew, *Canning CBG 039490*, 14.6.1968 (CBG); between Kunnunoppin & Mt Marshall & Lake Barlee, *Fraser NSW 116830*, winter–spring 1919 (NSW); c. 41 miles [66 km] S. of Marchagee, *Maslin 1407*, 10.10.1970 (PERTH); 5 miles [8 km] from Goomalling towards Wongan Hills, *Phillips CBG 039219*, 12.9.1968 (CBG),

NSW); 14.5 km from Wyalkatchem towards Dowerin, *Phillips CBG 054857*, 19.9.1962 (CBG); Merredin Research Station, *Landfield*, 10.1948 (PERTH); Grass Valley, *Despeissis*, 1898 (PERTH); Kellerberrin, *Leake*, 9.1897 (PERTH); Muntadgin, *Bailey 176*, 9.1945 (PERTH); Bruce Rock, *Baxter*, 10.1913 (PERTH); Quairading, *Waters*, 9.1957 (PERTH); 17 miles [27 km] E. of Pingelly, *Aplin 773*, 10.1960 (PERTH); 3 miles [5 km] W. of Wagin, *Phillips*, 28.10.1962 (CANB 027110); Kojonup, *Symon*, 9.1954 (ADW). **Darling:** York, *Meadly*, 6.12.1947 (PERTH); Perth, *Maiden NSW 116942*, 10.1909 (NSW); Meekering, 100 miles [160 km] S. of Perth, *Symon*, 9.1954 (ADW 44168); Kelmscott, *Helms*, 11.9.1897 (PERTH); Lake Banganup, Jandakot, *Weston 9798*, 2.11.1974 (PERTH); Medina, *Aplin 1068*, 10.1961 (PERTH); Capel, *Royce 2698*, 25.9.1948 (PERTH); Busselton, *Gardner*, 11.1936 (PERTH); Maryvale, *Macpherson*, 1898 (MEL 60006); Bremer Bay, *Wellstead*, 1900 (PERTH); Albany Highway, 25 km N. of Mt Barker, *Pullen 10004*, 12.12.1974 (CANB); King Georges Sound, *Oldfield* (MEL 59992). **Eyre:** between Jeramungup & Ravensthorpe at West River Crossing, *Canning*, 10.11.1968 (CBG); Desmond, near Ravensthorpe, *Maiden NSW 116949*, 11.1909 (NSW); between Esperance Bay & Frasers Range, *Dempster*, 1876 (MEL 60926).

S. tenuifolia is similar to *S. variabilis* but differs in the longer floret and awns and the longer, usually unequal glumes.

***Stipa trichophylla* Benth.**, Fl. Austral. 7: 570 (1878); Hughes, Kew Bull. 1921: 14 (1921); Gardner, Fl. W. Austral. 1, Gram.: 180 (1952).

HOLOTYPE: WESTERN AUSTRALIA: *Drummond 122* (K!; isotype MEL 60010, 60011, CANB photo 237021).

Caespitose perennial to 0.6 metres high with a basal tuft of mainly intravaginal shoots to half the height. Culms erect but usually geniculate at the first node, easily compressible, terete, 0.8–1.5 mm wide near the base, smooth to slightly ribbed, glabrous (or the basal internodes puberulous) but sparsely to moderately pubescent or scaberulous just below the nodes; nodes 2–3, exserted, to 50% broader than adjacent internodes, glabrous. Leaf sheaths tightly enveloping the culms although older basal sheaths often present and loose, ribbed, 2.5–5 mm wide, the uppermost sheath broader, to 7 mm wide; lowermost sheaths pubescent, almost glabrous, or villous with appressed hairs; upper sheaths glabrous to minutely scaberulous between the nerves; inner margin glabrous; outer margin long-ciliate, especially just below the orifice, or glabrous on the upper sheaths. Ligule membranous, 0.5–1 mm long where continuous with the sheath-margin lobes, usually much shorter in the middle, obtuse or lacinate, ciliate, auricles slightly thickened, not spreading, with a tuft of fine, straight or slightly crinkly hairs 1–1.7 mm long. Leaf blades to 20 cm long, very fine, erect or flexuose, tightly inrolled, 0.3–0.5 mm diameter; abaxial surface scarcely ribbed, hirsute with dense to sparse, soft, spreading hairs to 1 mm long, scabrous with a layer of shorter, stronger hairs; adaxial surface strongly ribbed, sparsely to densely hirsute with long hairs, margin similar to abaxial surface or with antrorse scabrous hairs. Panicle to 25 cm long, exserted, contracted, or occasionally spreading, 15–40 mm wide (excluding awns), sparse with moderately distant fascicles of few, sparsely-flowered branches; axis terete; axis, branches and pedicels scabrous to puberulous; branches angular to 8 cm long; pedicels to 15 mm long, very slender, flattened. Spikelets 9.5–14 mm long (excluding awn), slightly gaping after floret disarticulation. Glumes subequal to unequal, finely acuminate, purple-tinged at the ends of the nerves, otherwise straw-coloured, transparent and membranous at the tip, firm at the base; lower glume 9.5–14 mm long, the lower 50–70% 3-nerved; upper glume 8–11.5 mm long, the lower 20–50% 5-nerved, the next 10–40% 3-nerved. Floret linear to fusiform, 3.8–6.5 mm long (including callus) with a slight neck, the 3 main nerves slightly prominent at the apex. Lemma finely granular except tuberculate over the apex of the midvein, gold-brown at maturity, the nerves paler; hairs

white, erect and spreading, sparse especially at the apex; coma obscure, of few hairs in two lateral tufts to 1.5 mm long; lobes usually 2, to 0.3 mm long. Callus 1.2–2.5 mm long, straight and fine, with dense white hairs. Awn 38–60 (–75) mm long, 0.15–0.35 mm wide near the base, falcate; column 6–10 mm long, densely pubescent with spreading hairs 0.15–0.3 (–0.4) mm long; bristle scaberulous. Palea 0.25–0.5 mm shorter than the lemma, broadly acute to obtuse, coriaceous down the centre with a line of white hairs; margins and tip membranous and glabrous. Lodicules 2, membranous, abaxial, 0.5–0.7 mm long, linear to slightly spatulate. Anthers 1.5–2 mm long, penicillate. Caryopsis 2.3–3 mm long; embryo 20–30% the length; hilum 40–50% the length.

DISTRIBUTION: Scattered and uncommon in the drier areas of New South Wales, Victoria, South Australia, Northern Territory and southern Western Australia.

SELECTED SPECIMENS: NEW SOUTH WALES: **South Western Plains:** Kyalite State Forest, 34°58'S, 143°32'E, *Everett 52 & Jacobs*, 22.11.1980 (NSW). **North Far Western Plains:** Olive Downs Jump Up, 32°04'S, 141°55'E, *Everett 237 & Jacobs*, 6.9.1981 (NSW).

VICTORIA: Region C: S. slope of Mt Arapiles, 36°45'S, 141°50'E, *Everett 366 & Jacobs*, 17.10.1981 (NSW). **Region D:** 3.7 miles [6 km] W. of Tubbut, *Beaglehole 33132 & Finck*, 5.1.1970 (NSW).

NORTHERN TERRITORY: 8 miles [13 km] WNW. of Ayers Rock, *Lazarides 6152*, 7.9.1956 (NSW); 37 miles [43 km] NE. of Docker River Settlement, *Latz 868*, 28.10.1970 (NT, CANB).

SOUTH AUSTRALIA: North-western: Government North West Expedition, *Basedow 120*, 1903 (NSW); Tompkinson Ranges, *Cleland*, 25.8.1954 (AD 96806194); c. 1.75 km WNW. of summit of Mt Poondinna, *Whibley 6447*, 29.8.1978 (AD). **Lake Eyre Basin:** Hamilton Creek, *Langley 396*, 9.1898 (AD). **Flinders Ranges:** Arkaroola, 30°19'S, 139°18'E, *Everett 245* 13.9.1981 (NSW); Mt Gee, *Kuchel 3167*, 15.9.1973 (AD); Mt Chambers Gorge, *Cleland*, 31.5.1937 (AD 95714010); 'Moolooloo', between Blinman & Beltana, *Rogers NSW 116876*, 10.1915 (NSW); above Aroona Valley, *Symon 7241*, 12.9.1971 (ADW, NSW); Wilpena Pound, 31°31'S, 138°34'E, *Everett 266*, 17.9.1981 (NSW); Melrose, *Czornij 632*, 10.10.1973 (AD). **Eastern:** 'Koonamore', *Osborne*, 18.12.1924 (AD 97741253); 'Mt Victor', *Crisp 440*, 4.9.1971 (CBG); Morialta, *Vickery NSW 116873*, 11.1938 (NSW). **Eyre Peninsula:** Gawler Range, *Weber 3073*, 23.9.1972 (AD); Warunda, *White*, 10.1909 (AD 97734167). **Northern Lofty:** South Hummocks Range, *Blaylock 736*, 1.10.1967; nr. Owen, *Cleland*, 30.10.1968 (AD 97350090). **Murray:** 15 km W. of Murray Bridge, *Carrick 3805*, 2.10.1974 (NSW); c. 25 km N. of Lamerook, *Cleland*, 13.10.1960 (AD 968061298). **Yorke Peninsula:** 1.5 miles [2 km] N. of Winulta, *Symon 1475*, 14.9.1961 (ADW). **Southern Lofty:** 2 miles [3 km] WNW. of Gawler, *Smith 959*, 23.10.1967 (AD). **South-eastern:** 47 km N. of Kingston, *Symon 10548*, 11.10.1975 (ADW, NSW); 3.7 km S. of Banff, *Symon 10414*, 9.10.1975 (ADW, NSW).

WESTERN AUSTRALIA: Eucla: Eucla, *Noble NSW 116864*, 8.8.1973 (NSW). **Austin:** 40 miles [64 km] E. of Meekathara, *Royce 2004*, 15.6.1947 (PERTH); Wiluna area, *Morrisey 48*, 12.1970 (PERTH); 4 miles [6 km] S. of Agnew, *Beaglehole 59683 & Errey*, 14.9.1978 (NSW); Youanmi townsite, *Saffrey 1023*, 26.8.1970 (PERTH); Poison Creek via Leonora, *McGregor NSW 116857*, 9.1909 (NSW); 'Glenorn', *Burbidge 114*, 8.1938 (PERTH). **Coolgardie:** 30 miles [48 km] S. of Coolgardie, *Smith 532*, 16.9.1966 (NSW); Fraser Range, *Beard 6301*, 13.9.1970 (PERTH, NSW). **Roe:** 0.5 miles [1 km] E. of Julakin Rock, *Malcom*, 24.10.1959 (PERTH); Peak Charles, *Newbey 6457*, 11.11.1979 (PERTH); Desmond, *Maiden NSW 116861*, 11.1909 (NSW). **Eyre:** Cape Arid National Park, *Royce 10145*, 5.12.1971 (PERTH); 104 miles [168 km] W. of Esperance, *Beaglehole 13094*, 17.9.1965 (PERTH, NSW); Susetta Creek, *Royce 9190*, 21.10.1970 (NSW). **Avon:** 12 miles [19 km] NW. of Wialki, *Storr NSW 150582*, 4.10.1958 (PERTH); Merredin, *Maiden NSW 116855*, 10.1909 (NSW); Tammin, *Maiden NSW 116863*, 9.1909 (NSW); Northam, *Gardner 6433 p.p.*, 7–8.9.1942 (PERTH); 17 miles [27 km] E. of Pingelly, *Aplin 773*, 10.1960 (PERTH); Wagin, *Gardner*, 10.1920 (PERTH). **Carnarvon:** 1 mile [1.5 km] S. of Wannoo, *Phillips CBG 039486*, 16.9.1968 (CBG). **Irwin:** Northampton, *Helms NSW 116858*, 10.1898 (NSW, PERTH); Pindar, *Maiden NSW 116865*, 10.1909 (NSW). **Darling:** Mt Barker, *Gardner 1.1925* (PERTH).

***Stipa tuckeri* F. Muell.**, *Fragm.* 9: 129 (1881); Hughes, *Kew Bull.* 1921: 11 (1921); Gardner, *Fl. W. Austral.* 1, Gram.: 172, pl. 50B (1952); Willis, *Handb. Pl. Victoria* 1: 181 (1962), edn 2: 181 (1970); Black, *Fl. S. Austral.* 1: 65 (1922), edn 2: 84 (1943).

HOLOTYPE: The specimen labelled 'Type' in MEL bears the following: [in an unidentified hand] 'Stipa Tuckeri, F.v.M. in *Fragm.* XI. p 128 (1881) Type.' [and in Mueller's hand] 'Stipa brevipilumosa F.v.M. Between the Lach, and Darl. R. Not extending so far south as *S. elegantissima*. Garard Tucker' (MEL; dupl. NSW).

Caespitose perennial to c. 0.5 metres high, shortly rhizomatous, without a basal tuft of leaves but with many culm leaves. Culms erect to decumbent, terete, wiry, c. 1.5 mm wide near the base, frequently branching at the nodes, \pm compressible, smooth to strongly ribbed, lowest internodes glabrous, upper internodes pubescent with retrorse hairs 0.5–1 mm long; nodes 3–5, not swollen, not exerted, with sericeous hairs c. 0.6 mm long at the base of the node. Leaf sheaths at first tightly enveloping the culm, later becoming slightly free, pubescent with hairs 0.6–1 mm long, margins glabrous; lower sheath 4.5–7.5 mm wide, moderately ribbed; upper sheath 4.5–8.5 mm wide, weakly to strongly ribbed. Ligule obtuse, membranous, 2.5–6 mm long, glabrous to pubescent on the sides with hairs 0.2 mm long; auricles absent. Leaf blade expanded or loosely rolled, 0.3–1.2 mm wide, c. 13 cm long, strongly ribbed; abaxial surface pubescent with hairs 0.2–0.3 mm long to glabrous; adaxial surface pubescent with hairs 0.1–0.3 mm long; margins ciliate with hairs 0.2–0.5 mm long. Panicle 15–20 cm long, 10–17 cm wide (excluding awns), exerted, pyramidal with whorls of moderately long, few-flowered, compound branches, spreading widely at maturity; axis terete to slightly flattened, glabrous to plumose upwards with hairs c. 0.5 mm long; branches 5–6 cm long, slightly flattened to angular, plumose with hairs 0.3–0.6 mm long; pedicels 1–1.5 cm long, terete, plumose with hairs c. 0.3 mm long. Spikelets 6–7.5 mm long (excluding awn), gaping only at maturity. Glumes unequal, rounded on the back, purple with a straw-coloured tip, scabrous with hairs 0.1–0.2 mm long; lower glume 6–9 mm long, tip acute (to acuminate), lower 40–50% 3-nerved; upper glume 5–9 mm long with an acuminate tip, lower 50–60% 3-nerved, upper 40–50% 1 (–2)-nerved. Floret narrow-cylindrical, tapering to the apex, 4–5 mm long (including callus). Lemma dark brown, the surface tuberculate; coma obscure, 0.1–0.25 mm long; lobes absent. Callus 0.2–0.3 mm long, almost straight, with white hairs 0.2–0.5 (–0.8) mm long. Awn 30–35 mm long, straight or once bent, 0.1–0.2 mm wide near the base, straw-coloured to dark-brown; column c. 10 mm long, scabrous with hairs 0.05–0.1 mm long; bristle scaberulous. Palea 20–35% the length of the lemma, obtuse, surface granular down the centre, margins smooth. Lodicules 2, abaxial, 2–3 mm long, oblong with acute tips. Anthers 1–1.5 mm long, not penicillate. Caryopsis 2.5–3 mm long; embryo 10–30% the length; hilum 50–60% the length.

DISTRIBUTION: Mainly on the Western Plains of New South Wales but also on the North and Central Western Slopes, and in South Australia and Western Australia.

SELECTED SPECIMENS: NEW SOUTH WALES: **North Western Slopes:** Liverpool Plains, *no collector*, no date (NSW 115816). **Central Western Slopes:** Trangie, *Whittet NSW 115807*, 3.1946 (NSW); *Hutchens*, 3.1947 (CANB 13121); 6 miles [9 km] S. of Tullibigeal, 'Wilga Plains' road, *Ingram NSW 115805*, 9.1956 (NSW). **North Western Plains:** c. 25 miles [40 km] SE. of Louth, *Moore 4932*, 21.4.1967 (NSW, CANB); 3 miles [5 km] N. of Cobar, *Leigh NSW 97794*, 10.1966 (NSW); Mt Boppy, *Boorman NSW 115809*, 11.1903 (NSW, K); Nyngan, *Blakely NSW 115817*, 10.1912 (NSW). **South Western Plains:** 3 km NE. of Gilgunnia, *Pickard NSW 145675*, *s.d.* (NSW); 5 miles [8 km] N. of Ivanhoe, *Leigh NSW 115800*, 4.1969 (NSW); between Lachlan & Darling rivers, *Tucker NSW 115815*, *s.d.* (NSW); Yenda, *Nicholson NSW 115813*, 6.1925 (NSW).

SOUTH AUSTRALIA: **Eastern:** 'Bibliando', nr. New West Bore, 31°54'S, 139°03'E, *Crisp* 724, 12.4.1974 (CBG); N. of 'Baratta', SW. of Lake Frome, *Cleland*, 3.12.1930 (AD 97421157). **Murray:** 43 km N. of 'Hypurna', 33°10'S, 140°54'E, *Conn* 930, 12.9.1980 (AD).

WESTERN AUSTRALIA: **Austin:** 'Glenlorn', Malcolm, *Burbidge* 293, 8.1938 (PERTH). **Coolgardie:** Coolgardie–Esperance highway between Norseman & Widgiemooltha, *Willis*, 3.10.1961 (MEL 1509516).

***Stipa variabilis* Hughes**, Kew Bull. 1921: 15 (1921); Gardner, Fl. W. Austral. 1, Gram.: 182 (1952).

HOLOTYPE: WESTERN AUSTRALIA: *Drummond* 961 [which Hughes indicated by an asterisk as the Type] (K!; isotype MEL 59987, CANB photos 237000 and 237001). With her description, Hughes cites three purported synonyms and a number of specimens from four States. The first and second purported synonyms merely report misidentifications by the respective authors and, in view of her clear indication of the specimen she indicated as the Type of *S. variabilis*, have no claim for consideration as Type elements. The third appears to be a synonym of varietal rank, as discussed below. Of the specimens cited from Western Australia, Hughes herself (Kew Bull. 1922: 16 (1922)) casts doubt upon the identity of the three numbers collected at Kauring by Stoward (not seen by us). She accepted *Drummond* 961 as her Type, she also cited 'Ningham Country beyond the Arrowsmith River, *Monger*' which appears to be the Type of *S. pubescens* var. *effusa* Benth. We have seen three sheets: 'Beyond the River Arrowsmith, *Monger*' (MEL 60014), 'Ningham country, *Monger*' (MEL 60013, 60012) which are apparent duplicates, and which are conspecific with *S. variabilis*. We consider it highly improbable that the sheets Hughes cites from South Australia, Victoria and Tasmania (not seen by us) represent *S. variabilis*. Although *S. variabilis* does occur in South Australia it is relatively uncommon and the earliest record is from 1946 indicating the possibility that *S. variabilis* is a comparatively recent introduction to South Australia.

SYNONYM: *S. pubescens* var. *effusa* Benth., Fl. Austral. 7: 750 (1878), as 'var. ?*effusa*'. HOLOTYPE: WESTERN AUSTRALIA: 'Ningham country beyond Arrowsmith River, *Monger*' (K!; 3 apparent isotypes MEL 60012, 60013, 60014).

Caespitose perennial, to 0.8 metres high with a sparse basal tuft of mainly intravaginal shoots to a quarter the height. Culms erect or geniculate, compressible, terete, 0.6–1.0 mm wide near the base, slightly ribbed, glabrous but minutely puberulous just below the nodes, rarely sparsely puberulous overall; nodes 2–3, barely exerted, to 50% broader than adjacent internodes, glabrous. Leaf sheaths tightly enveloping the culms, at length loose, ribbed; lowermost sheaths pubescent or almost glabrous or villous with long, appressed hairs; upper sheaths glabrous or scaberulous; inner margin glabrous; outer margin ciliate, especially just below the orifice or glabrous on the upper sheaths. Ligule thinly coriaceous, 0.5–1.0 mm long in the middle, to 2.0 mm long where continuous with sheath-margin lobes, obliquely truncate, glabrous; auricles thickened, spreading; auricles with a dense line of long thick hairs. Leaf blades to 25 cm long, flexuose, usually inrolled, 0.5–0.6 mm diameter, occasionally expanded, to 4 mm wide; abaxial surface scarcely ribbed, glabrous or occasionally scabrous to hirsute, especially on the basal leaves; adaxial surface strongly ribbed, sparsely to densely hirsute; margins similar to abaxial surface or with minute antrorse scabrous hairs. Panicle to 35 cm long, exerted, contracted or occasionally spreading, to 4 cm wide (excluding awns), sparse with moderately close fascicles of few, sparsely-flowered branches; axis terete, glabrous or scaberulous; branches to 9 cm long, terete, scaberulous; pedicels to 20 mm long, terete, scaberulous to scabrous upwards. Spikelets 10–13 mm long (excluding awn), slightly gaping after floret disarticulation. Glumes equal to unequal, acuminate, usually purple-tinged; lower glume 10–15 mm long, membranous and translucent, the lower 30–50% 3-nerved; upper glume 8.5–12.5 mm long, membranous and translucent at the tip, firmer and green or yellow at the base, the lower 25–35% 5-nerved, 3-nerved to 40–60%. Floret

linear to fusiform, 4.5–6.5 (–7) mm long (including callus) with a slight neck, the 3 main nerves slightly thickened at the apex. Lemma finely granular, except tuberculate over the apex of the midvein, black-brown at maturity; hairs white, erect and spreading, sparse especially at the apex; coma obscure, of few hairs in 2 lateral tufts to 1.0 mm long; lobes usually 2, to 0.25 mm long. Callus 1.6–2.2 mm long, straight and sturdy, sericeous with dense white to pale yellow hairs. Awn 50–70 (–90) mm long, (0.2–) 0.3–0.4 mm wide near the base, falcate; column 11–14 mm long, 6–11 mm to the end of the straight portion, densely pubescent or villous with spreading hairs 0.2–0.5 mm long; bristle scaberulous. Palea 0.3–0.5 mm shorter than the lemma, broadly acute to obtuse, coriaceous down the centre with a line of white hairs; margins and tip membranous and glabrous. Lodicules 2, membranous, abaxial, 1.0–1.6 mm long, long-spathulate. Anthers 1.5–2.8 mm long, lightly penicillate. Caryopsis 3–4 mm long; embryo 25–30% the length; hilum 70–75% the length.

DISTRIBUTION: Southern Western Australia and eastwards to southern regions of South Australia.

SELECTED SPECIMENS: SOUTH AUSTRALIA: **Nullarbor:** 15 km E. of 'Koonalda', *Chinnock 1192*, 21.9.1973 (AD); Nullarbor Plain, *Hilton*, 22.8.1955 (ADW 1977). **Eyre Peninsula:** 9 km NE. of Penong, *Crisp 6362*, *Taylor & Jackson*, 5.10.1979 (CBG); c. 146 km S. of Kingoonya, Iron Knob road, *Orchard 939*, 26.8.1968 (AD). **Northern Lofty:** Tothill Range, *Kraehenbuehl 1084*, 27.10.1964 (AD). **Yorke Peninsula:** Kadina Mine dump, *Lothian 3032*, 3.11.1964 (AD). **Southern Lofty:** Elizabeth, *Kraehenbuehl 1428*, 20.6.1965 (AD); Anstys Hill, *Cleland*, 14.9.1946 (AD 96326158); Black Hill nr. Athelstone, *Spooner 5318*, 2.9.1977 (AD 97813108); National Park [Belair], *Cleland, s.d.* (AD 95714025); Woodville, *Cleland*, 9.9.1948 (AD 96326138); Victor Harbor, *Hilton*, 15.10.1955 (ADW 13246). **South-eastern:** nr. Keith, *Specht*, 9.1949 (AD 96514010).

WESTERN AUSTRALIA: **Eucla:** 50 miles [80 km] NNE. of Rawlinna, *Brooker 172*, 5.9.1974 (CANB); Forrest, *Aplin 1647*, 31.8.1962 (PERTH); 62 km S. of Rawlinna, Cocklebiddy road, *George 11882*, 13.7.1974 (PERTH, NSW); Western Australia–South Australia border, Eyre Highway, *Phillips 258*, 8.9.1962 (CBG); c. 1 km N. of Eucla, *Beaglehole 49433*, 30.8.1974 (CANB). **Austin:** W. of Youanmi, *Aplin 6089(a)*, 1.9.1975 (PERTH); Laverton, *Maiden NSW 117001*, 1.9.1909 (NSW). **Coolgardie:** 9 miles [14 km] W. of Coolgardie, *Phillips CBG 027104*, 16.9.1962 (CBG); between Norseman & Coolgardie, *Canning 2637*, 5.9.1968 (CBG, NSW); 48 km W. of Coonana nr. Cardonia Rocks, *Chinnock 1116*, 18.9.1973 (AD); Fraser Range, *Dempster*, 1876 (MEL 59986, 60905); 2.5 miles [4 km] from Caiguna towards Madura, *Canning CBG 039218*, 4.9.1968 (CBG, NSW); Woodline, *Cleland s.d.* (AD 966050958). **Roë:** Pallarup Rocks, SE. of Lake King, *George 1546*, 13.10.1960 (PERTH). **Eyre:** Israelite Bay, *Brookes NSW 151491*, 9.1915 (NSW); Munglinup River, Esperance–Ravensthorpe road, *Canning 7079*, 7090, 3.11.1968 (CBG); West River, between Jeramungup & Ravensthorpe, *Canning 7548*, 10.11.1968 (CBG, NSW); between Esperance Bay & Fraser Range, *Dempster 1876* (MEL 60937); Observatory I., 33°56'S, 121°48'E, *Weston 9415*, 2.6.1974 (PERTH); Lort River, Esperance–Ravensthorpe road, *Jackson 1365B*, 9.10.1968 (AD, PERTH); Susetta River, *George 10011*, 13.7.1970 (PERTH); Fitzgerald River, *George 10558* (PERTH), *10571* 19.12.1970 (PERTH, NSW); Stirling Range, *Nelson ANU 16802*, 24.10.1972 (CANB); Young River, Esperance–Ravensthorpe road, *Donner 2968*, 10.10.1968 (AD, PERTH). **Avon:** Mingenew, *Holmes*, 20.8.1934 (PERTH); Three Springs, *Canning 3347*, 23.9.1968 (CBG, AD); 46 miles [74 km] N. of Coorow, *Phillips CBG 018892*, 25.9.1962 (CBG); 35.6 miles [57 km] from Wubin towards Wongan Hills, *Canning 2889*, 13.9.1968 (CBG, BRI); 3–4 miles [5–6 km] from Northam, *Salasoo 241*, *244*, 15.10.1949 (NSW). **Irwin:** Northampton, *Galbraith 573*, 27.8.1964 (MEL); Minninooka [Moonyoonooka] 25 miles [40 km] E. of Geraldton, *Morris*, 9.1947 (MEL 60023, 60026). **Darling:** 15 miles [24 km] from Jurien Bay towards Moora *Phillips 1678*, 25.9.1968 (CBG, BRI); Moora, *Blake 18049*, 1.9.1947 (BRI, PERTH); c. 6 miles [9 km] S. of New Norcia, *Beard 7935*, 30.9.1976 (NSW, PERTH); Gingin, *Gardner*, 7.12.1923 (PERTH); Darling Range, *Morris*, 9.1947 (MEL 60017, 60018); 25 km N. of Mt Barker, *Pullen 10004*, 12.12.1974 (NSW).

The specific epithet has been applied to a range of species (nearly all of the Falcateae) by Australian collectors and authors in recent years, and their identifications and descriptions must be regarded with caution.

S. variabilis is characterised by a floret 4.5–7 mm long and a densely pubescent column of the awn.

***Stipa velutina* J. Vickery, S.W.L. Jacobs & J. Everett, sp. nov.**

S. flavescenti affinis, sed pilis velutinis laminarum foliorum vaginarumque, glumis pubescentibus, flosculo plerumque brevior, differt.

HOLOTYPE: SOUTH AUSTRALIA: **Nullarbor**: Head of Bight, *J.C. Noble* 7, 7.8.1973 (NSW 117409).

Caespitose perennial 0.3–0.8 metres tall, without rhizomes. Shoots conspicuously extravaginal, flexuose, half to equal the height. Culms geniculate at the base, terete, \pm compressible, 1.5–2 mm wide near the base, sparsely ribbed to strongly ribbed upwards, velutinous with dense soft minute hairs; nodes to 50% wider than the adjacent internodes, exerted, velutinous with hairs 0.2–0.5 mm long. Leaf sheaths tight around the culms, uppermost slightly inflated at the base of the panicle, moderately ribbed, velutinous with hairs minute–1 mm long; basal sheaths glabrous on innovations, 4–8 mm wide, outer margin long-ciliate with hairs 0.2–0.5 mm long, inner margin glabrous; upper sheaths 4–5 mm wide, outer margin long-ciliate with hairs 0.2–1 mm long, inner margin glabrous. Ligule membranous, broadly obtuse to truncate, often erose, 0.2–1 mm long, sericeous on the abaxial surface, ciliate with hairs 0.1–0.3 mm long; auricles \pm thickened, c. 1 mm long, with tufts of straight hairs 1 mm long. Leaf blades linear, expanded or loosely inrolled, 2–3 mm wide, to 40 cm long, margins and both surfaces velutinous with hairs minute–0.1 mm long; abaxial surface smooth to moderately ribbed; adaxial surface strongly ribbed. Panicle contracted, 15 cm long, 0.5–2 cm wide (excluding awns), with closely spaced fascicles of unequal, few-flowered, compound branches, exerted late; axis terete, velutinous with hairs minute–0.2 mm long; branches angular, to 3.5 cm long, pubescent with hairs 0.1–0.2 mm long; pedicels angular, 1–5 mm long, pubescent with hairs 0.1–0.2 mm long. Spikelets slightly gaping, 9–12 mm long (excluding awn). Glumes unequal, sparsely pubescent with hairs minute to 0.5 mm long; lower glume 9–12 mm long, long-acuminate, lower 20–35% 3-nerved, upper 65–80% 2–1-nerved, green-yellow at the base but purple-tinged for most of its length; upper glume 6.5–10 mm long, acute to acuminate, lower 25–50% 5-nerved, upper 50–75% 3–1-nerved, green-yellow, purple at the tip. Floret narrow-fusiform, 5–6.5 mm long (including callus). Lemma surface slightly granular, with soft spreading white hairs 0.5–1.5 mm long; coma 0.1–0.5 mm long, formed from the upper hairs; lobes absent or 2, 0.1–0.2 mm long. Callus straight, 1–2 mm long, densely sericeous with white hairs 0.1–0.8 mm long. Awn 0.2 mm wide at the base, 30–45 mm long with two bends; column straw-coloured, 10–25 mm long, 7–9 mm to the first bend, pubescent with soft hairs 0.1–0.3 mm long; bristle straw-coloured, scaberulous. Palea subequal to the lemma, broadly acute to obtuse, slightly granular down the centre, sericeous down the centre with hairs 0.5–1.5 mm long, the tip ciliate with hairs 0.1–0.5 mm long. Lodicules 2, abaxial, oblong to acute, membranous, 0.8–1.2 mm long. Anthers 1–2 mm long, not penicillate. Caryopsis c. 3 mm long; embryo 15% the length; hilum 70% the length.

DISTRIBUTION: Coast and islands of the Great Australian Bight.

SPECIMENS EXAMINED: SOUTH AUSTRALIA: **Nullarbor**: 'Nullarbor', *Cleland*, 12.11.1955 (AD 96324049); Head of Great Australian Bight, *Whibley 616*, 13.9.1960 (AD), *Noble 7*, 7.8.1973 (NSW 117409); Franklin I., *Forrest*, 22.2.1969 (ADW 36594); Masillon I., Nuyts Archipelago, *Wace 41* 5.1.1971 (AD); Fenelon I., *Wace 279*, 5.10.1972 (NT).

WESTERN AUSTRALIA: **Eucla**: 3.5 miles [6 km] E. of Eucla, *George 8516*, 15.10.1966 (PERTH); between Eucla & Eilsons Bluffs, *Phillips CBG 018888*, 8.9.1962 (CBG).

Stipa verticillata Nees ex Sprengel, Syst. Veg. 4, Cur. Post.: 30 (1827); Vickery, Contrib. N.S.W. Natl. Herb. 2: 77 (1953); Beadle, Evans & Carolin, Handb. Vasc. Pl. Sydney District: 532 (1963), Fl. Sydney Region: 657 (1972); Veldkamp, Blumea 22: 10 (1974).

Streptachne verticillata (Nees ex Sprengel) Trin. & Rupr., Mém. Acad. Imp. Sci. Saint-Pétersbourg, ser. 6, Sci., Math, Seconde Pt. Sci. Nat. 5: 8 (1842).

TYPIIFICATION: '*Sieber Agrostotheca* no. 64'. Sprengel's grass specimens were sold to Karl Muller and their whereabouts are now not known. Veldkamp (*loc. cit.*) claims that the Holotype is at LE but has not seen the specimen: he gives no reasons for making this claim. Isotypes are at K, MEL and BRI (and elsewhere). The specimen at K(!) has usually been taken as the Type and is here designated as **Lectotype**.

SYNONYM: *Stipa micrantha* R. Br., Prodr.: 175 (1810), non Cav. (1799). HOLOTYPE: AUSTRALIA: R. Brown, Iter Austral. 1802 (BM!, isotype: NSW 115965).

Caespitose perennial to c. 2 metres high, shortly rhizomatous, with numerous branches at each node, without a basal tuft. Culms erect, (0.9–) 2 (–3) mm wide near the base, terete, \pm compressible, finely but weakly ribbed, glabrous to scabrous with minute hairs; nodes (2–) 6–9, exserted, glabrous, 30–50% wider than the adjacent internodes. Leaf sheaths at first tightly enveloping the culm, later becoming free, glabrous, slightly to moderately ribbed, margins glabrous, basal sheath 0.5–1.5 cm wide, upper sheath (1–) 3–5 mm wide. Ligule erose to entire, membranous, 2–8 mm long, glabrous; auricles absent. Leaf blade expanded, linear, 1–3 mm wide, (14–) 17–25 (–40) cm long, often readily deciduous; abaxial surface slightly ribbed, pilose to scabrous; adaxial surface moderately ribbed, pilose to scabrous; margins glabrous to pilose or scabrous. Panicle 15–60 cm long, exserted, \pm contracted, (1–) 2–4 (–5) cm wide (excluding awns); axis terete, glabrous; branches to 13 cm long, angled, scabrous; pedicels (1–) 3–5 (–11) mm long, angled, scabrous. Spikelets 3 (–4) mm long (excluding awn), gaping. Glumes equal to subequal, acute, rounded on the back, pale green, scabrous along the nerves; lower glume 3–3.6 (–5) mm long, lower 90% 3-nerved; upper glume 3–3.5 (–5) mm long, lower 90–95% 3-nerved. Floret cylindrical without a neck, 2.7–3.5 (–4) mm long (including callus). Lemma straw-coloured, black at maturity, the surface with white hairs 0.2–0.5 mm long; lobes and coma absent. Callus 0.25 mm long, weakly bent, hairs 0.25–0.5 mm long, the same colour as those on the lemma. Awn 33–53 mm long, pale green to straw-coloured, scabrous with hairs 0.05–0.1 mm long, weakly once or twice bent, 0.1 mm wide near the base; column (7–) 10–16 (–30) mm long, 7–12 mm to the first bend; bristle often darker than the column. Palea 30–60% the length of the lemma, obtuse, the surface smooth to scabrous on the lower half, margins glabrous. Lodicules 2, abaxial, membranous, oblong. Anthers 1.5–2.8 mm long, penicillate. Caryopsis 2.1–3.5 mm long; embryo 25–30% the length, hilum c. 50% the length.

DISTRIBUTION: Widespread through eastern Queensland and the central and northern parts of New South Wales.

SELECTED SPECIMENS: QUEENSLAND: **Mitchell**: 'Warren Point', *Martensz* 94, 22.8.1968 (CANB). **Leichhardt**: Minerva, N. of Springsure, *Blake* 6928, 21.7.1934 (BRI); Carnarvon National Park, *Trapnell & Williams*, 29.6.1965 (BRI); 3 miles [5 km] E. of 'Glenmoral', *Speck* 1883, 17.10.1963 (BRI, NSW, CANB); 32 miles [51 km] W. of Theodore, *Lazarides* 6925, 7.8.1963 (CANB); Isla Gorge, *Sharpe & Hockings*, 21.8.1973 (BRI); 'Boxvale', *White* 9476, 26.10.1933 (BRI); 5.5 miles [9 km] N. of Wandoan, *Speck* 1968, 26.4.1964 (BRI, NSW, CANB, K). **Burnett**: Mundubbera, *Bloxsome*, 1930 (BRI); Gayndah, *White*, 13.5.1917 (BRI). **Warrego**: 'Chesterton', *Blake* 11096, 7.4.1936 (BRI, NSW); 24 km from Augathella on Tambo road, *Simon & Clarkson*, 18.5.1975 (BRI, NSW). **Maranoa**: Mitchell, *Blake* 5734, 4.4.1934 (BRI); 45 km S. of Roma, Surat road, *Blaxell* 1027 & *Johnson*, 29.11.1972 (BRI); between Tara & St. George, *Ebersohn*, 3.7.1962 (BRI); Noondoo, nr. Dirranbandi, *Blake* 10740A, 9.3.1936 (BRI). **Darling Downs**: c. 14 miles [22 km] NE. of

Chinchilla, *Boyland* 672, 9.2.1970 (BRI); Chinchilla, *Maiden NSW 115957*, 3.1909 (NSW); Jandowae, *Moore*, 3.1920 (BRI); 16 km SW. of Dalby, *Gillieatt*, 21.9.1964 (BRI); c. 12 miles [19 km] W. of Meandarra, *Johnson 753*, 23.3.1959 (BRI); nr. Allora, *Blake 295*, 25.6.1932 (BRI); Hermitage Research Station, *Simon & Henderson*, 9.12.1974 (BRI); between Inglewood & Milmerran, *White 9729*, 20.1.1934 (BRI); Yelarbon, *Blake 10466*, 22.2.1936 (BRI); Kurrumbul, *Everist 702*, 13.12.1934 (BRI); Maryland Creek, 28°38'S, 151°38'E, *Wilson 4251a*, 31.12.1981 (NSW); Wyberba, *Blake 4642*, 23.1.1933 (BRI). **Moreton:** nr. Yarraman, *Phillips CBG 001278*, 6.6.1961 (CBG); Brisbane River, *White*, 10.1915 (BRI); between One Mile Creek & Samson Vale, *Blake 192*, 28.12.1931 (BRI); Brisbane, *Blake 167*, 27.2.1931 (BRI); Laidley, *White 6820*, 5.7.1930 (BRI).

NEW SOUTH WALES: **North Coast:** Lismore, *Hewitt NSW 115960*, 12.1909 (NSW); Singleton, *Boorman NSW 115963*, 4.1908 (NSW); Bulga Ranges, *Brown NSW 115964*, 3.1906 (NSW). **Central Coast:** Windsor to Kurrajong, *Gray 5988*, 29.11.1966 (CANB); Penrith, *Betche NSW 115971*, 1899 (NSW); Flemington, *Vickery NSW 115967*, 5.1929 (NSW); Kogarah, *Cheel NSW 115969*, 10.1899 (NSW); Glenfield, *Cheel NSW 115972* (NSW). **South Coast:** Pig I., Shoalhaven River, *Rodway NSW 115973*, 1.1.1932 (NSW); Bega, *Waterson NSW 115975*, 12.1912 (NSW). **Northern Tablelands:** Moona Plains, *Crawford NSW 115962*, 3.1899 (NSW). **North Western Slopes:** Wallangra, *Boorman NSW 115991*, 4.1913 (NSW); Warialda, *Hadley NSW 115992*, 5.1908 (NSW); Gravesend to Glandon, *Carne NSW 115993*, 5.1914 (NSW); Inverell, *Thomas NSW 115995*, 1.1913 (NSW); Woods Reef, *Rupp NSW 115996*, 6.1913 (NSW); Boggabri, *Cabbage NSW 115997*, 11.1909 (NSW); Baradine, *Jensen NSW 115998*, 8.1911 (NSW); Manilla, *McKie NSW 2524*, 11.1938 (NSW); Gunnedah, *Cleland NSW 116000*, 2.1911 (NSW); Bugaldi, *Woodhill NSW 115999*, 2.1934 (NSW); between Piallamore & Dungowan, *Goode 74*, 11.1954 (NSW); Breeza, *Court NSW 116003*, 5.1899 (NSW). **Central Western Slopes:** Trangie, *Helms NSW 31946*, 11.1892 (NSW); Moonan Flat, *Maiden & Boorman NSW 115961*, 5.1902 (NSW, PERTH); Cassilis, *Reeve & Cook 23*, 11.3.1972 (CANB); Dunedoo, *Nicholson NSW 115978*, 6.1931 (NSW); Pages River, *Maiden NSW 115979*, 8.1899 (NSW); Belltrees via Scone, *White NSW 115980*, 2.1920 (NSW, BRI); Narromine, *Cowman NSW 115981*, 8.1946 (NSW); W. of Dubbo, Narromine Road, *Henderson NSW 9297*, 1.1948 (NSW); Growee Creek, nr. Bylong, *Gauba CBG 046359*, 8.3.1954 (CBG); Baerami Creek, SW. of Muswellbrook, *Story 6739*, 10.1959 (NSW, K); Wollar East, *Johnson & Constable NSW 16043*, 8.1950 (NSW); Yarrabin Road, Mudgee, *Wyndham 3562*, 16.3.1978 (NSW); 5 miles [8 km] S. of Cowra, *McBarron 9176*, 8.1964 (NSW). **South Western Slopes:** Thurgoona, nr. Albury, *McBarron 6082*, 2.1953 (NSW). **North Western Plains:** 15 miles [24 km] W. of Garah, *Solling 494*, 4.1973 (NSW); 16 miles [25 km] N. of Moree, *McBarron 15752*, 9.1968 (NSW); Burren Junction, *Boorman NSW 115986*, 6.1907 (NSW); Coonamble, *Breakwell NSW 115988*, 10.1912 (NSW); Gular, *Brown NSW 115989*, 6.1913 (NSW); 33 miles [53 km] W. of Nyngan, Cobar road, *Cunningham 901*, 5.1969 (NSW); Nyngan, *Little NSW 115990*, 1920 (NSW); 62 miles [99 km] E. of Cobar on Barrier Highway, *Moore 3924*, 19.11.1966 (CANB).

***Stipa vickeryana* J. Everett & S.W.L. Jacobs, *Telopea* 2(4): 397 (1983).**

HOLOTYPE: SOUTH AUSTRALIA: Ifould Lake, Nullarbor Plain Series R502 Barton 5121 74, 30°55'S, 132°05'E. Common grass. Forming dense clumps. Heads open, spreading. *R.J. Chinnock 2729*, 2.x.1975 (AD).

Caespitose annual or perennial to 45 cm high. Culms (1.5–) 2–2.5 mm wide near the base, terete to slightly flattened, ribbed, glabrous; nodes 1–2, glabrous. Leaf sheaths loose around the culms, glabrous except for the shortly pubescent bases of lowermost sheaths; outer margin fringed with long, woolly cilia; inner margin not ciliate. Ligule 3.5–8 (–13) mm long, laciniate, densely ciliate with long woolly hairs especially on those of the lower sheaths. Leaf blades to 18 cm long, 1.5–4 mm wide, often folded; abaxial surface unribbed, glabrous except for the very sparsely scabrous long-acute tip; adaxial surface strongly ribbed, the ribs covered with short \pm antrorse hairs. Panicle 9–20 cm long, slightly spreading, the base enclosed by the sheath. Spikelets scarcely gaping at maturity, widely gaping after floret disarticulation, 14–18 mm long (excluding awn). Glumes unequal, firm at the base, hyaline at the fine acuminate tip, the lower 75% 3-nerved, scaberulous on the nerves, glabrous between the nerves or minutely pubescent especially at the tip; lower glume 14–18 mm long, 3-nerved;

upper glume 9–14 mm long, 5-nerved at the base. Floret fusiform to turbinate, 6–7 mm long (including callus). Lemma deep brown at maturity, smooth except for an antrorsely scabrous neck, glabrous to very sparsely clothed with coppery hairs, denser along the margins; coma sparse, 1–1.5 mm long in two tufts. Callus straight, 2.5–3 mm long, with a tuft of coppery hairs. Awn relatively slender for its length, c. 0.3 mm wide near the base, (80–) 90–125 mm long, \pm straight to gently twice bent or sinuate; column 26–32 mm long, 15–18 mm to the first bend, densely pubescent with antrorse hairs 0.2–0.3 mm long; bristle antrorsely scabrous. Palea obtuse, subequal to the lemma, with sparse coppery hairs along the midline. Lodicules 3, membranous, spatulate; the 2 abaxial c. 1 mm long, the paleal much smaller. Anthers not observed. Caryopsis not observed.

DISTRIBUTION: Inland saline areas from eastern Western Australia to central South Australia.

SPECIMENS EXAMINED: SOUTH AUSTRALIA: **Nullarbor:** W. of Yarle Lakes, *Bowen 312*, 9.1956 (K); Ifould Lake, 30°55'S, 132°05'E, *Chinnock 2729*, 2.10.1975 (AD, NSW), *Lothian 4033*, 3.6.1967 (AD); Lake Ifould Crossing, *Copley 2644*, 28.7.1969 (AD).

WESTERN AUSTRALIA: **Coolgardie:** Norseman, *Andrews*, 10.1903 (PERTH).

Differs from *S. eremophila* in having few scattered hairs on the lemma (densely hairy in *S. eremophila*), in its long-hairy orifices (glabrous or sparsely hairy in *S. eremophila*) and longer (usually less than 1.5 mm in *S. eremophila*) lacinate ligules. *S. vickeryana* vegetatively resembles *S. macalpinei* but differs in its less hairy, broader and darker-coloured mature lemma. Additionally, on the sheaths, *S. macalpinei* has characteristic broad, curled, glistening-translucent hairs, quite different from the narrow, crinkled, more opaque hairs on those of *S. vickeryana*.

S. vickeryana differs from *S. nullanulla* in having coarser, usually folded leaves (rolled in *S. nullanulla*), a less open inflorescence and longer lemma and awn.

***Stipa wakoolica* J. Vickery, S.W.L. Jacobs & J. Everett, sp. nov.**

S. metatori affinis sed glumis flosculisque brevioribus, coma aristaque plerumque brevior, differt.

HOLOTYPE: NEW SOUTH WALES: **South Western Plains:** NE. of Lake Tooim, *D.L.W. Henderson 442*, 5.11.1947 (NSW 117410; isotypes UTC, K, US, BRI, MEL, AD, PERTH).

Densely caespitose perennial to 1 metre high with conspicuously extravaginal innovations. Culms erect or geniculate at the base, 1.5–3 mm wide near the base, terete, compressible, slightly ribbed, densely pubescent to hirsute at the base, the upper internodes similar or scaberulous to glabrous except just below the nodes; nodes 2–3, densely sericeous, exserted, to 40% wider than adjacent internodes. Leaf sheaths tightly enclosing the culms, ribbed, densely pubescent to hirsute; inner margin similar to adjacent surfaces; outer margin densely long-woolly ciliate. Ligule firm, 0.5–0.8 mm long, obtuse to truncate, densely ciliate, abaxial surface sericeous; auricles spreading, the inner auricle conspicuously tufted. Leaf blade expanded to inrolled, 1.5–2.5 mm wide at the base, to 40 cm long; abaxial surface slightly ribbed, densely pubescent and hirsute; adaxial surface strongly ribbed, densely pubescent and hirsute. Panicle spreading, moderately dense, to 36 cm long, exserted at length, with distant fascicles of many-flowered branches, 3–5 cm wide (excluding awns); axis \pm angular, finely scaberulous; branches to 10 cm long, angular, scabrous; pedicels 2–7 mm long,

angular, scabrous. Spikelets 11–15 mm long (excluding awn), gaping early in development. Glumes unequal, firm at the very base, membranous and purple-tinged to hyaline at the tip, minutely scabrous on the nerves; lower glume 11–15 mm long, acuminate, the lower 60% 3-nerved; upper glume 9–11 mm long, broadly acute, the lower 50% 5-nerved, the next 15% 3-nerved. Floret turbinate, the three main nerves thickened at the apex, 5.5–6.5 mm long (including callus). Lemma deep brown at maturity, \pm smooth, sericeous with dense white hairs yellowing at maturity, the apex finely tuberculate and glabrous near the midrib; coma of erect soft hairs 2–2.5 mm long; lobes 2, less than 0.2 mm long. Callus 1.5–2 mm long, fine and straight, with hairs similar to those of the lemma. Awn 0.2–0.25 mm wide near the base, 35–60 mm long, twice bent; column 15–25 mm long, 7–10 mm to the first bend, scabrous with hairs less than 0.15 mm long; bristle scabrous, slightly curved. Palea acute to obtuse, subequal to the lemma (to 0.5 mm shorter), coriaceous, shiny, with a broad band of dense hairs down the centre, hyaline and glabrous at the margins. Lodicules 2, abaxial, membranous, c. 1 mm long, oblong. Caryopsis 3–4 mm long; embryo 30% the length; hilum 60–75% the length.

DISTRIBUTION: Floodplains of the Murray River tributaries of the South Western Plains of New South Wales.

SPECIMENS EXAMINED: NEW SOUTH WALES: **South Western Plains:** Meran Creek, *Henderson 439*, 16.11.1947 (NSW, UTC); N. of Lake Tooim, *Henderson 443*, 31.10.1947 (NSW, UTC, K, BRI); Tulla, *Henderson 126*, 10.1945 (NSW, K).

The specific epithet is derived from the name of the Wakool shire, to which the species appears to be confined.

Acknowledgements

We wish to thank the many people who were involved in helping us with this study, especially Genevieve Godwin, Anna-Louise Quirico, Susanne Walker, Jeannie Highet, Liz Norris, Nerida Ashby and Robyn Thurtell. We would also like to thank Karen Wilson for preparing the Latin diagnoses and Don McGillivray for his useful comments on nomenclatural aspects.

We also acknowledge the assistance of the Directors of the various herbaria who lent specimens.

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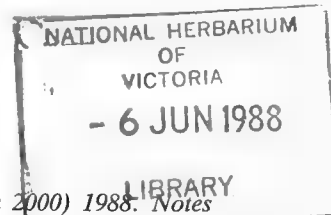
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Notes on Casuarinaceae III: The new genus *Ceuthostoma*

L.A.S. Johnson



Abstract

Johnson, L.A.S. (Royal Botanic Gardens, Sydney, Australia 2000) 1988. Notes on Casuarinaceae III: The new genus *Ceuthostoma*. *Telopea* 3(2): 133-137. — *Ceuthostoma* L. Johnson, gen. nov., and its two species, *C. palawanense* L. Johnson and *C. terminale* L. Johnson, are described. A synoptic key to the four genera of the family is given.

Four genera can be recognised in the family Casuarinaceae: *Casuarina*, *Gymnostoma* (Johnson 1980), *Allocauarina* (Johnson 1982) and *Ceuthostoma*, a small genus in the Malesian region. Preparation of a treatment of the family for 'Flora Malesiana' makes it desirable to describe this fourth genus and its two species now. Postulated phylogenetic relationships in the family will be discussed in a separate, more extensive paper.

The four genera of Casuarinaceae can be distinguished as in the following synoptic key:

- 1 Furrows of branchlets shallow and open, exposing the stomates; teeth 4 per whorl; infructescences on long or short branchlets that are similar to vegetative branchlets, and with a broad bract beneath each pair of bracteoles; samaras grey to pale brown; seed short-lived. $x = 8$. NE. Qld, Malesia to New Caledonia and Fiji ***Gymnostoma* L. Johnson**
- 1* Furrows of branchlets deep and narrow, the stomates not visible; infructescences with more or less thin and inconspicuous bracts 2
- 2 Infructescences on long branchlets that are similar to vegetative branchlets, with relatively very long bracteoles protruding antrorsely; teeth 4; samaras pale brown; seed probably short-lived. Chromosome number unknown. Palawan and Borneo to New Guinea ***Ceuthostoma* L. Johnson**
- 2* Infructescences on short modified woody branchlets ('peduncles'), with very short to long bracteoles protruding at c. 90 degrees to the vertical axis of the infructescence 3
- 3 Samaras grey or yellow-brown, dull; bracteoles of infructescences thin and without any dorsal protuberances; teeth 5 to many; seed short-lived. $x = 9$. SE. Asia to Pacific Islands, mainland Australia ***Casuarina* L.**
- 3* Samaras red-brown to black, shining; bracteoles of infructescences thick and convex, mostly with an angular, divided or spiny dorsal protuberance; teeth 4 to many; seed long-lived. $x = 10, 11, 12, 13, 14$. Australia ***Allocauarina* L. Johnson**

Ceuthostoma L. Johnson, gen. nov.

Arbores verisimiliter dioicae. Ramuli persistentes novelli eis deciduis similes; ramuli omnes quadricostati, sulcis intercostalibus profundis fere clausis, seriebus stomatum abditis. Folia 4 in verticillo unoquoque. Inflorescentiae masculae adhuc

ignotae; spiculae foemineae in ramulis elongatis vel mediocribus sed aspectu eis vegetativis similibus dispositae. Infructescentiae plerumque inter ramulos assimilantes dispositae; bracteae distaliter aliquantum expansae facie abaxiali infra apicem contractum acutumque verticali manifesta, altiore quam latiore vel dimensionibus subaequalibus; bracteolae valde protrudentes textura non valde lignosa, in dorso convexae sed nec fissae nec protuberatione instructae. Chromosomata adhuc ignota.

SPECIES TYPICA: *C. terminale* L. Johnson.

Trees, apparently dioecious. New persistent branchlets similar to deciduous branchlets; all branchlets longitudinally 4-ribbed, the furrows between the phyllichnia deep and almost closed, hiding the rows of stomates. Leaves 4 per whorl. Male inflorescences not known. Female inflorescences on at least moderately long branchlets that are similar to the vegetative branchlets. Infructescences ('cones') usually found amongst the assimilatory branchlets; cone body longer than broad or subequal in dimensions; cone bracts somewhat expanded distally, having an obvious vertical abaxial face below the contracted acute apex; bracteoles strongly protruding antorsely relative to the vertical axis of the body, not strongly woody in texture, convex dorsally and the dorsal eccentric rib obvious, but without protuberances and not striate; samara pale brown, dullish.

Two species in Malesia, from Palawan and Borneo to New Guinea.

The name is derived from Greek *keuthos* = 'hidden' and *stoma* = 'mouth', referring to the concealed position of the stomates in the branchlet furrows, in contrast to *Gymnostoma*. The gender is neuter. In English usage, the stress is on the second syllable, as it is in '*Gymnostoma*'.

Ceuthostoma resembles *Gymnostoma* in general aspect and in its constantly 4-merous whorls of reduced leaves. It differs from that genus in that the stomatal depressions between the phyllichnia* are deep and virtually closed by appression of their rims, as in *Casuarina* and *Allocasuarina*. The infructescences are very small and delicate, with less broadened and less woody bract-faces than in *Gymnostoma*. The infructescence is also distinctive in consisting of only a few (1-2 (-3)) fertile whorls and in having the relatively long bracteoles protruding antorsely to the vertical axis of the cone body, not at 90 degrees as in *Gymnostoma*. Unfortunately, no staminate material has yet been collected, and the chromosome number is not yet known. The stomate-bearing furrows formed by the edges of the phyllichnia may be synapomorphous with the similar condition in *Casuarina* and *Allocasuarina*; on the other hand the fruiting bracteole shape may be a synapomorphy with *Gymnostoma*. The much-broadened fruiting bracts of *Gymnostoma* are probably an apomorphy for that genus.

I had previously included these two species, both hitherto undescribed, in *Gymnostoma*, and specimens in a number of herbaria bearing my determinations under that generic name will need to be removed to *Ceuthostoma*.

*The term phyllichnium (pl. phyllichnia) was introduced by Loew (1865) and is useful to refer to a characteristic feature of Casuarinaceae. It refers to the ridges on the articles of the 'branchlet', which contain a foliar vascular strand for their full length and may be regarded as elongated and modified leaf-base regions, though more traditionally described as 'leaves concrescent with the axis'.

- 1 Branchlet articles 4–7 mm long, 0.7–0.9 mm diameter; phyllichnia with a rounded ridge; teeth 0.7–1.0 mm long; cone body 4–6 mm long; cone bracts 2.0–2.5 mm high and broad; cones on long branchlets **C. terminale**
- 1* Branchlet articles 2.5–5 mm long, 0.4–0.5 mm diameter; phyllichnia with an acute ridge; teeth 0.3–0.7 mm long; cone body 3–4 mm long; cone bracts 1–2 mm high and broad; cones on long or short branchlets **C. palawanense**

***Ceuthostoma terminale* L. Johnson, sp. nov.**

Arbor ad 30 m alta, cortice squamoso. Ramuli decidui 7–12 cm longi, articulis 4–7 mm longis, 0.7–0.9 mm diametro, laminis foliorum (dentibus) 0.7–1.0 mm longis, phyllichniis dorso rotundatis. Infructescentiae plerumque ramulos elongatos terminantes, corpore 4–6 mm longo, bracteis 2.0–2.5 mm altis latisque, bracteolis in seriebus fertilibus 1–2(–3), usque ad 5–7 mm protrudentibus.

HOLOTYPE: BORNEO: **Sabah:** Penibukan, 4000–5000 ft [1220–1525 m], Mt Kinabalu, J. & M.S. Clemens 30757, 7.i.1933 (K, ♀, infructescences). ISOTYPES: A, BO, L, NSW.

Tree to 30 m high, bark flaky or scaly. Deciduous branchlets 7–12 cm long, articles 4–7 mm long, 0.7–0.9 mm diameter, occasionally white-pubescent in the furrows, leaf laminae (teeth) narrow-deltoid, 0.7–1.0 mm long, phyllichnia dorsally rounded. Infructescences ('cones') mostly terminal on elongated branchlets, somewhat white-pubescent, with 1–2(–3) fertile whorls; cone body 4–6 mm long; bracts 2.0–2.5 mm high and broad, not markedly striate; bracteoles protruding up to 5–7 mm, with eccentric rib prominent dorsally; samara c. 6 mm long, wing hyaline. Fig. 1 a,b.

DISTRIBUTION: Known from a few isolated localities on the following islands: Borneo (on the slopes of Mt Kinabalu from 1000 to 2000 m), Halmahera (Nucifera, Weda district) and New Guinea (Irian Jaya near Djayapura).

SPECIMENS EXAMINED: BORNEO: **Sabah:** Ulu, Mahandui, Mt Kinabalu, Carr SFN 26398, 6.iii.1933 (NSW, SING); Bembangan R., Mt Kinabalu, Chew & Corner RSNB 4490, 4963, 23.ii.1964 (K); Pinosuk Plateau, Sungei Bembangan, Mt Kinabalu, Chew, Corner & Stainton 1297 (K, L); spur ridge S. of Kinataki R., Mt Kinabalu, Clemens s.n. (BO); spur ridge S. of Kina Taki R., Penibukan, Mt Kinabalu, Clemens & Clemens NSW 63028, 5.ii.1933 (NSW); Penibukan, Clemens & Clemens 31312, 16.i.1933 (A, B, BO, L); Penataran R., Mt Kinabalu, Clemens & Clemens 32576, 16.vi.1933 (A, BO, L); Penataran basin, Mt Kinabalu, Clemens & Clemens 40154, 31.viii.1933 (A, BO, NSW); Lamag District: Mt Tavai, Karamuak, Kinabatongan, Meijer 51741, 19.vi.1965 (K); no precise locality, Clemens 3132 (A, B, BO, K), 50314 (A, K).

MALUKU: Halmahera, Nucifera, De Haan 1757, 26.ix.1950 (K); Halmahera, – (L).

NEW GUINEA: **Irian Jaya:** Hollandia [Djayapura], Brass 8820, vi–vii.1938 (A, BRI, NSW 63026), Versteegh 4704, 20.iii.1957 (CANB, L, LAE), van Royen & Sleumer 6308, 26.vii.1961 (CANB, K, L); Cape Tanah Merah, van Royen & Sleumer 6497, 7.viii.1961 (BRI, K, LAE).

C. terminale is found in places where the rainforest canopy is interrupted, on ridges and slopes. On Mt Kinabalu it has been recorded from the banks of the Penataran River, on ridges [granite] and old landslides, sometimes forming pure stands of small extent. On Halmahera it is said to occur on hills, on clayey yellow earth derived from weathered serpentinite, and to be a very common tree '... used for construction and firewood'. Near Djayapura (formerly Hollandia) it is recorded from sea level to 200 m altitude in eroded places on lateritic soil near forest margins, or sometimes in the forest. The species is recorded as a tree

6–30 m, with 'shaly [scaly?]' bark, with rounded crowns on old trees. In some of the New Guinea specimens the bark on the branches is thick, rough and corky, but this feature is not evident in the specimens from Borneo. The branchlets are said to be grey-green, which may be due in part to short hairs sometimes evident in the furrows. There appear to be slight differences between the populations in dimensions of cone-parts, but these may not be significant.

The specific epithet refers to the fact that the female inflorescences are mostly borne on elongated branchlets, thus appearing 'terminal' rather than 'lateral'.

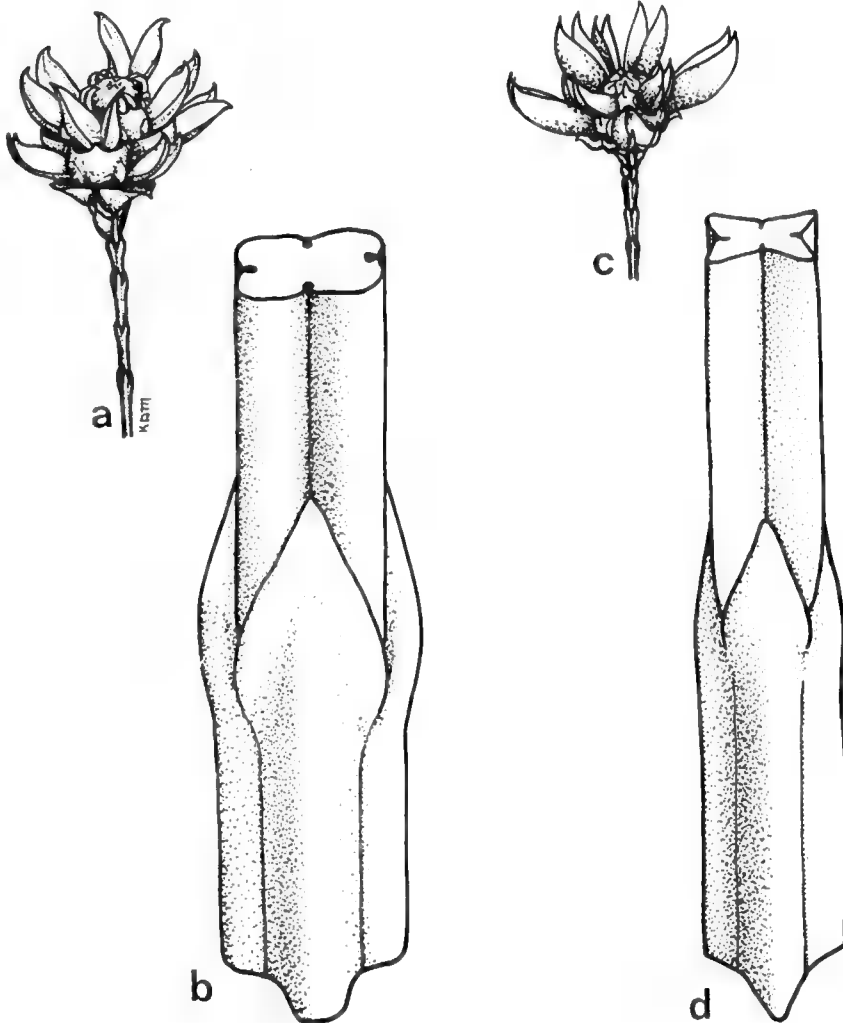


Fig. 1. *Ceuthostoma terminale*: a, infructescence (X2.6); b, portion of branchlet (X26). *C. palawanense*: c, infructescence (X2.6); d, portion of branchlet (X26). (a from NSW 63026; b from Clemens & Clemens 40154; c from Foxworthy 710; d from Merrill 785).

***Ceuthostoma palawanense* L. Johnson, sp. nov.**

Arbor ad 10 m (vel altior?). Ramuli decidui circiter 6–8 cm longi, articulis 2.5–5 mm longis, 0.4–0.5 mm diametro, laminis foliorum 0.3–0.7 mm longis, phyllichniis dorso acutis. Infructescentiae ramulos breves vel modice elongatos terminantes, corpore 3–4 mm longo, bracteis 1–2 mm altis latisque, bracteolis in seriebus 1–2, usque ad 5 mm protrudentibus.

HOLOTYPE: PHILIPPINES: **Palawan** ('Island of Paragua'): E-wi-ig River, *E.D. Merrill 785*, 18.ii.1903 (A, ♀, infructescences). ISOTYPES: K, NSW, NY, SING, US.

Tree to 10 m (or taller?). Deciduous branchlets c. 6–8 cm long, articles 2.5–5 mm long, 0.4–0.5 mm diameter, occasionally white-pubescent in the furrows, leaf laminae (teeth) narrow-deltoid, 0.3–0.7 mm long, phyllichnia dorsally acute. Infructescences ('cones') terminal on short or moderately elongated branchlets, somewhat fulvous-pubescent; cone body 3–4 mm long; bracts 1–2 mm high and broad, not markedly striate; bracteoles in 1–2 whorls, protruding up to 5 mm, with eccentric rib dorsally; samara c. 6 mm long, wing chartaceous. Fig. 1 c,d.

DISTRIBUTION: Known only from four collections from the island of Palawan in the southwestern Philippines. Apart from the type locality, where it was said to occur along streams, it has been collected at 160 m altitude on the Malasgao River, at Aborlan, 'on the forest edge'. Although little known, *C. palawanense* clearly differs in its much more slender parts and acutely ridged phyllichnia from the more widely ranging *C. terminale*.

SPECIMENS EXAMINED: PHILIPPINES: **Palawan**: Malasgao R., Aborlan, *Edaño 14100*, 10.iv.1951 (A, BR, L); no precise locality, *Curran 3820*, iii.1906 (K), *Foxworthy BS 710*, iii–iv.1906 (BO, L, NSW, NY, US).

Acknowledgements

My thanks are due to Mrs Karen Wilson for continuing assistance in many ways. Mr David Mackay drew the figure.

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Notes on Aizoaceae and Chenopodiaceae

S.W.L. Jacobs

Abstract

Jacobs, S.W.L. (*National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000*) 1988. *Notes on Aizoaceae and Chenopodiaceae. Telopea* 3(2): 139–143. The new combinations *Zaleya galericulata* ssp. *australis* (Melville) S.W.L. Jacobs, *Sclerolaena stelligera* (F. Muell.) S.W.L. Jacobs and *S. brachyptera* (F. Muell.) S.W.L. Jacobs are made and *Aizoon secundum* L.f. (= *Galenia secunda*) and *A. pubescens* Ecklon & Zeyher (= *Galenia pubescens*) are lectotypified.

The following new combinations and lectotypifications are made to make them available for the forthcoming first volume of the 'Flora of New South Wales'.

Aizoaceae

(i) *Zaleya galericulata* (Melville) Eichler ssp. *australis* (Melville) S.W.L. Jacobs, **comb. et stat. nov.**

BASIONYM: *Trianthema australis* Melville, Kew Bull. 7: 266 (1952).

HOLOTYPE: NEW SOUTH WALES: Narrabri, *White NSW 13559*, April 1914 (NSW; dupl. K).

Trianthema australis has either been recognised (Jacobs & Pickard 1981; Beadle *et al.* 1982), ignored (Beadle 1972) or treated as a synonym of *Zaleya galericulata* (Prescott 1984). In none of these publications has there been any discussion of the reasons for its distinction from *T. galericulata*.

Melville (1952) distinguished *T. australis* from *T. galericulata* by:

(a) the 'poorly developed' crest on the apex of the operculum in *T. australis* (well-developed in *T. galericulata*).

(b) stamens 5 (5–12 in *T. galericulata*).

(c) the reticulate ridging on the side of the operculum (? absent in *T. galericulata*).

(d) the everted base of the operculum (? not everted in *T. galericulata*), and

(e) the shape of the incomplete septum on the sutural surface of the opercular valves.

A study of the many recent collections in the National Herbarium of New South Wales (NSW) has shown that the range of morphological variation in both *T. galericulata* and *T. australis* is much greater than Melville (1952) supposed it to be. Many of the characters used by Melville to distinguish the two species have been found to intergrade, e.g.:

(a) the rounded or dome-shaped (as opposed to crested or crowned) operculum supposedly characteristic of *T. australis* is found quite commonly in plants which possess the other characteristics of *T. galericulata*.

(b) a specimen which has other characteristics of *T. australis* has 10 stamens (normally 5).

(c) the distinct reticulate ridges on the operculum, listed as characteristic of *T. australis* are equally common in *T. galericulata*, and

(d) the 'often everted' operculum of *T. australis* is only true in very few cases.

One character, however, does provide a reproducible sorting of the specimens — a sorting in which trends in some other characters and two more or less discrete geographical distributions (Fig. 1) are apparent. That character is the shape of the incomplete septum of the inner articulating faces of the operculum valves (Fig. 2). Melville does mention the septum briefly in his Latin descriptions but, more importantly, provides clear illustrations of the differences between *T. australis* and *T. galericulata*. The character has not subsequently been much used as it is only observable in mature fruit, and describing the differences is difficult. In *T. australis*, the gap between the margins of the incomplete septum of the inner articulating surfaces of the operculum valves is narrowest at the apex and extends almost to the top of the operculum. In *T.*

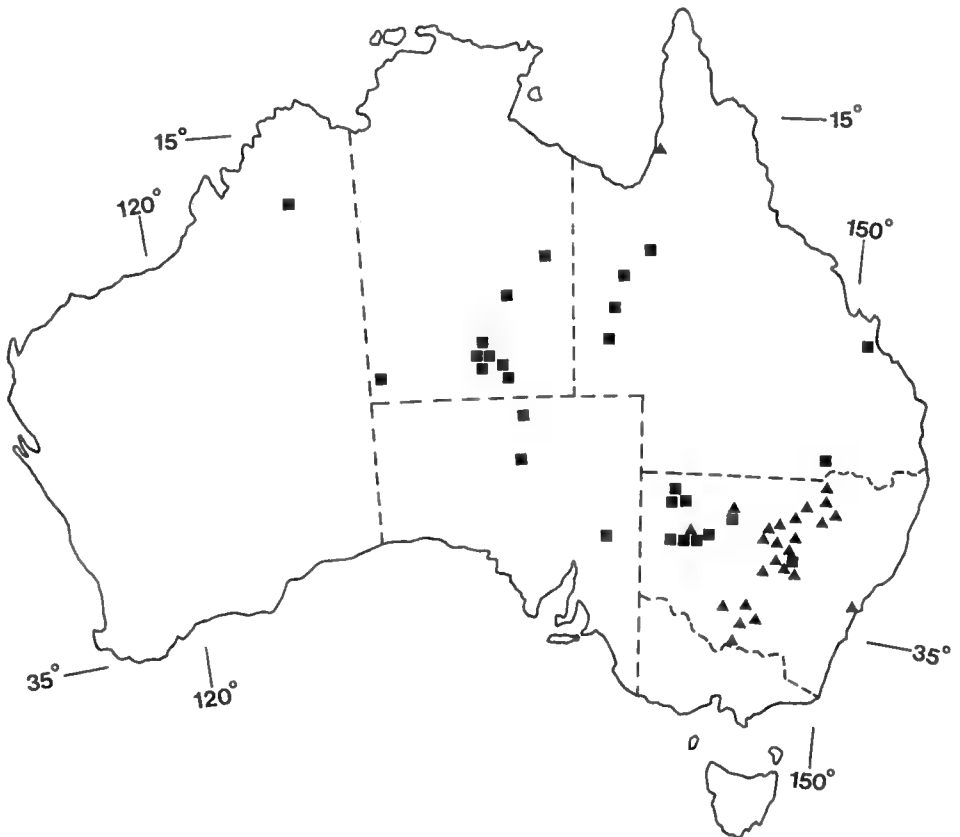


Fig. 1. Distribution of *Zaleya galericulata* ssp. *galericulata* (■) and ssp. *australis* (▲).



Fig. 2. Characteristic shapes of the incomplete septum of the inner articulating faces of the operculum valves in *Zaleya galericulata* (X10). a, ssp. *galericulata* (S. Jacobs 3040). b, ssp. *australis* (Cunningham 1703 & Milthorpe).

galericulata this gap is narrowest in the lower half of the operculum valves and extends to within about 0.5 mm of the top of the operculum. Apart from this distinction, *T. australis* mostly has 5 stamens (one specimen at the geographical boundary between the two taxa has 10 stamens), a dome-shaped operculum, and is found mostly on the Western Slopes and Plains of New South Wales, with one specimen from N. Queensland. *T. galericulata* has 5 or 10 stamens (about half the specimens with each number), the operculum apex is frequently crowned (though this is not developed in many specimens), and is found in the North Far Western Plains (NFWP) of New South Wales and throughout the rest of the mainland States except Victoria, with one specimen from the Central Western Slopes of New South Wales (probably introduced). Both taxa occur in the NFWP of New South Wales, *T. australis* in the SE. of the region and *T. galericulata* in the NW.

In view of the incomplete separation of most of the characters and the discreteness of the geographical distributions, recognition of two subspecies in *Zaleya galericulata* is the most appropriate treatment.

Jeffrey (1960) treated *Zaleya* Burm. f. as a genus distinct from *Trianthema* and transferred two species from this latter genus. He has subsequently been followed in Australia (Eichler 1965, Prescott 1984). The two taxa discussed above, then, become *Z. galericulata* ssp. *galericulata* and *Z. galericulata* ssp. *australis*.

(ii) Lectotypification of *Aizoon secundum* L.f. (= *Galenia secunda*) and *A. pubescens* Ecklon & Zeyher (= *Galenia pubescens*)

The name *Galenia secunda* (L.f.) Sonder in Harvey [*Aizoon secundum* L.f.] has been applied to introduced African species differently in New South Wales (Jacobs & Pickard 1981, Beadle *et al.* 1982) and in South Australia since Eichler (1965). The earlier treatment in Black (1948) for South Australia agrees with the application of the name in New South Wales. Eichler treated *G. secunda sensu* NSW and J.M. Black as *G. pubescens* (Ecklon & Zeyher) Druce. The application at NSW of the name *G. secunda* was based on identification (and citation, Adamson 1956) of an NSW specimen (NSW 26301 (K, no dupl. at NSW) and the possession of duplicates of some cited African specimens. Prescott (1984) followed Eichler (1965).

G. pubescens is based on *Aizoon pubescens* Ecklon & Zeyher (1837). An isotype (Zeyher 2638, Swartkops River, South Africa) is held at S(!) and, following the convincing arguments of Nordenstam (1980) about the location of the main Ecklon and Zeyher collections, this specimen is here designated as the **lectotype** of *A. pubescens*.

G. secunda is based on *A. secundum* L.f., the Type being a Thunberg collection from 'Cape of Good Hope' s.n. In the Linnean Herbarium in London there is only one Thunberg collection under either *Aizoon* or *Galenia*, and this collection is neither labelled nor annotated as *A. secundum* (Savage 1945). This specimen (650.4), even as seen on microfiche, clearly differs from the protologue of *A. secundum* in the shape of the leaves and the degree of hairiness. In Thunberg's herbarium (UPS) there are two specimens labelled *A. secundum*, both from 'Cap. b. spei' (Cape of Good Hope). These specimens represent two different species, one (no. '1', sheet no. 12058) represents the species referred to as *G. secunda* by Jacobs and Pickard (1981) and treated as *G. pubescens* by Prescott (1984), and the other (no. '4', sheet no. 12059) represents the species treated as *G. secunda* by Prescott. The protologue is so general that it could be equally applicable to either specimen; current usage is no guide since the name has been commonly applied both ways — even Adamson (1956) included specimens of both *G. secunda* and *G. pubescens* (*sensu* Prescott) within his circumscription of *G. secunda*, even though he recognised *G. pubescens* as a separate species.

Of the characters included in the protologue, the only two that can be used to distinguish the two specimens are (a) degree of hairiness and (b) leaf shape. Although 'hirsuto-canum' could apply to either specimen, sheet no. 12059, with longer hairs, could be regarded as more so. Both specimens also have ovate leaves: specimen 12058 has ovate to spatulate leaves whereas specimen 12059 has ovate to linear-ovate leaves. As the specimen UPS 12059 could arguably be described as a 'better' fit, and its selection as lectotype will require no alteration to the current nomenclature (though it will require some alterations in the application of the name), it is here designated as the **lectotype** of *Aizoon secundum* L.f. This preserves the application of the name used in Prescott (1984).

Chenopodiaceae

(iii) Two new combinations in Chenopodiaceae

Scott (1978) described the genus *Stelligera* and resurrected *Sclerochlamys* F. Muell. *Stelligera* was separated from *Sclerolaena* because it possessed both intertepaline and tepaline 'spines'. *Sclerochlamys* was resurrected without comment but presumably because of the tepaline wing that connects the intertepaline spines. Both genera are monotypic and Wilson (1984) considered them to be closely related both to each other and to species of *Sclerolaena*, with which they readily hybridize. Both represent extreme forms in *Sclerolaena* — extremes of trends also present in other species (e.g. *S. tetragona*, *S. microcarpa*, *S. walkeri*). A similar situation occurs with other fruit characters elsewhere in *Sclerolaena* (e.g. the fimbriate spines of *S. fimbriolata* and *S. symoniana*, and the hollow base and reduction in number of spines in the *S. uniflora* group). There seems little justification for maintaining *Stelligera* and *Sclerochlamys* as distinct, and the following new combinations are made:

Sclerolaena stelligera (*F. Muell.*) *S.W.L. Jacobs*, **comb. nov.**BASIONYM: *Maireana stelligera* F. Muell., *Fragm.* 1: 39 (1859).TYPE: New South Wales: Salt Plains on the Darling River, *J. Dallachy* (MEL).SYNONYM: *Stelligera endescaspinis* A.J. Scott, *Feddes Repert.* 89: 115 (1978).**Sclerolaena brachyptera** (*F. Muell.*) *S.W.L. Jacobs*, **comb. nov.**BASIONYM: *Sclerochlamys brachyptera* F. Muell., *Trans. & Proc. Philos. Inst. Victoria* 2: 76 (1858).LECTOTYPE: New South Wales: Salt Flats on Murray River, *F. Mueller*; see E.H. Ising, *Trans. Roy. Soc. South Australia* 88: 76 (1964).

Acknowledgements

I would like to thank Christine Payne for drawing the figures.

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Prunus (Amygdalaceae) in New South Wales

J.M.B. Smith

Abstract

Smith, J.M.B. (Dept. of Geography and Planning, University of New England, Armidale, Australia 2351) 1988. *Prunus* (Amygdalaceae) in New South Wales. *Telopea* 3(2): 145–157. — Thirteen introduced species of *Prunus* occur in New South Wales, and are described from material collected from wild individuals in the State. Four or five are in process of becoming naturalized. Dispersal, distribution and phenology, and the taxonomy of plums, are discussed. A key to the species, subspecies and varieties is provided.

Introduction

While native species of *Prunus* L. (subgenus *Laurocerasus*) are found in New Guinea and north Queensland rainforests, all species in New South Wales have been introduced. It is a nearly cosmopolitan genus of some 430 species (Willis 1966). Many species have been cultivated widely in temperate regions for several centuries. As a result, and because hybrids are also common, the taxonomy of the genus is well studied but complex, and variously interpreted. The taxonomic units used here generally follow those in 'Flora Europea' (Tutin *et al.* 1968).

In this paper all *Prunus* species known to occur as wild plants in New South Wales are considered. However, like most introduced plants in Australia, their collection and study have been generally neglected, and specimens are few. Jacobs and Pickard (1981) listed *P. cerasifera*, *P. lusitanica*, *P. persica* and *P. serotina* as having been collected in the State, but only for *P. persica* did specimens come from more than one region. My own fieldwork has been conducted principally in northeast New South Wales since 1980; especially in other areas, it is possible that further *Prunus* species occur at least occasionally as wild plants, without yet having been collected or recorded.

No *Prunus* species were listed by Anderson (1939) as being naturalized in New South Wales up to that time; later regional floras (e.g. Beadle 1976; Beadle, Evans & Carolin 1972; Burbidge & Gray 1970) also make no mention of *Prunus* except as cultivated plants. However in Victoria, Willis (1972) considered *P. cerasifera* to be truly naturalized, and mentioned *P. armeniaca*, *P. cerasus*, *P. dulcis* (as *P. amygdalus*), *P. laurocerasus* and *P. persica* as sometimes appearing where stones or kernels had been discarded from the fruits of various cultivars. Lord (1964) noted that *P. cerasifera* was frequently self-sown in southeast Australian gardens or nearby. In Tasmania, Curtis (1956) described *P. domestica* subsp. *insititia* (as *P. insititia*) as an established alien, occasional in hedges and widespread. In South Australia, Eichler (1965) noted that several cultivated species of Rosaceae were established and becoming naturalized, mainly in the Mount Lofty Ranges, and cited specimens of *P. cerasifera*, *P. cerasus*, *P. domestica*, *P. dulcis* (as *P. amygdalus*), *P. laurocerasus* and *P. persica*.

In the present paper, thirteen *Prunus* species are recorded and described from wild plants in New South Wales, of which four or five may be considered to be in process of becoming naturalized, one widely and commonly. They are of some significance as potential uncontrolled reservoirs of orchard pest and disease organisms, as well as being sources of fruit collected wild, and of aesthetic value when in conspicuous white or pink blossom in spring.

Distribution, Dispersal and Naturalization

Prunus has been planted in New South Wales widely and for several reasons. *P. persica* (Peach and Nectarine), *P. armeniaca* (Apricot), *P. domestica* (European Plum), *P. salicina* (Japanese Plum), other plum species, and *P. avium* (Sweet Cherry) are grown in orchards and gardens for their fruit, and *P. dulcis* (Almond) for its seeds. *P. cerasifera* (Cherry Plum), *P. cerasus* (Sour Cherry) and probably *Prunus* sp. 'a' have been widely used as rootstocks for grafts of fruit-bearing *Prunus*. Many species, including purple-foliaged forms of *P. cerasifera*, the evergreen species *P. laurocerasus* (Cherry Laurel) and *P. lusitanica* (Portuguese Laurel), *P. serotina* (Black Cherry) and flowering varieties of several other species and hybrids, are grown as ornamental trees and shrubs. *P. mahaleb* (St Lucie's Cherry) is useful as a rootstock for *P. avium*.

Wild individuals appear to arise through seed dispersal by people (in those species grown for their fruit); through dispersal by birds (for smaller-fruited species); or through vegetative reproduction by suckers.

A study of roadside alien trees and shrubs taller than one metre in New England (Smith 1982a, 1982b) found beside 1193 km of surveyed roads 163 Peaches and Nectarines (*P. persica*), 118 Plums (mostly *P. cerasifera* with a few *P. domestica* and *P. salicina*) and 42 Apricots (*P. armeniaca*). These and other fruit trees (the commonest of all being Apple, *Malus domestica*) were most frequent beside the busiest roads, and it was inferred that they were mostly derived from seeds discarded as fruit wastes by vehicle passengers. The only fruit tree that apparently regularly regenerated *in situ* from its own seed (though some wild roadside individuals of most species fruited at least occasionally), as indicated by 'mother and babies' clumps, was *Prunus cerasifera*. This was also the species that showed the relationship between roadside abundance and traffic volume least clearly. Trees of *P. persica* were found in the same study to be tallest in areas with highest minimum temperatures.

In a further study (Smith 1985) of alien trees and shrubs taller than one metre along a main road transect between Wyong (north of Sydney) and Ipswich (south-west of Brisbane) through New England, *Prunus armeniaca* was found to be tallest and most abundant in southern Queensland, while *P. persica* was most abundant in areas south of New England. Both failed to grow as tall at high altitudes as in lower areas to both north and south, but both were absent from the Queensland coastal plain near Ipswich. Plums showed less clear patterns perhaps due to two species (*Prunus cerasifera* and *P. salicina*) not being distinguished. *P. domestica* subsp. *domestica*, *P. avium* and *P. cerasus* occurred sporadically at high altitudes.

Prunus species with smaller fruits are not particularly associated with roadside habitats, and to a degree this is also true of *P. cerasifera*. In this they resemble other alien woody plants with small fleshy fruits (e.g. species of *Cotoneaster*, *Crataegus*, *Ligustrum* and *Pyracantha*) all of which are probably dispersed by birds, especially currawongs (*Strepera* spp.). Such species tend to

grow within several kilometres of centres of European settlement (Mulvaney 1984; Smith 1982a, 1985), where parental trees were planted in hedges and gardens, and whence birds have spread their seeds. *P. mahaleb* is becoming naturalized at a site near Armidale and *P. serotina* at Leura. *P. laurocerasus* is already common in the Robertson area and in parts of the Blue Mountains. *P. lusitanica* has been collected once, away from roads but near gardens in the Blue Mountains.

Three *Prunus* taxa appear to regenerate only vegetatively, by suckers, forming dense thicket-like colonies marking the sites of abandoned orchards, cottages and similar locations of original plantings. All are fruit trees (*P. domestica* subsp. *domestica* and subsp. *insititia*, and *P. cerasus*), the last probably having been planted more as a rootstock for grafted sweet cherries than in its own right. Other alien woody plants with similar reproductive characteristics show similar patterns, such as species of *Chaenomeles*, *Populus*, and *Ulmus*.

It is of interest to speculate why alien woody species such as these, many of which occur frequently as wild individuals, have been collected so infrequently, and largely ignored by the writers of floras. Wace (1978) defines a naturalized plant as 'one that grows and reproduces for several generations at least, without the direct aid of man, outside its native range'. No *Prunus* species can properly be described as naturalized by this definition because barely sufficient time has elapsed since their introduction to allow the passage of several generations. Possibly this explains their having been neglected by botanists, although lack of interest in the collection and study of aliens compared with natives seems a more likely explanation.

Wace's definition of a naturalized plant seems impractical for woody species with a long life-cycle. An alternative may be to define as being in the process of naturalization those species whose populations outside their native range include large proportions of young individuals, not solely restricted to the immediate vicinity of parental individuals, without having received direct human assistance. Woody plants, which are generally large and conspicuous and whose size is generally proportional to their age, can readily be assessed in this way.

According to this definition, *P. cerasifera* is certainly in the process of naturalization, and *P. laurocerasus*, *P. mahaleb*, *P. serotina* and probably *P. persica* can be considered so on a local scale. *P. armeniaca*, *P. salicina* and probably *P. avium*, whose populations appear to be entirely dependent upon seeds discarded by people; those taxa that regenerate only by suckering; and *P. domestica* subsp. *italica* (Greengage), *P. dulcis*, *P. lusitanica* and *P. sp. 'a'* (if distinct from *P. cerasifera*) which are rare, cannot be considered as being now in the process of naturalization. They may, of course, become so in future, as may other species that are yet to be collected or recorded as wild individuals but which have been, or will be, planted in gardens or elsewhere.

Phenology

Except for *P. laurocerasus* and *P. lusitanica*, species in New South Wales are deciduous, the flowers opening before the leaves, and flowering generally being completed before any leaves are fully extended. The timing of budburst in spring varies with the seasons to some extent, but also varies between species, as indicated by some data from wild individuals in and near Armidale (Fig. 1).

Prunus species flower between July and October in the Armidale area. *P. dulcis* is the earliest flowering species, followed closely by *P. cerasifera*, *P. salicina*, *P. armeniaca* and *P. persica*. Latest flowering species are *P. mahaleb* and *P. domestica*. The latter flowers about a month later than the other plums, scarcely overlapping with them, which (as well as its different chromosome number) may restrict possibilities of hybridisation between *P. domestica* and other species in subgenus *Prunus*.

P. cerasifera and *P. salicina*, at least, may suffer frost damage to flowers or young fruits in some years, and carry no fruits to maturity in the Armidale area and presumably elsewhere at high altitudes. Frost may also explain the apparent inability to set fruit of the only wild individual of *P. dulcis* observed, in a frost-prone location beside a floodplain. A similar inability exhibited by *P. avium* may be due to the rarity of wild individuals of this species, and the remoteness of those observed from conspecific trees in orchards or elsewhere, since they are obligate cross-pollinators. *P. avium* can hybridise with *P. cerasus*, this being the origin of some cherry cultivars. The two species overlap in flowering periods, but that of *P. avium* begins 2–3 weeks earlier than *P. cerasus*.

Prunus flowers are insect-pollinated; they may be fragrant, and many insects can be seen to visit them.

Fruiting periods also differ between species (Fig. 1). *P. cerasifera* ripens its fruits earliest, though individuals vary, so that ripe fruits can readily be found

SPECIES	YEAR	J	J	A	S	O	N	D	J	F	M
<i>P. persica</i>	1982				—						
<i>P. persica</i>	1983				—					—	
<i>P. dulcis</i>	1982			—	—						
<i>P. dulcis</i>	1983		—	—	—						
<i>P. armeniaca</i>	1982				—						
<i>P. armeniaca</i>	1983				—				—		
<i>P. cerasifera</i>	1982				—	—					
<i>P. cerasifera</i>	1983			—	—			—	—		
<i>P. d. domestica</i>	1982					—					
<i>P. d. domestica</i>	1983				—	—				—	
<i>P. d. insititia</i>	1983					—				—	
<i>P. salicina</i>	1983			—	—				—	—	
<i>P. mahaleb</i>	1983				—	—		—	—		

Fig. 1. Times of flowering (July–October) and fruiting (December–February) of some wild individuals of species of *Prunus* growing near Armidale.

throughout a period of six weeks in years without late, damaging frost. *P. domestica* and *P. persica* are those species whose fruits ripen latest in summer.

Plum taxonomy

Most *Prunus* species occurring as wild plants in New South Wales are taxonomically distinct. However, this is not so for the plums, of which at least three species (*P. cerasifera*, *P. domestica*, and *P. salicina*) occur as wild individuals, with possible hybrids. Details of ploidy, hybridisation and ancestry of plums reported below come mainly from abstracted data in Knight (1969).

P. domestica is a variable, hexaploid species which is itself believed to be of hybrid origin, derived from *P. cerasifera* (usually diploid) and *P. spinosa* (usually tetraploid).

Japanese plums are usually grouped under *P. salicina* (normally diploid), but some have hybrid origin. Of the cultivars grown in Australia listed by Ikin (1974) as 'Japanese and American hybrids' about a quarter are believed not to be pure *P. salicina*. One cultivar each of the American species *P. angustifolia* ('Chickasaw') and *P. munsoniana* ('Wild Goose') are recorded as being cultivated in Queensland, and the cultivar 'Beaty' (Western Australia and Victoria) may be a hybrid between these species. The widely grown cultivar 'Santa Rosa' is a complex hybrid between *P. salicina*, the Chinese species *P. simonii*, and *P. americana*. Other cultivars in Australia may be hybrids involving further American species: *P. hortulana* ('Excelsior', 'Formosa'), *P. nigra* ('Patterson Pride') and *P. maritima* ('Shipper'), though the ancestry of these and other cultivars is not entirely clear. The diploid *P. cerasifera* can also hybridize with *P. salicina* and this may be the origin of the widely grown cultivar 'Billington'. Both *P. cerasifera* and *P. salicina* can also produce tetraploid hybrids with *P. domestica*, with higher ploidy levels common in the subsequent generation. Most cultivated, ornamental purple-foliaged trees belong to *P. cerasifera*; Lord (1964) mentions four such cultivars, the commonest being 'Atropurpurea' (= 'Pissardii') and 'Nigra'. The similar but double-flowered '*P. blireiana*' is a hybrid between *P. cerasifera* 'Atropurpurea' and the Japanese *P. mume*.

It is not surprising, therefore, that it is not always easy to allocate species names to individual wild plum trees. It might even be anticipated that any attempt would be nearly futile, were it not for the experience that most can, in fact, be identified with some confidence, intermediates being exceptional. Most (more than 95% in New England) belong to *P. cerasifera*, including all maroon-foliaged individuals. *P. salicina* and *P. domestica* both occur infrequently. All three species are common and widespread in cultivation in New South Wales. Ikin (1974) lists 77 cultivars of *P. domestica* and 47 of 'Japanese and American hybrids' present in Australia. *P. cerasifera* is also grown for its fruit (two or three cultivars, though not listed for New South Wales) but is used more widely as a rootstock for grafts of other plums, and as a garden ornamental and street tree.

Intraspecific taxonomy of *Prunus domestica* is confused. Wild plants in New South Wales include a range of unarmed, suckering, shrubby, purple-fruited forms, which I call here subsp. *domestica*, except for one with distinctly small, ovoid and mildly astringent fruits and hirsute young twigs which I call subsp. *insititia* (Damson); there is also an armed, non-suckering, small tree with green, very sweet fruits that I call subsp. *italica* (Greengage).

The New South Wales species

Each *Prunus* species recorded wild in New South Wales is described, and a key to the species, subspecies and varieties is provided, below.

All data in the species descriptions derive from specimens collected wild in New South Wales. They differ at times in detail from descriptions of the same species in Floras of north temperate regions. This may be due to the influence of local climatic or other conditions on phenotypes, to there being a dearth of old plants, to only a limited genetic range being represented, or possibly to doubtful identifications in some cases.

It is also partly due to only a limited number of specimens having been collected, and therefore studied, in New South Wales. Some descriptions are incomplete because of inadequate material from wild plants being available. Further details can readily be obtained from Floras and other botanical works pertaining to north temperate regions.

All specimens referred to are lodged in the National Herbarium of New South Wales. Where two or more specimen numbers and dates are separated by slashes, they refer to specimens collected at different times from the same individual plants.

Key to species, subspecies and varieties of *Prunus* found in New South Wales

- | | | |
|----|---|--|
| 1 | Leaves evergreen, coriaceous | 2 |
| 1a | Leaves not as above | 3 |
| 2 | Leaves not exceeding 8 cm long, with serrate margin | 12. <i>P. lusitanica</i> |
| 2a | Leaves up to 13 cm long, margin with only distant, small teeth | 13. <i>P. laurocerasus</i> |
| 3 | Inflorescence a raceme more than 8 cm long with more than 10 flowers | 11. <i>P. serotina</i> |
| 3a | Inflorescence a raceme less than 3 cm long with fewer than 10 flowers | 10. <i>P. mahaleb</i> |
| 3b | Flowers borne singly or in clusters of 2 or 3 | 4 |
| 4 | Leaves mostly lanceolate; petals pink | 5 |
| 4a | Leaves mostly ovate; petals white (or if pink then leaves are maroon) | 7 |
| 5 | Petals uniformly pink or dark pink; sepals reflexed in open flower to become perpendicular to flower axis | 6 |
| 5a | Petals pale pink, darker only at base; sepals not reflexed | 2. <i>P. dulcis</i> |
| 6 | Fruit velutinous | 1a. <i>P. persica</i> var. <i>persica</i> |
| 6a | Fruit glabrous | 1b. <i>P. persica</i> var. <i>nucipersica</i> |
| 7 | Fruits less than 2 cm long; petioles with glands | 8 |
| 7a | Fruits more than 2 cm long; petioles lacking glands | 9 |
| 8 | Tree with few or no suckers; leaves up to 12 cm long | 8. <i>P. avium</i> |
| 8a | Shrub with abundant suckers; leaves not exceeding 6 cm long | 9. <i>P. cerasus</i> |

- 9 Flowers sessile; fruit velutinous; leaves broadly ovate with rounded or cordate base **3. *P. armeniaca***
- 9a Flowers pedicellate; fruit glabrous; leaves ovate or elliptical with cuneate base 10
- 10 Ripe fruits purple or green; winter buds conical; leaves usually glossy above with veins prominently raised below 11
- 10a Ripe fruits red or yellow; winter buds ovoid, sometimes with acute tip; leaves not as above 13
- 11 Ripe fruits purple; mesocarp red; unarmed; abundant suckers 12
- 11a Ripe fruits green; mesocarp yellow; stout spines; no suckers **5c. *P. domestica* subsp. *italica***
- 12 Fruits globose; leaves up to 7 cm long; first-year twigs glabrous or nearly so **5a. *P. domestica* subsp. *domestica***
- 12a Fruits ovoid; leaves not exceeding 4 cm long; first-year twigs hairy **5a. *P. domestica* subsp. *insititia***
- 13 Fruits over 3 cm long; mesocarp orange or red; winter buds with acute tip; leaves often becoming red above **6. *P. salicina***
- 13a Fruits less than 3.5 cm long; mesocarp yellow (or if red then leaves are maroon); winter buds with obtuse tip; leaves green or maroon 14
- 14 Erect tree or shrub, especially when young, often with stout spines; flowers mostly borne singly **4. *P. cerasifera***
- 14a Broadly spreading unarmed shrub; flowers borne in pairs **7. *P. sp.* 'a'**

Subgen. *Amygdalus* (L.) Focke

1. *Prunus persica* (L.) Batsch (Peach, Nectarine)

Shrub or small tree to 4 m, rather erect but sometimes becoming spreading with age; suckers absent; first-year twigs 2–4 mm thick, green or reddish brown; winter buds ovoid, 3 mm long, bud-scales reddish brown but appearing grey because hirsute, especially distally; leaves deciduous, green, 5–13 cm long, c. 4 times as long as wide, lanceolate with acute tip and serrulate margin (teeth < 0.5 mm), glabrous, tending to be recurved; petioles 5–10 mm; flowers sessile or nearly so, borne singly; sepals maroon or sometimes green, tomentose, 4 mm long, held perpendicular to flower axis when flower is open; petals pink, 13–17 mm long, 10–14 mm wide, or dark pink, 8–9 mm long, 5–6 mm wide; anthers maroon; filaments pink or white (or rarely pink, petaloid and lacking anthers); fruit globose, green, becoming red especially where unshaded; mesocarp green or yellow, sweet; endocarp coarsely pitted and ridged. Ebor, *JMBS*, Sep. 1983; Guyra, *JMBS* 702, Sep. 1982; Kangaroo Valley, *J.A. Rodway, s.n.*, Aug. 1917; Willow Tree, *JMBS* 713, Sep. 1982.

1a. var. *persica* (Peach)

Fruit 4–5 cm diameter, velutinous; endocarp 25–30 mm long, 20–25 mm wide. Armidale, *JMBS* 858, Jan. 1984; Wellington, *L.A.S. Johnson & B.G. Briggs* 8222, Nov. 1975.

1b. var. nucipersica (Borkh.) C.K. Schneider (Nectarine)

Fruit 3–4 cm diameter, glabrous, often with maroon spots; endocarp 20–25 mm long, 16–20 mm wide. Guyra, *JMBS* 852, Jan. 1984.

P. persica is native to China or Central Asia (possibly of cultivated origin); widespread and frequent in eastern New South Wales, especially beside roads and in moister, warmer areas, apparently becoming naturalized on some sandy riverbanks, e.g. Glen Fernaigh Creek near Bostobrick, Dorrigo Plateau.

2. Prunus dulcis (Miller) D.A. Webb (Almond)

Small tree to 3 m; suckers absent; unarmed; shoots tend to lean to north-west (afternoon sun); first-year twigs 2–3 mm thick, green; winter buds 2–2.5 mm long, ovoid, bud-scales reddish brown and conspicuously mucronate; leaves deciduous, green, 3–6 cm long, more than twice as long as wide, glabrous, lanceolate to ovate with acute tip and serrulate margin (teeth 0.5 mm); petioles 8–10 mm; flowers sessile, borne singly or in pairs; sepals green, tinged maroon, with long marginal hairs, 2–2.5 mm long, not reflexed; petals very pale pink, darker at base, 15 mm long, 15 mm wide; anthers yellow; filaments pink; fruit not seen. Armidale, *JMBS* 695/837, Sep. 1982/Jan. 1984.

Native to central and south-west Asia and north Africa. Rare as a wild plant in New South Wales, known only from one individual in Armidale growing on a roadside bank where garden refuse may have been discarded.

Subgen. Prunus**3. Prunus armeniaca** L. (Apricot)

Shrub to 3 m, spreading habit; suckers absent; unarmed; first-year twigs 2–3 mm thick, brown; winter buds conical or ovoid with acute tip, dark brown, 2 mm long; leaves deciduous, green, glabrous, 3–5 cm long, about as wide as long, broadly ovate with rounded to cordate base, acute to acuminate tip, and serrulate margin (teeth 0.5 mm); petioles 20–40 mm; flowers sessile, borne singly; sepals maroon, becoming paler at their united bases, hirsute, 4–5 mm long, reflexed when flower is open; petals white, often pink at base, 7–13 mm long, 8–15 mm wide; anthers yellow; filaments white becoming pink with age; fruit globose, 4–5 cm diameter, orange, velutinous; mesocarp orange, sweet, not adhering to endocarp; endocarp rugose, 18 mm long, 18 mm wide. Armidale, *JMBS* 794/857, Sep. 1983/Jan. 1984; Ben Lomond, *JMBS* 706, Sep. 1982; Muswellbrook, *F. Liddell s.n.*, Mar. 1913; Tenterfield, *JMBS* 814, Nov. 1984.

Native to central Asia and China. Widespread and frequent beside roads in eastern New South Wales.

4. Prunus cerasifera Ehrh. (Cherry Plum)

Shrub or tree to 4 m tall, rather erect with crown not as wide as it is tall especially when young; suckers apparently absent but often many seedlings present; may have stout spines on lower branches; first year twigs 1.5–2.5 mm thick, greenish or dark brown; winter buds ovoid, sometimes with acute tip, 1 mm long; leaves deciduous, green (often reddish when young) or maroon, 2.5–5 cm long, less than twice as long as wide, ovate to elliptical with serrulate margin (teeth 0.5 mm long) and acute tip; flowers mostly borne singly, some in pairs; pedicels 5–15 mm long, green or maroon; sepals green (sometimes tinged

pink) or maroon, with translucent pink margin, shortly hairy, 2 mm long; petals white (sometimes with pale pink base), or pale pink (in maroon-foliaged plants) 5–10 mm long, 4–9 mm wide; anthers yellow, orange or dark red; filaments white or pink (or rarely petaloid, pale pink and lacking anthers); fruit globose, 2–3 cm diameter, red or yellow; mesocarp yellow (or red in maroon-foliaged plants), sweet, sour or insipid; endocarp 12–17 mm long, 8–10 mm wide, smooth sometimes with longitudinal ridges, with obtuse ends. Armidale, *JMBS* 697, Sep. 1982, *JMBS*, Jan. 1984, *JMBS* 844, Jan. 1984; Guyra, *JMBS* 712, Sep. 1982; Kangaroo Valley, *F.A. Rodway 2004A/2004B*, Aug. 1934/Nov. 1935.

Native to the Balkan Peninsula, Turkey and the Caspian region. Widespread in eastern New South Wales, common on roadsides and in other places with past but not frequently repeated disturbance, especially near towns. Frequently clumped, with many seedlings and saplings around a large parental tree, often with different leaf or fruit colours.

5. *Prunus domestica* L. (European Plum, Greengage, Damson)

Shrub or tree to 4 m tall, usually with spreading crown; winter buds conical; leaves deciduous, green, with serrate margin (teeth 1 mm long) and acute tip, glossy above and paler, pubescent and sometimes glaucous below, veins prominently raised on lower lamina; flowers mostly borne in pairs, sometimes singly, or rarely in threes; pedicels 4–8 mm, green; sepals 2–3 mm long, sparsely hirsute, green with a translucent colourless or pale pink margin; petals white, 8–10 mm long, 6–8 mm wide; anthers yellow; filaments white; endocarp with longitudinal ridges or irregularly rugose, with acute or obtuse ends.

5a. subsp. *domestica* (European Plum)

Freely suckering; unarmed; first-year twigs 2–3 mm thick, grey-brown, glabrous or nearly so; leaves 3–7 cm long, 1.5–4.5 cm wide, ovate; fruit globose, 25–35 mm diameter, purple; mesocarp yellow or red, sweet; endocarp 20 mm long, 14 mm wide. Armidale, *JMBS* 808/863, Sep. 1983/Jan. 1984; Guyra, *JMBS* 853, Jan. 1984.

5b. subsp. *insititia* (L.) C.K. Schneider (Damson)

Freely suckering; unarmed; first-year twigs 1.5–2.5 mm thick, grey-brown, with many short hairs; leaves 1.5–4 cm long, 1–1.8 cm wide, ovate to elliptical; fruit ovoid, 20 mm long, 17 mm wide, purple with pronounced bloom; mesocarp red, sweetish but mildly astringent; endocarp 20 mm long, 14 mm wide. Armidale, *JMBS* 720/862, Oct. 1982/Jan. 1984.

5c. subsp. *italica* (Borkh.) Hegi (Greengage)

No suckers; some stout spines, especially on lower branches; first-year twigs 1.5–2 mm thick, grey, glabrous or nearly so; winter buds 1–1.5 mm long; leaves 2.5–8 cm long, obovate; petals may be tinged pink distally in opening bud; fruit globose, 25 mm diameter, green; mesocarp yellow; sweet; endocarp 18–20 mm long, 12 mm wide. Bostobrick, *JMBS* 741/793/836, Dec. 1982/Sep. 1983/Dec. 1983.

P. domestica is of hybrid origin, probably in the Caucasus region. In New South Wales, subsp. *domestica* frequently grows at high altitudes as suckering

clumps near houses, in abandoned orchards and similar places; subspp. *insititia* and *italica* are rare, known only from a single suckering clump in a paddock near Armidale and a single roadside tree near Bostobrick, Dorrigo Plateau, respectively.

6. *Prunus salicina* Lindl. (Japanese Plum)

Shrub or tree to 4 m tall, crown spreading and about as wide as tall; apparently not suckering though a few seedlings may be present; may have stout spines, especially when young or on lower branches; first-year twigs 1.5–3 mm thick, reddish brown; winter buds ovoid with acute tip, 1 mm long; leaves deciduous, green, sometimes becoming reddish on upper surface, 3–6 cm long, more than twice as long as wide, elliptical to lanceolate with serrulate margin (teeth 0.5 mm) and acute to acuminate tip; flowers mostly borne in pairs, sometimes singly or in threes; fruit globose, 30–40 mm diameter, dark red; mesocarp orange or red, sweet; endocarp 17–21 mm long, 10–24 mm wide, smooth, sometimes with longitudinal ridges, and with acute ends. Armidale, *JMBS* 699/846, Sep. 1982/Jan. 1984, *JMBS* 790/859, Sep. 1983/Jan. 1984.

Native to China and Japan. In New South Wales it occurs infrequently beside roads in New England and probably in other regions.

7. *Prunus* sp. 'a'

Similar to *P. cerasifera*, of which it may be a form or hybrid. Shrub to 3 m, spreading, crown wider than tall; few or no suckers; unarmed; first-year twigs 1.5–2 mm thick, reddish brown; buds ovoid with acute tip, dark brown, 1.5 mm long; leaves deciduous but sometimes persisting to late winter, green, 3–3.5 cm long, about twice as long as wide, ovate with acute to obtuse tip and serrulate margin (teeth > 0.5 mm); petioles 8–12 mm; flowers borne in pairs; pedicels 5–7 mm; sepals 1 mm long, green with translucent pale pink margin with sparse marginal hairs; petals white, 5 mm long, 5 mm wide; anthers yellow; filaments white; fruit ovoid, 34 mm long, 25 mm wide, red; mesocarp yellow, insipid; endocarp 20 mm long, 15 mm wide, with shallow pitting. Armidale, *JMBS* 694/861, Sep. 1982/Jan. 1984.

Rare, known from three individuals on roadsides near houses at separate locations near Armidale.

Subgen. *Cerasus* (Miller) Focke

8. *Prunus avium* L. (Sweet Cherry)

Tree to 6.5 m; few or no suckers; unarmed; bark tends to peel in horizontal papery strips; first-year twigs 2–3 mm thick, grey-brown; winter buds 3–4 mm long, ovoid with acute to obtuse tip, reddish brown; leaves deciduous, green, 4–12 cm long, nearly twice as long as wide, elliptical to ovate with acute to acuminate tip and serrate margin (teeth 1–1.5 mm), glabrous above, paler with hairs below; petioles 10–30 mm, reddish green with one or two brown glands distally; pedicels 2–8 mm (when flowering); flowers borne singly or in pairs; sepals green, glabrous, reflexed in open flower, 3 mm long; petals white, 10 mm long, 7–8 mm wide; anthers yellow; filaments white; fruit not seen. Ebor, *JMBS* 803/854, Sep. 1983/Jan. 1984.

Native to Europe and West Asia. In New South Wales infrequent on roadsides at high altitudes.

9. *Prunus cerasus* L. (Sour Cherry)

Shrub to 3.5 m; abundant suckers; unarmed; first-year twigs 1.5–2 mm thick, reddish brown or grey-brown; winter buds 2 mm long, reddish brown; leaves deciduous, green, 3–6 cm long, about twice as long as wide, elliptical to obovate, with obtuse to acute tip and serrate margin (teeth 1–1.5 mm), glabrous above, paler with hairs below, with brown gland on margin near petiole; petioles 10–15 mm, green or reddish; pedicels 6–8 mm (in flower) or 15–22 mm (in fruit); flowers borne in pairs, sometimes singly or in threes; sepals green with reddish tinge, glabrous, 3 mm long; petals white, 8–12 mm long, 7–12 mm wide; anthers yellow; filaments white; fruit globose, 10–15 mm diameter, green ripening to red. Guyra, *JMBS 811*, Nov. 1983; Uralla, *JMBS 873*, Oct. 1984; Wallabadah, *JMBS 731*, Nov. 1982.

Native to south-west Asia. In New South Wales grows infrequently in eastern areas as suckering clumps, usually on sites of old orchards or gardens.

10. *Prunus mahaleb* L. (St. Lucie's Cherry)

Tree or large shrub to 4.5 m tall with spreading habit; suckers absent but with numerous seedlings below old trees; unarmed; first-year twigs 1–2 mm thick, pale grey; winter buds ovoid, reddish brown, 2 mm long; leaves green, deciduous, 1.5–3.5 cm long, 1–2.5 cm wide, ovate with rounded base, acute tip and crenulate margin; petioles slender, 4–8 mm; flowers borne in racemes of 4–10 flowers, on pedicels 8–12 mm and peduncles 15–25 mm long, both green; sepals green, glabrous, reflexed when flower is open, 2 mm long; petals white, 3–7 mm long, 2–4 mm wide; anthers yellow; filaments white; fruit globose, 8 mm long, 9 mm wide, red ripening to black, bitter; endocarp smooth, globose, 4–5 mm diameter. Armidale, *JMBS 722/809/842*, Oct. 1982/Sep. 1983/Jan. 1984.

Native to central and southern Europe. In New South Wales, occurring as a small, expanding population in a pine plantation near Armidale.

Subgen. *Padus* (Miller) Focke

11. *Prunus serotina* Ehrh. (Black Cherry)

Shrub or tree to 13 m tall with straight trunk; suckers absent; unarmed; leaves green, deciduous, 4–11 cm long, 2.5–4 cm wide, ovate-lanceolate with serrulate margin (teeth 0.5 mm) and acute tip, rusty-hirsute beside proximal half of raised midrib on lower surface; flowers (not seen) borne in racemes of c. 20; peduncles 80–110 mm; pedicels 4–6 mm; fruit spheroidal, green tinged red, becoming black and soft when ripe, 8–10 mm diameter; mesocarp purplish black, sweetish and slightly astringent; endocarp 6 mm long, 5 mm wide, ovoid, slightly flattened, obtuse at both ends, smooth. Leura, *L.A.S. Johnson s.n.*, Dec. 1959; *JMBS 884*, Feb. 1985.

Native to eastern North America. In New South Wales known wild only at Leura and Katoomba, Blue Mountains, becoming frequent beside paths and roads in shrubland and disturbed eucalypt forest on sandstone (probably derived from planted trees at 'Leuralla').

Subgen. *Laurocerasus* (Duh.) Rehder

12. *Prunus lusitanica* L. (Portuguese Laurel)

Young plant a shrub 1.5 m tall; young twigs very dark reddish, 1–2 mm thick; leaves not deciduous, coriaceous, 5–8 cm long, ovate to lanceolate with acuminate tip and serrate margin (teeth 1 mm). Flowers and fruit not seen. Mt Wilson, *D. Blaxell s.n.*, Dec. 1958.

Native to Portugal, Canary Islands and Madeira. Collected once at Mt. Wilson, Blue Mountains, as a sterile shrub 'in rainforest on basalt (apparently from seed from gardens on Mt. Wilson)'.

13. *Prunus laurocerasus* L. (Cherry Laurel)

Shrub or spreading multistemmed tree to 10 m tall; no suckers; unarmed; young twigs reddish, 3–4 mm thick; leaves not deciduous, green, very coriaceous, 5–13 cm long, 2–5 cm wide, with acute tip and finely and distantly toothed margin; flowers shortly pedicellate in racemes 10–13 cm long, each of 10–20 flowers; petals white; fruits ovoid and bluntly pointed (obpyriform), 15–17 mm long, 11–14 mm wide, green tinged red, becoming black and soft when ripe; mesocarp yellow-brown, sweetish; endocarp ovoid, not conspicuously flattened, 12 mm long, 7 mm wide, with acute ends, smooth. Mt Wilson, *JMBS* 879, Feb. 1985; Robertson, *R. Pullen* 3899, Oct. 1963, *JMBS* 888, Feb. 1985.

Native to the Balkan Peninsula, Turkey, Armenia and north Iran. Becoming naturalised within a 5 km radius of Robertson on roadsides and in degraded remnants of eucalypt forest; and in higher parts of the Blue Mountains (Katoomba, Mt. Tomah, Mt. Wilson) on roadsides and in tall eucalypt forest with rainforest understorey.

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Notes on the fruits of *Lechenaultia* (Goodeniaceae), with a new species from northern Australia

David A. Morrison

Abstract

Morrison, David A. (John Ray Herbarium, Macleay Building (A12), University of Sydney, Sydney, Australia 2006*) 1988. Notes on the fruits of *Lechenaultia* (Goodeniaceae), with a new species from northern Australia. *Telopea* 3(2): 159–166. — Characteristics of the fruits and seeds of the 25 species of *Lechenaultia* are described and 22 of them are illustrated. *Lechenaultia ovata*, a rare species from the Northern Territory closely allied to *L. filiformis*, is also described.

Introduction

Since the completion of my recent revision of *Lechenaultia* R. Br. (Goodeniaceae) (see Morrison 1987), a new species from the Northern Territory has been brought to my attention by L.A. Craven of the Australian National Herbarium. This species has a distinctive surface sculpturing on the fruits, and this has prompted me to provide detailed notes on the fruits of the other *Lechenaultia* species. Herbarium specimens of *Lechenaultia* very rarely possess fruits, and consequently knowledge of fruit shape and structure has been very limited. In particular, Carolin (1966) discusses the fruits of only five species when reviewing the Goodeniaceae, although he does note that the shape of the fruits is frequently a good characteristic for distinguishing species. Mueller (1867) and Gardner & George (1963) depict fruits of two of the species.

Fruits

The fruit of *Lechenaultia* is usually described as a capsule containing a double row of small hard seeds, but it is actually somewhat more complex than this, and it is not homologous with a true capsule. It has been described in detail for *L. biloba* by Carolin (1966), and the notes presented here are an extension of this earlier work to cover the rest of the genus. Some of the fruit characteristics that vary between species are listed in Table 1, and the fruits of 22 of the 25 species in the genus are shown in Fig. 1. Gardner & George (1963) depict the fruit of *L. subcymosa*, which is not included in Fig. 1 due to a lack of material; and material was also not available for *L. chlorantha* or *L. pulvinaris*.

During development of the fruit, the outer walls of the loculi grow inwards and partially fuse with smaller outgrowths from the axile placenta. This results in the seeds being entirely surrounded by tissue derived from the loculus wall. The tissue between each seed then separates horizontally, thus forming an 'article' (after Carolin 1966) containing the seed. These articles then separate from each other, and are the final dispersal unit. It is these articles, with their

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Table 1. Some characteristics of the fruits of *Lechenaultia*

Species	Pseudocapsules				Articles		
	Length (mm)	Woody	Opening at maturity	Beak	No. rows	No. pairs per pseudocapsule	Length (mm)
<i>L. acutiloba</i>	12-16	not	yes	absent	2	5-7	2
<i>L. biloba</i>	23-35	not	yes	absent	2	8-15	2.5
<i>L. brevifolia</i>	22-29	not	yes	absent	2	15-21	1
<i>L. chlorantha</i>	18-23	not	yes	absent	2	8-10	2
<i>L. divaricata</i>	9-32	woody	later	present	1	1-4	3-5
<i>L. expansa</i>	5-10	not	yes	absent	2	2-5	1.5
<i>L. filiformis</i>	25-50	not	yes	present	2	8-14	1-2
<i>L. floribunda</i>	11-18	not	yes	absent	2	7-15	1
<i>L. formosa</i>	10-29	not	yes	absent	2	10-22	1
<i>L. heteromera</i>	20-28	not	yes	absent	2	6-8	2
<i>L. hirsuta</i>	35-42	not	yes	absent	2	7-9	2.5
<i>L. juncea</i>	15-25	not	yes	absent	2	6-8	1
<i>L. laricina</i>	17-29	not	yes	absent	2	10-20	1
<i>L. linarioides</i>	19-33	woody	yes	absent	2	7-11	2.5
<i>L. longiloba</i>	20-26	not	yes	absent	2	13-16	2
<i>L. lutescens</i>	15-25	not	yes	absent	2	10-13	1
<i>L. macrantha</i>	22-33	not	yes	absent	2	15-20	1
<i>L. ovata</i>	22-28	not	yes	present	2	6-9	1
<i>L. papillata</i>	10-16	not	yes	absent	2	9-14	1
<i>L. pulvinaris</i>	5-7	not	yes	absent	2	c.8	1
<i>L. stenosepala</i>	16-22	not	yes	absent	2	8-16	1
<i>L. striata</i>	23-37	not	yes	absent	2	16-20	1.5
<i>L. subcymosa</i>	19-33	not	yes	absent	2	7-11	2
<i>L. superba</i>	13-20	not	yes	absent	2	5-8	2
<i>L. tubiflora</i>	5-7	not	yes	absent	2	c.6	1

hard woody outer layer derived from the loculus wall, that have usually been interpreted as the seeds; however, the hard outer layer is probably homologous with the true fruit (Carolin 1966). The outer floral parts surrounding the inferior ovary develop into what has been interpreted as a capsule, which contains the articles in a double row. However, strictly speaking, the outer floral parts separate from the true fruit and the fruit breaks up like a lomentum. I will refer to the outer 'capsule' as a 'pseudocapsule' for want of a better term.

All of the species have seeds and fruits that follow the pattern of development described by Carolin (1966) for *L. biloba*, except for *L. divaricata*. In this species, the swelling of the seed ruptures the septum and there is no division along the placenta when the fruit breaks up into articles. Thus each article is derived from both loculi, one of the seeds of each pair being subsumed by the other (see Carolin 1966).

The pseudocapsules are very uniform between species, and are essentially enlarged almost-unchanged floral tubes, often with persistent sepals and style. The pseudocapsules of *L. divaricata* and *L. linarioides* form a woody outer layer, giving them a distinctive grey appearance when dry, and *L. divaricata* often retains the fruits for several years before the pseudocapsules open.

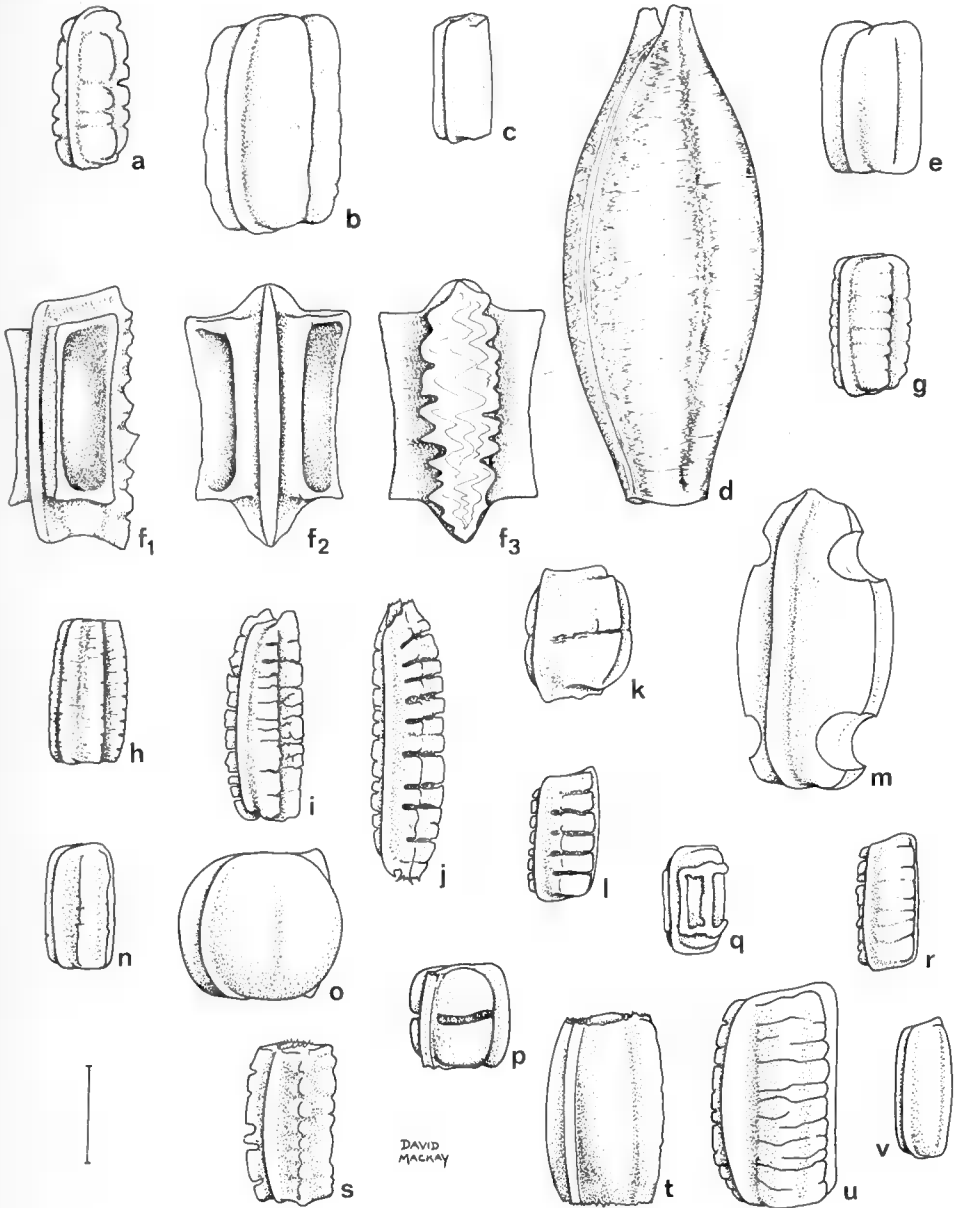


Fig. 1. Articles of some *Lechenaultia* species: **a**, *L. acutiloba* (Morrison 230, SYD). **b**, *L. biloba* (Morrison 172, SYD). **c**, *L. brevifolia* (Newbey 3322, SYD). **d**, *L. divaricata* (Carolin -vi.1956, SYD). **e**, *L. expansa* (Goaddy 216, NSW 76517). **f**, 1-3, *L. filiformis* (oblique, front, side views) (Byrnes 1858, SYD). **g**, *L. floribunda* (Morrison 220, SYD). **h**, *L. formosa* (Benn 10.x.1963, SYD). **i**, *L. heteromera* (Morrison 227, SYD). **j**, *L. hirsuta* (Morrison 223, SYD). **k**, *L. juncea* (Morrison 189, SYD). **l**, *L. larcina* (Morrison 217, SYD). **m**, *L. linarioides* (Morrison 178, SYD). **n**, *L. longiloba* (Drummond 179, NSW 76454). **o**, *L. lutescens* (George 8781, SYD). **p**, *L. macrantha* (Morrison 222, SYD). **q**, *L. ovata* (Craven 2438, CANB 269215). **r**, *L. papillata* (Wrigley 6.xi.1968, NSW 125989). **s**, *L. stenosepala* (Morrison 186, SYD). **t**, *L. striata* (George s.d., SYD). **u**, *L. superba* (Morrison 229, SYD). **v**, *L. tubiflora* (Morrison 203, SYD). Scale bar = 1 mm.

Although the flowers are 5-merous, the pseudocapsules have eight valves. There are only four sepaline ribs, as two of the sepals are connate (Carolin 1959), and there are only four semi-free corolla parts (Carolin 1959). This produces four small and four large valves respectively. Most species, however, open their pseudocapsules through only four valves, as the adjacent sepaline and petaline valves remain fused. The exception is *L. striata*, which opens through four to eight valves.

The articles have a hard outer covering formed from the inner layers of the loculus wall, the cells of which have greatly thickened walls (Carolin 1966). The shape of this outer layer is very useful in distinguishing species (Fig. 1), although the seeds themselves are all almost identical (see Carolin 1966). Most species have cylindrical articles, but a number have broad ovoidal ones. The surface sculpturing of the articles can also be very useful in distinguishing species, although this usually correlates with the shape. All of the articles have a distinctive ridge around the circumference where the adjacent pairs of articles were originally coherent.

Several of the species have specifically characteristic articles (see Fig. 1), notably *L. divaricata*, *L. juncea*, *L. linarioides*, *L. lutescens*, *L. macrantha* and *L. ovata*; and *L. filiformis* has very distinctive articles with large truncate appendages on either side. The articles of the other species tend to fall into two broad groups. One group has a wrinkled or corrugated surface to the articles, and includes *L. heteromera*, *L. acutiloba*, *L. floribunda*, *L. heteromera*, *L. hirsuta*, *L. laricina*, *L. papillata*, *L. stenosepala*, *L. subcymosa* and *L. superba*. The other group includes *L. biloba*, *L. brevifolia*, *L. chlorantha*, *L. expansa*, *L. formosa*, *L. longiloba*, *L. pulvinaris*, *L. striata* and *L. tubiflora*, all of which have relatively smooth articles.

These groups have very little similarity to the cladogram groups of Morrison (1987), which were based on floral and vegetative characteristics. This suggests that the surface structure of the articles is complex and not easily resolved into characters suitable for coding for cladistic analysis.

However, following the ideas presented by Mickevich & Mitter (1981) and Mickevich (1982) these complex polymorphic characters can be usefully analysed. For example, the articles can be roughly described by a two-state polymorphic attribute (surface wrinkled or not), with the unique articles being treated as autapomorphies (unique derived character states). If the two character states are then plotted onto the cladogram, an analysis can be made of which polymorphic state (wrinkled or smooth) is more likely to be the derived (apomorphic) condition and which the primitive (plesiomorphic) condition using the parsimony criterion.

If the wrinkled state is considered to be the primitive condition, then 7 character state changes are required on the cladogram (Fig. 2), whereas if the smooth state is considered to be primitive then at least 8 changes are necessary. Therefore, the most parsimonious hypothesis is that the wrinkled articles are the plesiomorphic character state, while the smooth articles are the apomorphic state.

Furthermore, by including the articles on the cladogram, two of the five polychotomies can be resolved into pairs of dichotomies. The trichotomy between *L. stenosepala*, *L. biloba* and the *L. pulvinaris/L. expansa* group is resolved if smooth articles is a shared derived character state (synapomorphy) for *L. biloba*, *L. pulvinaris* and *L. expansa*; and the trichotomy between *L. brevifolia*, *L. striata* and the *L. juncea/L. ovata/L. filiformis* group is resolved if

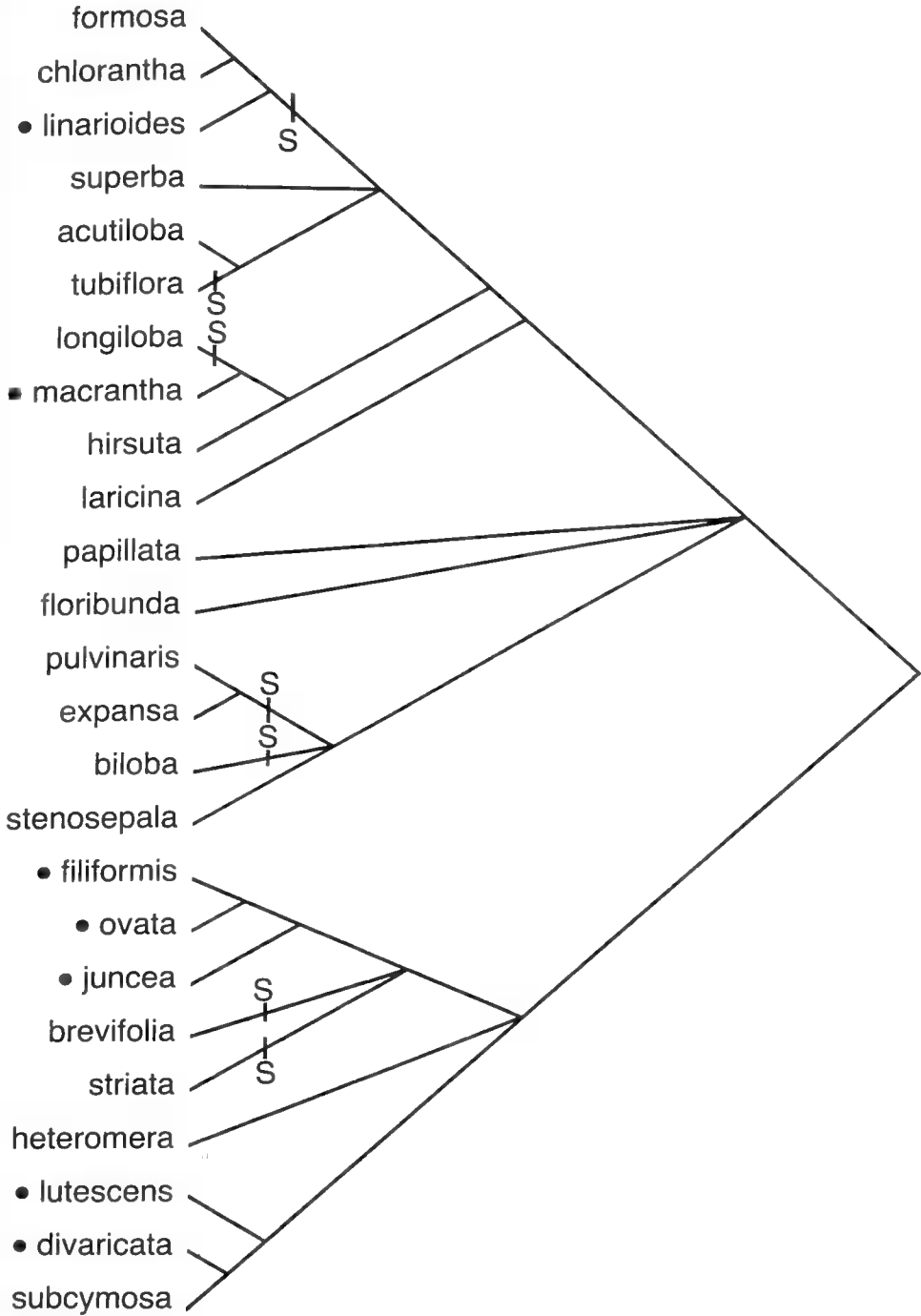


Fig. 2. Cladogram of the *Lechenaultia* species as presented by Morrison (1987). The distribution of the 2-state polymorphic article attribute has been plotted onto the cladogram, with the smooth state (s) treated as the apomorphic condition. The species with unique articles (treated as autapomorphies) are marked with a ●; all of the remaining species have wrinkled articles (the plesiomorphic condition).

smooth articles is a synapomorphy for *L. brevifolia* and *L. striata*. This would reduce the number of character state changes required for the articles by 2 steps, as only 1 postulated origin of the derived character state is required instead of 2 at each of the resolved trichotomies.

Therefore, the cladistic analysis of the articles, although perhaps less elegant than that of the floral and vegetative attributes, improves the information content of the cladogram by allowing some of the uninformative ambiguities to be resolved.

***Lechenaultia ovata* D.A. Morrison, sp. nov.**

Species affinis *L. filiformis* R. Br. sed foliis ovatis perparvis, floribus perparvis notabilis.

HOLOTYPE: NORTHERN TERRITORY: 30 km SE of Jabiru, c. 12°50'S 133°05'E, Craven 2438, 27.2.1973 (CANB 269215) [the upper left hand specimen is designated as the holotype]. ISOTYPI (*n.v.*): A, BRI, L, NT.

Perennial herb, to 10 cm high and 15 cm diam., glabrous. *Stems* many, ascending to erect, probably growing annually from a common woody rootstock, not or only sparsely branched with the branches erect, terete or angled by decurrent leaf bases, up to 0.5 mm thick, not woody, glaucous. *Leaves* not crowded, somewhat fleshy, ovate to narrow-ovate, 7.5–10 mm long, 1.6–2.0 (–2.2) mm wide, more or less flat, acute to acuminate, more or less smooth to rugulose, glabrous. *Flowers* solitary and terminal; bracts narrow-ovate, 3.5–7 mm long, 1–1.5 mm wide, acute to acuminate, more or less smooth, glabrous. *Calyx* lobes scarcely overlapping at the base, linear, the four inferior lobes 3–4 mm long, the superior lobe 1 mm longer than the others, 0.2–0.3 mm wide, acuminate, rugulose, glabrous. *Corolla* white; tube split to the base but the petals cohering, 2.5–3 mm long, outside glabrous, inside with dense short erect simple hairs on the edges of the petals on the upper half; lobes not equal, inferior lobes erect at the base and more or less spreading towards the tips, narrow-lanceolate, 6–7 mm long, 0.7–0.8 mm wide; superior lobes more or less erect, strongly coherent along the lower half by interlocking very dense long erect simple hairs, enclosing the indusium, narrow lanceolate-falcate and distinctly widened around the indusium, 4.5–5 mm long, 0.7–0.8 mm wide; all lobes acute and not extending beyond the wings, outside and inside glabrous; wings on the inferior lobes rounded, 2–2.5 mm long, 0.7–0.8 mm wide, margins crinkled, transverse veins obscure; wings on the superior lobes rounded, 1 mm long, 0.1 mm wide, transverse veins obscure. *Stamens* enclosed in the tube; filaments very thin, 1.7–1.9 mm long; anthers linear, 0.7–0.8 mm long, obtuse, yellow. *Ovary* erect, 17–24 mm long, more or less smooth, glabrous; style erect, thin, not dilated towards the base, 5–5.5 mm long, glabrous or with scattered very short erect capitate hairs on the middle third, with dense short weak simple hairs at the back of the indusium. *Pseudocapsule* 4-valved, 22–28 mm long, not woody, opening spontaneously at maturity, slightly constricted between the articles, many distal articles not developed, glabrous. *Articles* in two rows when mature, about 6–9 per row, prismatic, 1 mm long, dark purplish, ridged around the middle with a B-shaped boss on each side. Fig. 3.

DISTRIBUTION: Known only from the type collection.

HABITAT: The type was collected from short sedgeland in a sandy depression on a sandstone plateau.



Fig. 3. *Lechenaultia ovata*: a, habit. b, flower. c, pseudocapsule (Craven 2438, CANB 269215). *Lechenaultia filiformis*: d, habit. e, flower. f, pseudocapsule (Byrnes 1858, SYD). Scale bar: a,d = 4 cm; b,c,e,f = 1 cm.

CONSERVATION STATUS: 1E. The population is fairly large (L. Craven, personal communication), but the collection locality would seem to be just outside Kakadu National Park.

The epithet refers to the ovate leaves, which are unique within the genus.

L. ovata is very closely related to *L. filiformis*, the only species of *Lechenaultia* with which it is sympatric. These two species possess three

characters that are not found elsewhere within the genus: a prolongation of the superior sepal, interlocking hairs along the cohering margins of the superior petals, and a long 'beaked' appearance of the capsule due to many of the distal articles not developing (*L. divaricata* also has a 'beak', but it is much shorter). These characteristics give these two species both flowers and fruits that are very distinctive within the genus.

Nevertheless, the two species can be easily distinguished from each other (Fig. 3). The flowers and fruits of *L. filiformis* are very variable in size (Morrison 1987); however, *L. ovata* has much smaller flowers and fruits than have been recorded for *L. filiformis* (c. 81 specimens examined). Also, the flowers of *L. ovata* are solitary rather than in monochasial or dichasial cymes as in *L. filiformis*; and the articles have distinctive surface sculpturing. More noticeably, the leaves of *L. ovata* are much shorter and wider than those of *L. filiformis*, and the plants are also notably smaller.

L. filiformis grows in the same general area as *L. ovata* (L. Craven, personal communication), with both species remaining distinct. This suggests that there is some form of isolating mechanism keeping the populations genetically distinct.

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Gentiana sect. *Chondrophyllae* (Gentianaceae) in Australia

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Abstract

Adams, L.G.¹ & Williams, J.B.² (¹Australian National Herbarium, CSIRO, Canberra, Australia 2601; ²Botany Department, University of New England, Armidale, Australia 2351) 1988. *Telopea* 3(2): 167–176. *Gentiana* sect. *Chondrophyllae* (Gentianaceae) in Australia. — For the first time sect. *Chondrophyllae* Bunge is recorded from Australia, being represented by four new species: *G. baeuerlenii*, *G. bredboensis*, *G. wingecarribiensis* and *G. wissmannii*. A brief history of their discovery is given; the geography of the section, and the features distinguishing it from the purely Southern Hemisphere sections *Andicola* and *Antarctophila* Kusn., present in Australasia, are discussed. Full Latin and English descriptions, locality and habitat data (where known), conservation status, and a species key are provided.

Introduction

In March 1887 Wilhelm Baeuerlen, the resident postmaster of the Southern Tablelands town of Bombala, N.S.W., and also a keen amateur naturalist, collected a tiny Gentian on the property 'Quidong', about 20 km west of the town. He sent it to Ferdinand von Mueller in Melbourne [MEL] for identification; Mueller apparently requested more material and Baeuerlen was able to find a further small quantity (Baeuerlen in herb. MEL, no date, in litt.). The taxon has never been recorded since, which is hardly surprising considering the remoteness of the area from main taxonomic research centres, and the ease of overlooking such a small plant, especially as the corollas no doubt exhibit the photonastic (or thermonastic?) movements (Harder *et al.* 1965: 380–381; Pringle 1979) characteristic of the genus *sensu lato* and tend to 'disappear' in dull weather.

After a gap of eighty years two further taxa were discovered, by remarkable coincidence in the same year. One, at first thought to be Baeuerlen's long-lost plant, was found by the senior author south of Jerangle, also in the Southern Tablelands, in June 1967; the other was collected a few months later in Wingecarribee Swamp, east of Moss Vale, N.S.W., by P. Bates. Then, in 1973, a fourth taxon very similar to the latter was found by H. Wissmann, this time near the Northern Tablelands town of Ebor, N.S.W.

It is immediately evident that all four taxa belong in *Gentiana* sect. *Chondrophyllae* Bunge (1829), as circumscribed by Pringle (1979). None of them can be satisfactorily equated with any previously described, including the 23 species recorded from Papua New Guinea by Royen (1983). However, an affinity with many of the latter appears to be indicated by the lack of basal rosulate leaves in *G. wingecarribiensis* and *G. wissmannii*, a feature also characteristic of the somewhat narrower circumscription of the section for Europe by Tutin (1972). The other two species, *G. baeuerlenii* and *G. bredboensis*, seem to have closer affinities with Eurasian elements of the section as circumscribed by Grossheim (1967) *ex descriptio*, especially members of his

series *Aquaticae* Grossh., characterised by small corollas, obovoid capsules and annual growth habit (but see Marquand 1938, Ho 1985). Until the taxonomic infrastructure of *Chondrophyllae* is more rigorously defined it would be premature to attempt to place the Australian taxa in a detailed context.

The taxa of sect. *Chondrophyllae* Bunge are clearly distinct from those purely Southern Hemisphere gentians in Australasia that belong to the sections *Andicola* and *Antarctophila* of Kusnezov (1895). These latter, referred to as the 'southern gentians' in a lucid appraisal of this problematical genus *sensu lato* by Philipson (1972), are currently retained in *Gentiana* in most New Zealand literature but considered by several workers better placed in the genus *Gentianella* Moench (in our opinion with some justification, perhaps as a new section). The *Chondrophyllae* are readily distinguished from the 'southern gentians' by the presence of interpetaline plicae (resulting in a relatively much longer corolla tube), the rigid anthers (not versatile), and the ovarian (as opposed to corolline) nectaries.

Sect. *Chondrophyllae* is a large, typically montane, and predominantly Northern Hemisphere group. In the Old World it is distributed from Europe (Pyrenees and Alps) through central and eastern Asia to Japan and into Southeast Asia, Indonesia, New Guinea and the Philippines; in the New World, from the Aleutians, Alaska and the Rocky Mountains to Mexico and Central America, and the Andes from Venezuela to Tierra del Fuego (Pringle 1979). The section has not been previously designated for Australia, and its discovery here constitutes a significant extension of range in the southern latitudes of the Old World.

In view of this, it is ironic that all four species fall within Conservation Status (Leigh *et al.*, 1981) of 'X' (presumed extinct), 'E' (endangered) or 'V' (vulnerable). Because of the plants' small stature, viable populations are probably dependent on a stable habitat of short, damp turf of forbs, sedges, grasses and bryophytes, to judge from our field observations. Prior to European settlement this type of habitat was maintained presumably by native herbivores, with negligible amounts of other disturbance. Modifications brought about since by trampling and over-grazing by stock, however, especially in times of drought, together with permanent changes in the watertable as well as other forms of disturbance, have no doubt drastically destabilised habitats. The point has now been reached where all species could be seriously at risk unless management policies geared towards a return to optimum conditions are initiated.

For example, *G. wingecarriensis* seems to be restricted exclusively to a subtle micro-habitat zone of sedge/bryophyte tussocks within a fen community. Its long-term survival could depend on the watertable remaining relatively high and fluctuating only within limits of a few centimetres for length, and possibly critical, seasonal periods.

Key to the species

- 1 Plants usually with a basal rosette of 2–6 pairs of leaves much larger than the cauline leaves and with more or less smooth margins; corolla white or very pale blue; fruiting gynophore much less than 10 mm long 2
- 1* Plants rarely with a basal rosette, and if so then the leaves not or little larger than the cauline leaves, and the margins clearly scaberulous; corolla sky blue; fruiting gynophore 10–25 mm long 3

- 2 Basal leaves to 8 mm long, the apices obtuse or shortly mucronate; corolla-lobes whitish blue inside; plicae 1(-2)-lobed; anthers c. 0.5 mm long; fruiting gynophore 5 mm long **1. *G. baeuerlenii***
- 2* Basal leaves to 20 mm long, the apices acute or acuminate, usually mucronate; corolla-lobes pure white inside; plicae lacerate or (1-)2-lobed; anthers c. 1 mm long; fruiting gynophore 2.5 mm long **2. *G. bredboensis***
- 3 Stem scaberulous above, leafless basal part 10-25 mm long; fruiting gynophore 15-25 mm long **3. *G. wingecarribiensis***
- 3* Stem smooth throughout, leafless basal part 5-10 mm long; fruiting gynophore 10-15(-20) mm long **4. *G. wissmannii***

1. *G. baeuerlenii* L. Adams, sp. nov.

[*G. quadrifaria* auct. non Blume (1826: 847): Mueller (1888a:14, 1888b: 357, 1889: 152).]

Herba annua, erecta, glabra, 2-4 cm alta. *Radix* tenuis, simplex. *Caulis* simplex vel sparsim ramosus, superne scaberulus, basin versus laevis; pars aphylla basalis brevissima vel nulla. *Folia basalia* (1-)2 paribus, sessilia, late ovata, usque ad 8 mm longa; apices obtusi vel mucronulati, vix recurvi; margines laeves, tenues, infirme cartilaginei. *Folia caulina* 3-4 paribus, foliis basalibus similia sed parviora, 4-6 mm longa, superiora marginibus crassioribus. *Florae* 1-3, singulares, apicales, (4-)5-merae. *Calyx* anguste infundibuliformis, 4-5 mm longus, (4-)5-lobus; costae anguste alatae; lobi ovati, acuminati, erecti, 1-2.5 mm longi, obscure 3-nerves, membranibus intersepalinis connexi. *Corolla* anguste campanulata, 5-8 mm longa, (4-)5-loba, plicata, 'viridula extus, albida caeruleascens intus' (fide Muellerei); lobi patentes, acuti, apice 2-3 mm liberi. *Plicae* apicibus acuminate 1(-2)-lobae, (albi?), translucetes. *Stamina* (4-)5, tubo corollae inclusa. *Fila* c. 4 mm longa, dimidio inferiore adnata. *Antherae* c. 0.5 mm longae. *Ovarium* stipitatum, subcompressum, alis secus suturas membranaceis angustis. *Stylus* 1 mm longus. *Stigmata* 2, linearia, c. 0.5 mm longa, recurva, in fructu persistentia. *Nectararia* rudimentaria, ad ovarium affixa. *Gynophorum* 1.5 mm longum, demum in fructu usque ad 5 mm elongatum. *Capsula* ovoidea, bivalvis, 3.5 mm longa. *Semina* numerosa, 'turgida ovata, minuta, sine appendix; testa subtiliter striolata, pallide fusca' (fide Muellerei, holotypo, MEL). Fig. 1.

TYPUS: Quidong [Quidong], Southern Tablelands, N.S.W. [Quidong is 18 km W of Bombala: precise locality of collection unknown but approximately 37°S, 149°E], *W. Baeuerlen* 462, March 1887 (*holo:* MEL; *iso:* NSW).

Habit: annual, erect, glabrous, 2-4 cm high. **Taproot:** slender, unbranched. **Stem:** simple or sparsely branched, minutely scaberulous above, smooth below; basal leafless portion very short or absent. **Basal leaves:** (1-)2 pairs, sessile, broadly ovate, up to 8 mm long; apices obtuse or very shortly mucronate, scarcely recurved; margins smooth, thin and weakly cartilaginous. **Cauline leaves:** 3-4 pairs, like the basal leaves but smaller, 4-6 mm long, the upper with thicker margins. **Flowers:** 1-3, solitary, terminal, (4-)5-merous. **Calyx:** narrow-infundibuliform, 4-5 mm long, (4-)5-lobed; ribs narrowly winged; lobes ovate, acuminate, erect, 1-2.5 mm long, obscurely 3-veined, connected by intersepaline membranes. **Corolla:** narrow-campanulate, 5-8 mm long, (4-)5-lobed, plicate, 'greenish outside, whitish-blue inside' (fide Mueller); lobes spreading, acute, the



Fig. 2. *Gentiana bredboensis* (from holotype). Scale in mm.



Fig. 1. *Gentiana baeuerlenii* (from holotype). Scale in mm.

upper 2–3 mm free. *Plicae*: with apices acuminately 1(–2)-lobed, (white?), translucent. *Stamens*: (4–)5, enclosed in corolla-tube. *Filaments*: c. 4 mm long, adnate in lower half. *Anthers*: c. 0.5 mm long. *Ovary*: stipitate, sub-compressed, with narrow membranous wings along sutures. *Style*: 1 mm long. *Stigmas*: 2, linear, c. 0.5 mm long, recurved, persistent in fruit. *Nectaries*: rudimentary, ovarian. *Gynophore*: 1.5 mm long, elongating to 5 mm in fruit. *Capsule*: ovoid, 2-valved, 3.5 mm long. *Seeds*: numerous, 'turgid-ovate, minute, without an appendage; testa finely striolate, pale brown' (*vide* Mueller, holotype, MEL).

NOTES: 'Flowers closed up [at time of gathering?], white with bluish tinge' (*vide* Baeuerlen, holotype, MEL). Baeuerlen's plant is generally similar in size and appearance and obviously closely related to both *G. quadrifaria* Bl. and *G. aquatica* L., but these species have significant differences. *G. quadrifaria*, from Java, has ovate leaves with conspicuously acuminate-aristate apices. *G. aquatica*, widespread in central and eastern Asia, differs in its lax, basally multi-branching habit and narrowly oblong-lanceolate cauline leaves. Another related Asiatic species is *G. pseudo-aquatica* Kusn. but this is also basally multi-branched and the cauline leaves are strongly spatulate.

A label with a fragment of Baeuerlen's collection in the NSW herbarium states: 'Quiedong nr. Bombala NSW, W. Baeuerlen nr. 462' in an unknown hand. The MEL sheet bears two labels, both carrying 'Nro. 462' in Baeuerlen's hand and annotated by Mueller as '*G. quadrifaria* Bl.', although on one he also states 'near *G. aquatica* L.'. However, while one label mentions 'Quiedong' (in Baeuerlen's writing), on the other Mueller has written 'Genoa'! The latter would seem to be the explanation for this plant later being listed for Victoria (Mueller 1888a,b; 1889). We can find no evidence that Wilhelm Baeuerlen ever collected in the Genoa area of East Gippsland, Victoria, and although it is not inconceivable for the plant to occur there we consider that without further evidence this 'record' is an error.

HABITAT: Unknown, but presumably damp places in short turf.

CONSERVATION STATUS: 1?X. This species is still known only from the type collection, despite some searching by the senior author of likely sites on the Quidong property. In view of the general remoteness of the area and the diminutive habit of this easily overlooked plant, it is too soon to presume the species extinct; every opportunity should be taken to search for it in suitable habitats of the Delegate River catchment.

2. *G. bredboensis* L. Adams, *sp. nov.*

Herba annua vel ?biennis, erecta, glabra, 2–9 cm alta. *Radix* tenuis, plerumque ramosa. *Caulis* plerumque multiramosus, raro simplex, scaberulus; pars aphylla basalis brevissima. *Folia basalia* 3–6 paribus, sessilia, late ovata, usque ad 20 mm longa; apices acuti vel acuminati, plerumque mucronati, recurvi; margines laeves vel sub-scaberulus, crassiusculus, cartilagineis. *Folia caulina* 3–6 paribus, foliis basalibus similia sed sursum gradatim parvioria et marginibus crassioribus, 6–15 mm longa. *Florae* 1–6, singulares, apicales, (4–)5-merae. *Calyx* anguste infundibuliformis, 5–8 mm longus, (4–)5-lobus; costae anguste alatae; lobi ovati, acuti, erecti, carinati, 2.5–3.5 mm longi, 1-nerves; membranis intersepalinis connexi. *Corolla* anguste campanulata, 8–10 mm longa, (4–)5-loba, plicata, costis sub-roseis extus, candida intus; lobi patentes, acuti, apice 2–4 mm liberi. *Plicae* apicibus laceratae vel irregulariter (1–)2-lobae,

albotranslucentes. *Stamina* 5, tubo corollae inclusa. *Fila* 3–5 mm longa, dimidio inferiore adnata. *Antherae* c. 1 mm longae. *Ovarium* stipitatum, subcompressum, alis secus suturas membranaceis. *Stylus* 0.5 mm longus. *Stigmata* 2, linearia, c. 3 mm longa, recurva, in fructu persistentia. *Nectaria* rudimentaria, ovarium affixa. *Gynophorum* 1.5 mm longum, demum in fructu usque ad 2.5 mm elongatum. *Capsula* oblonge ovoidea, bivalvis, 5–6 mm longa. *Semina* numerosa, oblique ovoidea, 0.6 mm longa, sine appendice; testa reticulata striolata, brunnea. Fig. 2.

TYPUS: c. 7 miles S [11 km SSE] of Jerangle, Southern Tablelands, N.S.W., alt. 930 m, 35°58'S 149°25'E, grid ref. GA 171175, Pullen & Adams 4427, 3.xii.1971 (*holo*: CANB; *iso*: K, L, MEL, NE, NSW, US).

Habit: annual or ?biennial, erect, glabrous, 2–9 cm high. *Taproot*: slender, usually branched. *Stem*: usually many-branched, rarely simple, scaberulous; basal leafless portion very short. *Basal leaves*: 3–6 pairs, sessile, broadly ovate, up to 20 mm long; apices acute or acuminate, usually mucronate, recurved; margins smooth or sub-scaberulous, moderately thick and cartilaginous. *Cauline leaves*: 3–6 pairs, like basal leaves but becoming smaller upward and with thicker margins, 6–15 mm long. *Flowers*: 1–6, solitary, terminal, (4–)5-merous. *Calyx*: narrow-infundibuliform, 5–8 mm long, (4–)5-lobed; ribs narrowly winged; lobes ovate, acute, erect, keeled, 2.5–3.5 mm long, 1-veined, connected by intersepaline membranes. *Corolla*: narrow-campanulate, 8–10 mm long, (4–)5-lobed, plicate, pinkish-ribbed outside, pure white inside; lobes spreading, acute, the upper 2–4 mm free. *Plicae*: with the apices lacerate or irregularly (1–)2-lobed, white, translucent. *Stamens*: 5, enclosed in corolla-tube. *Filaments*: 3–5 mm long, adnate in lower half. *Anthers*: c. 1 mm long. *Ovary*: shortly stipitate, compressed, with narrow membranous wings along sutures. *Style*: 0.5 mm long. *Stigmas*: 2, linear, c. 1.5 mm long, recurved, persistent in fruit. *Nectaries*: rudimentary, ovarian. *Gynophore*: 1.5 mm long, shortly elongating up to 2.5 mm in fruit. *Capsule*: oblong-ovoid, 2-valved, 5–6 mm long. *Seeds*: numerous, obliquely ovoid, 0.6 mm long, without appendages; testa reticulate-striolate, brown.

NOTES: Flowers only opening in direct sunlight.

HABITAT: Margins of very wet seepage slopes in sheep pasture on granitic sandy soil; closely grazed turf amongst *Baeckea*–*Leptospermum* thickets.

CONSERVATION STATUS: 2V. This species is known only from the type locality, on private property, over a distance of a few hundred metres along a small tributary of the Bredbo River. Many similar pockets of this type of habitat on granitic soils probably exist within the Bredbo River catchment.

SPECIMENS EXAMINED: NEW SOUTH WALES: **Southern Tablelands**: c. 7 miles S. [11 km SSE.] of Jerangle, *Adams 1886A*, 15.vi.1967 (CANB); *Adams et al. 2598*, 27.viii.1971 (CANB).

3. *G. wingecarribiensis* L. Adams, sp. nov.

Herba annua, erecta, glabra, 4–9 cm alta. *Radix* tenuis, simplex. *Caulis* simplex vel sparsim ramosus, superne scaberulus basin versus laevis, valde rubello-suffusus; pars aphylla basalis 1–2.5 cm longa. *Folia basalia* nulla. *Folia caulina* 4–7 paribus, sessilia, late vel oblonge ovata, carinata, 3–8 mm longa; apices acuti vel obtusi, mucronati, plus minusve recurvi; margines cartilaginei, scaberuli. *Florae* 1–6, singulares, apicales, (4–)5-merae. *Calyx* anguste

infundibuliformis, 6–10 mm longus, (4–)5-lobus; costae exalatae; lobi lanceolati, acuti, erecti, 2–4 mm longi, obscure 3-nerves; membranis intersepalinis connexi. *Corolla* anguste campanulata, 10–17 mm longa, (4–)5-loba, plicata, virello-costa extus, caerulea intus; lobi patentes, acuti vel acuminati, apice 2–3 mm liberi. *Plicae* apicibus laceratae vel irregulariter 1–2-lobae, caeruleae, translucetes. *Stamina* 5, tubo corollae inclusa. *Fila* 3–5 mm longa, dimidio inferiore adnata. *Antherae* c. 1 mm longae. *Ovarium* stipitatum, subcompressum, alis secus suturas membranaceis. *Stylus* nullus. *Stigmata* 2, linearia, c. 3 mm longa, recurva, in fructu persistentia. *Nectaria* rudimentaria, ovario affixa. *Gynophorum* 2–3 mm longum, demum in fructu ad 15–25 mm elongatum. *Capsula* late obovoidea, bivalvis, 4–5 mm longa. *Semina* numerosa, oblique ellipsoidea fusiformia, 0.3 mm longa, sine appendice; testa reticulata striolata, pallide brunnea, translucens. Fig. 3.

TYPUS: Wingecarribee Swamp, c. 9.6 km W of Robertson, Central Tablelands, N.S.W., alt. c. 670 m, 34°34'S 150°31'E, grid ref. KG 718712, Pullen 4999, 3.x.1973 (*holo*: CANB; *iso*: NSW).

Habit: annual, erect, glabrous, 4–9 cm high. *Taproot*: slender, unbranched. *Stem*: simple or sparsely branched, minutely scaberulous above, smooth below, strongly reddish-tinged; basal leafless portion 1–2.5 cm long. *Basal leaves*: absent. *Cauline leaves*: 4–7 pairs, sessile, broad- or oblong-ovate, keeled, 3–8 mm long; apices acute or obtuse, mucronate, more or less recurved; margins cartilaginous, scaberulous. *Flowers*: 1–6, solitary, terminal, (4–)5-merous. *Calyx*: narrow-infundibuliform, 6–10 mm long, (4–)5-lobed; ribs not winged; lobes lanceolate, acute, erect, 2–4 mm long, obscurely 3-veined; intersepaline membranes present. *Corolla*: narrow-campanulate, 10–17 mm long, (4–)5-lobed, plicate, greenish-ribbed outside, sky blue inside; lobes spreading, acute or acuminate, the upper 2–3 mm free. *Plicae*: with apices lacerate or irregularly 1–2-lobed, pale blue, translucent. *Stamens*: 5, enclosed in corolla tube. *Filaments*: 3–5 mm long, adnate in lower half. *Anthers*: c. 1 mm long. *Ovary*: stipitate, subcompressed, with membranous wings along sutures. *Style*: absent. *Stigmas*: 2, linear, c. 3 mm long, recurved, persistent in fruit. *Nectaries*: rudimentary, ovarian. *Gynophore*: 2–3 mm long, greatly elongating to 15–25 mm in fruit. *Capsule*: broadly obovoid, 2-valved, 4–5 mm long. *Seeds*: numerous, obliquely ellipsoid-fusiform, 0.3 mm long, without appendages; testa reticulate-striolate, pale brown, translucent.

NOTES: Corolla opening only in bright sunlight.

HABITAT: Sphagnum hummocks and small open patches in dense *Juncus*/sedge community, c. 15 cm above watertable. Not seen in adjoining, floristically different communities, or in wetter areas.

CONSERVATION STATUS: 2E. This species is known only from the type locality, which is on private property. The habitat site, although relatively large, is threatened by permanent flooding and peat mining; no other similar sites are known in the area.

SPECIMENS EXAMINED: NEW SOUTH WALES: **Central Tablelands**: Pullen 4999, 3.x.1973 (CANB, NSW); P. Bates s.n., 15.ix.1967 (NSW 142611); Johnson & Briggs s.n., 18.ix.1967 (NSW 142612); Adams et al. 2606, 26.x.1971 (CANB).

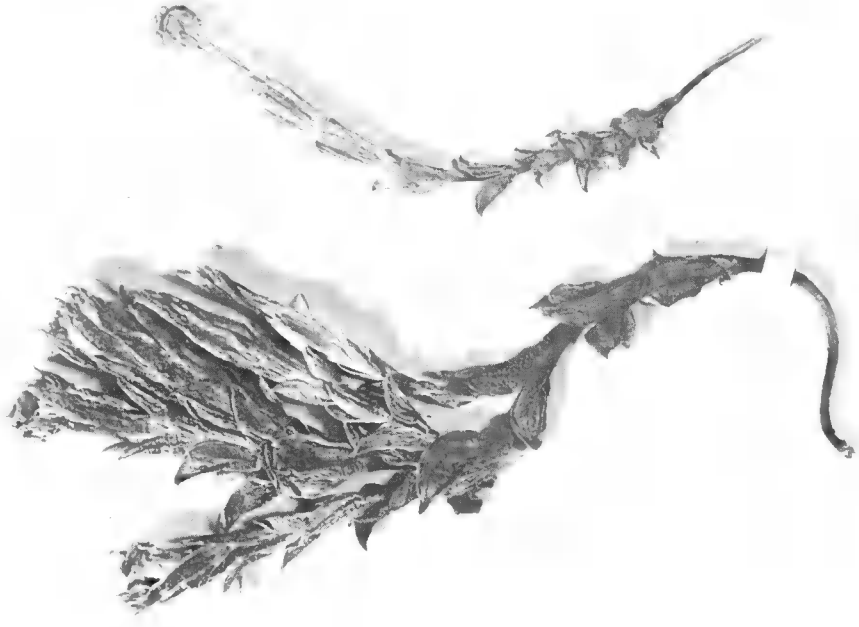


Fig. 4. *Gentiana wissmannii* (from holotype). Scale in mm.



Fig. 3. *Gentiana wingecarribiensis* (from holotype). Scale in mm.

4. *G. wissmannii* J.B. Williams, sp. nov.

Herba annua, erecta, glabra, 3–8 cm alta. *Radix* tenuis, simplex. *Caulis* simplex vel 2–4-ramosus, laevis, valde rubello-suffusus; pars aphylla basalis 0.5–1 cm longa. *Folia basalia* nulla; (folia caulina inferiora plantarum brevissimocaulium sub-rosulata). *Folia caulina* 3–10 paribus, sessilia, ovata vel oblonge ovata, carinata, 4–10 mm longa; apices acuti vel obtusi, plus minusve recurvi; margines cartilaginei, scaberuli. Florae 1–8, singulares, ramis brevissimis apicales, (4–)5-merae. *Calyx* anguste infundibuliformis, 8–11 mm longus, (4–)5-lobus; costae exalatae; lobi oblonge ovati vel lanceolati, acuti, erecti, 3–4 mm longi, obscure 3-nerves, membranis intersepalinis connexi. *Corolla* anguste campanulata, 8–15 mm longa, (4–)5-loba, plicata, virello-costa extus, caerulea intus; lobi patentes, acuti vel breviter acuminati, apice 2–2.5 mm liberi. *Plicae* apicibus laceratae vel irregulariter 2–3-lobae, caeruleae, translucentes. *Stamina* 5, tubo corollae inclusa. *Fila* 4–5 mm longa, dimidio inferiore adnata. *Antherae* (0.7–)1 mm longae. *Ovarium* breviter stipitatum, compressum, alis secus suturas membranaceis angustis. *Stylus* nullus. *Stigmata* 2(–3), linearia, 2.5 mm longa, recurva, in fructu persistentia. *Nectaria* rudimentaria, ovario affixa. *Gynophorum* c. 2 mm longum, demum in fructu ad 10–15(–20) mm elongatum. *Capsula* obovoidea, 2(–3)-valvis, 5–6 mm longa. *Semina* numerosa, ellipsoidea fusiformia, 0.3 mm longa, sine appendice; testa reticulata striolata, cinnamomea, translucens. Fig. 4.

TYPUS: Ebor–Armidale road, 1.6 km E of Yooroonah, 0.6 km E of Oaky Creek, Northern Tablelands, N.S.W., alt. 1100 m, 30°30'S 152°16'E, grid ref. MM 290257, J.M.B. Smith 221, 2.xi.1976 (holo: CANB; iso: NE).

Habit: annual, erect, glabrous, 3–8 cm high. *Taproot*: slender, unbranched. *Stem*: simple or 2–4-branched, smooth, strongly reddish-tinged; basal leafless portion 0.5–1 cm long. *Basal leaves*: absent; (lower cauline leaves of very short-stemmed plants sub-rosulate). *Cauline leaves*: 3–10 pairs, sessile, ovate to oblong-ovate, keeled, 4–10 mm long; apices acute or obtuse, more or less recurved; margins cartilaginous, scaberulous. *Flowers*: 1–8, solitary, terminal on very short branches, (4–)5-merous. *Calyx*: narrow-infundibuliform, 8–11 mm long, (4–)5-lobed; ribs not winged; lobes oblong-ovate, lanceolate, acute, erect, 3–4 mm long, obscurely 3-veined; intersepaline membranes present. *Corolla*: narrow-campanulate, 8–15 mm long, (4–)5-lobed, plicate, greenish-ribbed outside, sky blue inside; lobes spreading, acute or short-acuminate, the upper 2–2.5 mm free. *Plicae*: with apices lacerate or irregularly 2–3-lobed, pale blue, translucent. *Stamens*: 5, enclosed in corolla-tube. *Filaments*: 4–5 mm long, adnate in lower half. *Anthers*: (0.7–)1 mm long. *Ovary*: shortly stipitate, compressed, with narrow membranous wings along sutures. *Style*: absent. *Stigmas*: 2(–3), linear, 2.5 mm long, recurved, persistent in fruit. *Nectaries*: rudimentary, ovarian. *Gynophore*: c. 2 mm long, greatly elongating to 10–15(–20) mm in fruit. *Capsule*: obovoid, 2(–3)-valved, 5–6 mm long. *Seeds*: numerous, ellipsoid-fusiform, 0.3 mm long, without appendages; testa reticulate-striolate, orange-brown, translucent.

NOTES: Flowers opening only in bright sunlight.

HABITAT: Margins of *Leptospermum*/*Restio*/*Sphagnum* swamps, usually in closely-grazed turf (cattle or kangaroos).

CONSERVATION STATUS: 2V or 2?C. This species is recorded from the general area between Round Mountain and Ebor; most of the known sites appear to be on private property, but the plant probably also occurs in the adjacent Cathedral Rock National Park.

SPECIMENS EXAMINED: NEW SOUTH WALES: **Northern Tablelands:** Round Mountain Area, 50 miles [80 km by road] E of Armidale, *H. Wissmann s.n.*, 14.x.1973 (CANB, NSW); slopes SE of Cathedral Rocks, near Ebor, *J.M.B. Smith 33*, 25.ix.1974 (CANB, NE); Kangaroo Creek valley, c. 6 km E of Round Mountain, *J.M.B. Smith & G.S. Hope 218*, 21.x.1976 (CANB, NE), *J.M.B. Smith 219*, 2.xi.1976 (CANB, NE); Bullock Creek, Armidale–Ebor road, 10 km SW of Ebor, *J.M.B. Smith 220*, 2.xi.1976 (CANB, NE); Armidale–Ebor road, 0.5 km E of Yooroonah, *J.M.B. Smith 222*, 4.xi.1976 (CANB, NE); Kangaroo Creek, Ebor–Guyra road, 6 km W of Ebor, *J.M.B. Smith 224*, 4.xi.1976 (CANB, NE); Sandy Creek, 10 km W of Ebor, *J.M.B. Smith 225*, 4.xi.1976 (CANB, NE).

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Polygonum sensu lato (Polygonaceae) in Australia

K.L. Wilson

Abstract

Wilson, K.L. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1988. *Polygonum sensu lato* (Polygonaceae) in Australia. *Telopea* 3(2): 177–182. — *Polygonum* has generally been used in a broad sense in Australia to include *Fallopia*, *Persicaria* and *Reynoutria*. In light of recent studies, these four groups are recognised as distinct genera. A key is provided to those genera at some time included in *Polygonum* but now regarded as distinct, that is, the above-mentioned genera plus *Aconogonon*, *Bistorta*, *Fagopyrum* and *Koenigia*. A list of these genera and of species recorded for Australia (whether native, naturalised or cultivated) is provided. New combinations are made for *Persicaria decipiens* (R. Br.) K.L. Wilson and *P. subsessilis* (R. Br.) K.L. Wilson.

Introduction

When Linnaeus established the genus *Polygonum* in 'Species Plantarum' (1753), he included in it species now assigned to seven different genera, viz. *Aconogonon* (Meissner) Reichb., *Bistorta* Scop., *Fagopyrum* Miller, *Fallopia* Adans. emend. Holub, *Persicaria* Miller, *Polygonum sens. strict.* and *Reynoutria* Houtt. emend. Nakai. Various treatments of these genera, summarised by Haraldson (1978, Table 8), have been used since 1753, usually with sectional rank given to those included in *Polygonum sens. lat.* All have been treated as distinct genera by one author or another. *Koenigia* L. has been included in *Polygonum* in some treatments. *Fagopyrum* has generally been regarded as distinct, perhaps because of the economic significance and therefore familiarity of one of its species, *F. esculentum* Moench (Buckwheat).

There has been gradual recognition of the diversity within *Polygonum*: diversity not only in gross morphology but also in vegetative anatomy (Haraldson 1978) and in pollen morphology (Hedberg 1946). This has led to some authors accepting all the above-mentioned groups as genera (see, for example, Holub (1971), Hara (1966, 1982)). Haraldson (1978) made a detailed study of subfamily Polygonoideae (the only subfamily present in Australia), in which she reviewed previous information and added more, especially on vegetative anatomy of the included taxa.

Haraldson used anatomical features of the stem, petiole, leaves and trichomes, as well as pollen and gross morphological characters, to develop her classification of the subfamily. In the case of *Polygonum sens. lat.* she concluded that some segregate genera were less closely related to *Polygonum sens. strict.* than to other genera (for example, *Persicaria* to *Koenigia*).

The evidence presented by Haraldson and earlier authors has led me to accept *Polygonum* in the narrow sense and to place in segregate genera the other species found in Australia. When this is done the only genera with Australian native species are *Persicaria* and *Polygonum sens. strict.*, both of which also include naturalised species. *Fagopyrum*, *Fallopia* and *Reynoutria* are represented in Australia only by naturalised and cultivated species.

Segregate genera

Traditional usage of *Polygonum sens. strict.* has been for the group of species commonly known as Wireweeds (e.g. *P. aviculare* L. and *P. arenastrum* Bor.). However, Börner (1913) chose *Polygonum lapathifolium* L. (belonging to *Persicaria*) as lectotype for *Polygonum*. McNeill (1981) proposed that *Polygonum* be conserved with *P. aviculare* as lectotype. Having been recommended for acceptance by the Committee on Spermatophyta (*Taxon* 33: 299 (1984)), this proposal was formally accepted at the XIV International Botanical Congress (1987).

The correct names for the segregate genera and their Australian species are listed in Table 1. The correct name for the lectotype species of *Persicaria* (*Polygonum persicaria* L.) appears to be *Persicaria maculosa* S.F. Gray rather than *Persicaria maculata* (Raf.) A. & D. Löve or various other early names that have been suggested (J. McNeill, pers. comm.), but there is still some doubt about this. An earlier name that may displace it is *Persicaria ruderalis* (Salisb.) Reed, based on *Polygonum ruderale* Salisb.

Only two new combinations in the segregate genera are necessary for the species occurring in Australia. These are:

***Persicaria decipiens* (R. Br.) K.L. Wilson, comb. nov.**

BASIONYM: *Polygonum decipiens* R. Br., Prodrumus: 420 (1810).

LECTOTYPE: (here designated): Port Jackson, R. Brown (*Bennett/Britten no.* 2995), 1804 (BM).

SYNONYM: *Polygonum minus* Hudson ssp. *decipiens* (R. Br.) Danser, *Bull. Jard. Bot. Buitenzorg ser.* 3, 8: 178 (1927).

This species has been confused in Australia with the annual European species *Persicaria minor* (Hudson) Opiz but is distinct from that species, differing in being perennial with often larger leaves (5–12 x 0.5–1.3 cm; in *P. minor*, 2–7 x 0.4–0.9 cm) and with the flower clusters in the spike-like inflorescence uniformly spaced (in *P. minor*, the clusters are much more distant towards the base of the inflorescence). However, it is very close to *Persicaria salicifolia* (Brouss. ex Willd.) Assenov (incl. *Polygonum serrulatum* Lag.) of Europe, Africa and South-West Asia, and study of more material may show that they are synonymous. Although this is uncertain, what is certain is the status of the species as a native in Australia, since Banks and Solander collected it at Botany Bay in 1770.

Table 1. Names accepted here for genera at some time previously included in *Polygonum sens. lat.*, as well as for all species recorded for Australia (whether native, naturalised (*) or cultivated (†)).

Accepted name	Name in <i>Polygonum sens. lat.</i>
<i>Polygonum</i> L. <i>sens. strict.</i> , <i>nom. cons.</i> [c. 50 spp., cosmopolitan; prob. introduced in many regions]	—
?* <i>P. arenastrum</i> Boreau	—
* <i>P. argyrocoleon</i> Steudel ex Kunze	—
?* <i>P. aviculare</i> L.	—
* <i>P. patulum</i> M. Bieb.	—
<i>P. plebeium</i> R. Br.	—

Accepted name	Name in <i>Polygonum sens. lat.</i>
<i>Fagopyrum</i> Miller, <i>nom. cons.</i> [15 spp., in temperate Asia]	<i>P. sect. Fagopyrum</i> (Miller) DC.
Sect. <i>Fagopyrum</i> * <i>F. esculentum</i> Moench	<i>P. fagopyrum</i> L.
<i>Fallopia</i> Adans. <i>emend.</i> Holub [7 spp., native to northern temperate regions]	<i>P. sect. Tiniaria</i> Meissner
Sect. <i>Fallopia</i> * <i>F. convolvulus</i> (L.) A. Löve	<i>P. convolvulus</i> L.
Sect. <i>Pleuropterus</i> (Turcz.) Haraldson † <i>F. baldschuanica</i> (Regel) Holub	<i>P. sect. Pleuropterus</i> (Turcz.) Benth. & Hook. f. <i>P. baldschuanicum</i> Regel
<i>Persicaria</i> Miller [c. 150 spp., cosmopolitan but more common in N. Hemisphere]	<i>P. sect. Persicaria</i> Meissn.
Sect. <i>Persicaria</i> <i>P. attenuata</i> (R. Br.) Soják <i>P. barbata</i> (L.) H. Hara <i>P. decipiens</i> (R. Br.) K.L. Wilson <i>P. elatior</i> (R. Br.) Soják <i>P. hydropiper</i> (L.) Spach <i>P. lapathifolia</i> (L.) S.F. Gray * <i>P. maculosa</i> S.F. Gray † <i>P. odorata</i> (Lour.) Soják <i>P. orientalis</i> (L.) Spach <i>P. prostrata</i> (R. Br.) Soják <i>P. subsessilis</i> (R. Br.) K.L. Wilson	<i>P. attenuatum</i> R. Br. <i>P. barbatum</i> L. <i>P. decipiens</i> R. Br. <i>P. elatius</i> R. Br. <i>P. hydropiper</i> L. <i>P. lapathifolium</i> L. <i>P. persicaria</i> L. <i>P. odoratum</i> Lour. <i>P. orientale</i> L. <i>P. prostratum</i> R. Br. <i>P. subsessile</i> R. Br.
Sect. <i>Echinocaulon</i> (Meissner) Gross <i>P. dichotoma</i> (Blume) Masamune <i>P. praetermissa</i> (Hook. f.) H. Hara <i>P. strigosa</i> (R. Br.) Gross	<i>P. sect. Echinocaulon</i> Meissner <i>P. dichotomum</i> Blume <i>P. praetermissum</i> Hook. f. <i>P. strigosum</i> R. Br.
Sect. <i>Cephalophilon</i> (Meissner) Gross * <i>P. capitata</i> (Buch.-Ham. ex D. Don) Gross	<i>P. sect. Cephalophilon</i> Meissner <i>P. capitatum</i> Buch.-Ham. ex D. Don
Sect. <i>Tovara</i> (Adans.) Gross † <i>P. filiformis</i> (Thunb.) Nakai	<i>P. sect. Tovara</i> (Adans.) Benth. & Hook. f. <i>P. filiforme</i> Thunb.
<i>Reynoutria</i> Houtt. <i>emend.</i> Nakai [c. 15 spp., native to Asia]	<i>P. sect. Reynoutria</i> (Houtt.) Nakai
* <i>R. japonica</i> Houtt. * <i>R. sachalinensis</i> (Schmidt) Nakai	<i>P. cuspidatum</i> Siebold & Zucc. <i>P. sachalinense</i> Schmidt
<i>Aconogonon</i> (Meissner) Reichb. [c. 10 spp. in N. Hemisphere]	<i>P. sect. Aconogonon</i> Meissner
<i>Bistorta</i> Scop. [c. 7 spp. in N. hemisphere]	<i>P. sect. Bistorta</i> D. Don
<i>Koenigia</i> L. [c. 5 spp. in Asian mountains, 1 sp. arctic circumpolar & Tierra del Fuego]	<i>P. sect. Koenigia</i> (L.) Hook. f.

Persicaria subsessilis (*R. Br.*) *K.L. Wilson, comb. nov.*

BASIONYM: *Polygonum subsessile* R. Br., Prodrumus: 419 (1810).

LECTOTYPE (here designated): Iter Austral., *R. Brown (Bennett/Britten no. 3000)*, 1802–1805 (BM). The collection site is unclear since the type sheet bears two field labels, one giving Port Dalrymple in Tasmania as the locality and the other Port Jackson in New South Wales (both regions are cited in the protologue).

SYNONYM: *Polygonum minus* ssp. *subsessile* (R. Br.) Danser, *Bull. Jard. Bot. Buitenzorg ser. 3*, 8: 176 (1927).

This species is related to *Persicaria decipiens*, but is quite distinct. *P. subsessilis* is generally a coarser plant than *P. decipiens*, and has white flowers (bright to pale pink or rarely white in *P. decipiens*) and is usually covered in coarse hairs (*P. decipiens* is glabrous apart from occasional fine hairs on leaf margins and veins and long cilia on the upper margin of the ocreae).

Distinguishing features

For practical discriminatory purposes, gross morphological features such as inflorescence structure, flower form, stigma form, leaf form and trichome arrangement are most useful. The distribution of most of these features can be seen in the following key, which is drawn largely from data in Haraldson's paper, especially Table 7. Genera occurring in Australia are in **bold type**.

- 1 Pit nectaries present at the base of the petiole. Outer three perianth segments enlarged and winged or keeled in fruit. [Leaves usually with an abscission zone at the base of the petiole.]
 - 2 Stigmas shortly elongate, fimbriate. Flowers unisexual. Stout rhizomatous perennial herbs with erect annual stems. **Reynoutria**
 - 2* Stigmas capitate and smooth, or small-peltate and very shortly fimbriate. Flowers bisexual. Twining or decumbent slender but woody perennial herbs. **Fallopia**
- 1* Pit nectaries absent. Perianth segments without enlarged wings or keels. [Stigmas capitate, smooth. Flowers bisexual.]
 - 3 Ocreae deeply lacerate, silvery or white, glabrous. Flowers solitary or in small axillary clusters. Stamen filaments subulate above, broadly dilated in lower half. [Leaves usually with an abscission zone at base of petiole. Plants usually glabrous.] **Polygonum sens. strict.**
 - 3* Ocreae entire and tubular (often only shortly so and distintegrating with growth), pale brown to hyaline, glabrous or pubescent or with cilia on upper margin. Flowers in clusters or in paniculate, spike-like or capitate inflorescences. Stamen filaments uniformly subulate or filiform.
 - 4 Nut greatly exceeding the perianth, at least twice as long, often winged on the angles. Leaves with abscission zone (occasionally hard to see) at base of petiole. **Fagopyrum**
 - 4* Nut enclosed by perianth, or shortly exceeding it (less than twice as long), not winged (or occasionally so in *Aconogonon*). Leaves without an abscission zone.

- 5 Flowers in dense to lax, clearly defined, spike-like or capitate inflorescences.
 - 6 Strongly rhizomatous perennial herbs with erect or ascending annual or perennial stems. Basal leaves strongly developed. Leaf margins revolute or rarely flat, mostly with prominent nerves on the curved portion. *Bistorta*
 - 6* Annual or perennial herbs, with erect to decumbent persistent stems, often rooting at the nodes, rarely with a slender rhizome. Leaves more or less evenly distributed along stems. Leaf margins flat or rarely revolute but always without prominent veins on the margin. **Persicaria**
- 5* Flowers in diffuse small clusters or large loose panicle-like inflorescences.
 - 7 Strongly rhizomatous perennial herbs with erect or flexuose annual stems. Nut occasionally winged. *Aconogonon*
 - 7* Small erect or decumbent annuals. Nut not winged. *Koenigia*

The five genera found in Australia are readily distinguished on morphological features. For specimens in the vegetative state, the deeply lacerate, silvery or white, glabrous ocreae immediately distinguish species of *Polygonum sens. strict.* from those of the other genera, which have entire, tubular, pale brown to hyaline ocreae (often only very shortly tubular and disintegrating with growth) that may be pubescent, ciliate or glabrous. Occasionally species of *Persicaria* have a green limb of leaf-like texture on the upper margin of the ocrea. Plants of *Polygonum* are mostly quite glabrous, although extra-Australian species may occasionally bear two or the thirteen types of trichome that Haraldson (1978) recognised. Plants of the other genera generally bear at least some hairs of various types. The leaves of *Polygonum*, *Fagopyrum*, *Fallopia* and *Reynoutria* are distinctive in having an abscission zone (occasionally hard to see) at the base of the petiole. Pit nectaries ('Grubbenektarien' of Zimmerman, as detailed in Elias 1983) are found just below the abscission zone in *Fallopia* and *Reynoutria*. Salisbury (1909) described these nectaries, suggesting that their secretory activity played an important part in regulating the water-relations of the plant. A proposed alternative function for extra-floral nectaries (Bentley 1977) is that of attracting ants and hence protection of the plant by those ants against herbivorous animals. Bentley (1977) suggests that a protective function is more common than a strictly physiological function.

The genera differ in habit and habitat preferences. *Persicaria* species are generally erect to decumbent annuals or perennials with persistent stems often rooting at the nodes, rarely rhizomatous, and are mostly found in habitats seasonally or permanently wet. The other four genera are found in dryland habitats. *Polygonum* species are slender perennials, procumbent or decumbent or more rarely erect. *Fagopyrum esculentum* is an erect annual; extra-Australian species of *Fagopyrum* may be perennial and twining. *Fallopia* species are slender but somewhat woody twiners or decumbent. *Reynoutria* species are strongly rhizomatous herbaceous perennials, producing stout erect annual stems.

Flowers are bisexual except in *Reynoutria*, in which the functionally unisexual flowers may have vestiges of the other sex present. Cleistogamy occurs occasionally in *Persicaria* and *Polygonum*. The flowers are solitary or in small

clusters in the leaf axils in *Polygonum*, with the flower-bearing stems mostly not readily distinguishable from vegetative stems; in the other genera the inflorescence-bearing axes are more clearly differentiated and the flowers are arranged in paniculate, spike-like or capitate inflorescences. *Persicaria* sect. *Tovara* (represented in Australia only by the cultivated *P. filiformis*) has a distinctive inflorescence: spike-like but very long, narrow and lax, with few flowers, which become deflexed soon after anthesis. The dispersal mechanism in section *Tovara* is unique in the family (Graham & Wood 1965). The two styles become rigid and hooked at the apex and are persistent on the nut. The pedicel partly abscises so that any disturbance causes the mature fruit to separate from the plant and be catapulted up to 4 m. The persistent hooked styles may enable further dispersal on the coats of animals.

In species of *Fallopia* and *Reynoutria* perianth segments are thin-winged or keeled and enlarged in fruit, completely enclosing the nut. In *Persicaria* the perianth segments also enclose the nut but are not markedly enlarged or winged. In contrast, the nut of *Fagopyrum* is at least twice as long as the perianth and may itself be winged. Stigma form varies from capitate and smooth in *Persicaria* and *Polygonum* to shortly elongate and fimbriate in *Reynoutria* (described as triangular by Haraldson 1978). In *Fallopia* the stigma is either capitate and smooth or small-peltate and very shortly fimbriate. Stamen filaments are subulate above and broadly dilated in the lower half in *Polygonum*; in the other genera they are uniformly subulate or filiform.

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The genus *Dampiera* (Goodeniaceae): systematic arrangement, nomenclatural notes and new taxa

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Abstract

Rajput, M.T.M.,¹ and Carolin, R.C.² (¹Botany Dept, Sind University, Jamshoro, Pakistan; ²John Ray Herbarium, University of Sydney, Australia 2006) 1988. The genus *Dampiera* (Goodeniaceae): systematic arrangement, nomenclatural notes and new taxa. *Telopea* 3(2): 183–216. — A cladistic analysis of the genus is presented with a discussion of the characters used and the results incorporated in a new subgeneric classification. A new subsection **Angulares** is proposed, the previous section *Cephalantha* is not recognized and the previous section *Camptospora* is reduced to the rank of series. Species and varieties in the genus *Dampiera* are provided with lectotypes and neotypes where required. Where there appears to be some doubt as to holotypes, these are discussed. The following new species are described: *D. angulata*, *D. atriplicina*, *D. decurrens*, *D. deltoidea*, *D. fitzgeraldensis*, *D. fusca*, *D. galbraithiana*, *D. heteroptera*, *D. krauseana*, *D. obliqua*, *D. orchardii*, *D. pedunculata*, *D. ramosa*, *D. rodwayana*, *D. salahae*, *D. scaevolina*, *D. sylvestris* and *D. tephrea*; *D. dysantha* (Benth.) and *D. latealata* (E. Pritzel) are raised to species rank.

Introduction

The genus *Dampiera* (Goodeniaceae) is confined to Australia and occurs throughout the continent in a wide variety of habitats. The genus contains 66 species as recognised at present. The last revision is due to Krause (1912). No previous assessment of phylogeny has been made.

The new taxa, nomenclatural changes and lectotypifications presented here, relate to the impending treatment of this genus in the 'Flora of Australia'. They are also necessary for a discussion of the systematics of the genus.

Both Bentham (1868) and Krause (1912) subdivided the genus into sections and although these systems were similar there were some minor differences principally in the level at which the subgeneric taxa were recognised and the emphasis which different characters were given. The results of Carolin (1959) and Rajput and Carolin (1984) suggest that a new assessment is necessary.

The most satisfactory subgeneric classification should be based upon the putative phylogeny of the genus. Cladistic methods in general are likely to provide a reasonable approximation to phylogeny although it is clear that they have some drawbacks (Carolin 1985; Johnson & Briggs 1985) and that the algorithms may not in fact reproduce the correct phylogeny (Fiala & Sokal 1985). Nevertheless, a cladogram obtained by parsimonious methods is a satisfactory starting point for considering possible phylogenies (Carolin 1986). The first section of this contribution attempts to develop a phylogeny in this way and provide a systematic framework for the genus.

The phylogeny and systematics are considered first because this section necessarily contains a discussion of the characters used in the descriptions of the new taxa. Some of these characters require special terminology, e.g. the hairs, and this is established before they are used. Moreover, the descriptions and nomenclatural notes are arranged in a systematic order and this is also established in the first section.

Phylogeny and systematic arrangement

Characters

Whilst the characters which are used in a cladistic analysis are not usually weighted, it is clear that all cladograms are produced after the exclusion of characters which the researcher is prepared to reject (Carolin 1985, 1986). The method adopted here was to generate up to five parsimonious cladograms from characters which are considered to be important in discriminating between the species, using the WAGNER78 algorithm of Farris. This was quick and relatively cheap and in the earlier stages of this investigation the more sophisticated PAUP package was not available. This preliminary data set included 31 binary characters, some of which represented ordered multistate characters additively coded. However, a number of characters which discriminate effectively between species are extremely homoplastic. That is they reverse more than three times on different branches or they reverse to the primitive condition and then revert to the advanced condition on the same branch. These appear to be relatively inconstant characters and may well obscure the phylogeny. Homoplastic characters may increase the number of most parsimonious trees which can be generated from a given set of data and may even decrease the probability of finding any of the most parsimonious trees. The characters which are herewith rejected as being too homoplastic to reflect phylogeny accurately are: (i) leaves dentate or entire; (ii) leaves lobed or entire; (iii) sepals present or absent; (iv) auriculate wing of the corolla smaller than the others or not.

A second data set, without these characters and containing 27 binary characters, some of which also were additive, was then used to generate other cladograms using Swofford's PAUP package (Swofford 1984). One hundred trees were generated using global branch swapping and a strict consensus tree was generated from them. Some further adjustment was then suggested.

To produce a cladogram it is necessary to polarize the states of a character and the most efficient way to do this is by outgroup comparison, although philosophically this may involve an infinite regress. Nevertheless, in this case there is a reasonably well authenticated higher level cladogram (Carolin 1977, Fig. 3) which identifies the clade within which *Dampiera* occurs and thus its sister groups, *Anthotium* plus *Lechenaultia*. It also suggests *Brunonia* as the sister clade to this one. *Brunonia*, however, shows a number of advanced characters and, if we accept Campanulaceae as the outgroup of the Goodeniaceae (see Carolin 1977), one can arrive at a most parsimonious solution for the primitive states of most characters using the methods of Maddison *et al.* (1984). Appendix 1 provides a quick reference to the characters used. Appendix 2 gives the data matrix used in the cladistic analysis.

Below are listed and discussed the characters which are used, together with the states which they may assume. The state coded '0' is considered to be primitive. Where this is not unequivocally determined by the outgroups some discussion is given. An asterisk (*) indicates that the immediate outgroups of *Dampiera* indicate the polarity of that character.

1. *Sub-shrub-0; rosette-1
2. *Sub-shrub-0; multicaulate-1

Multicaulate habit is defined as several more or less herbaceous stems arising from a very short stock. New growth starts more or less at ground level.

Sometimes only one stem arises in any one year but over several years several stems arise. Sub-shrubs, on the other hand, have one or few basal woody stems which are usually much branched above and more or less long-lived. New growth starts on the branches of old growth. The lateral branches behave like the stems of the multicaulate plants. Indeed the multicaulate habit seems to have arisen as a condensation of the main stems of the sub shrubs into the thick basal stock with very short internodes (Fig. 1). The rosette habit represents a condensation of the lateral branches as well as the main stems.

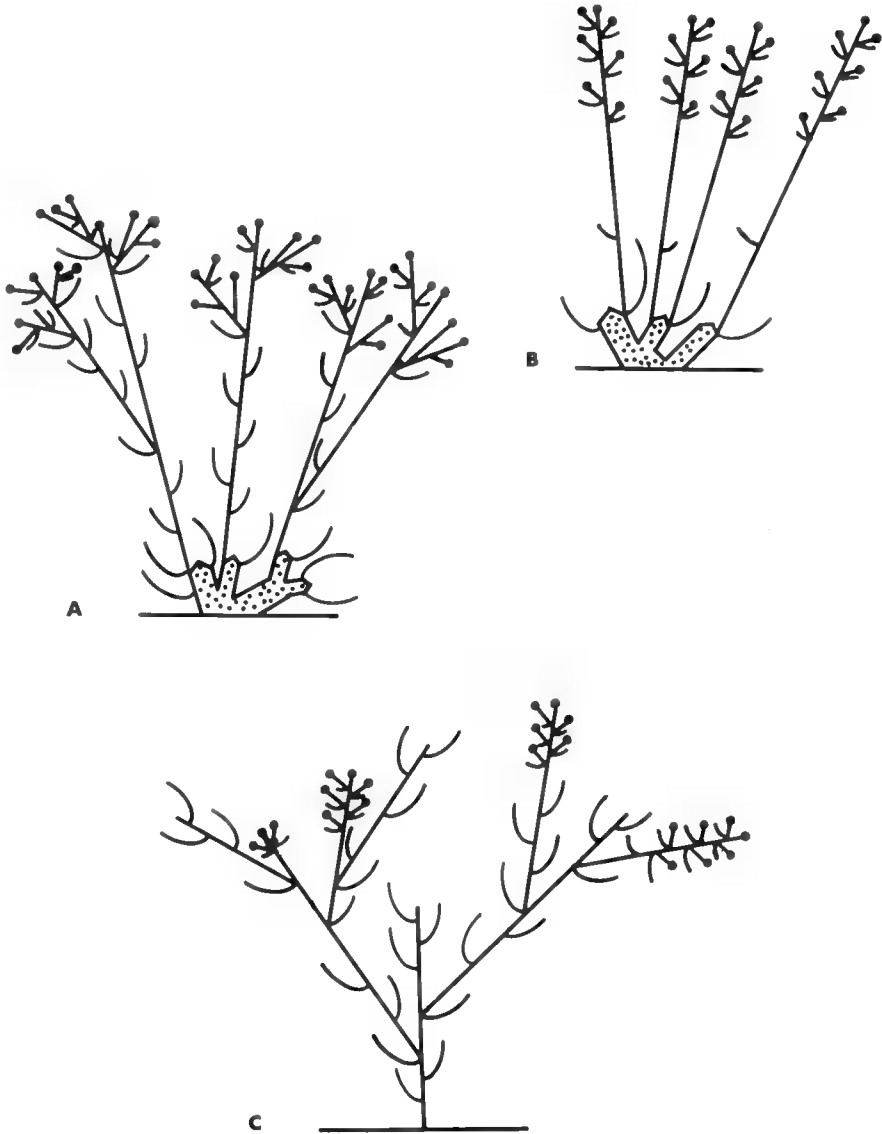


Fig. 1. Diagrammatic representation of habit and inflorescence types as used in descriptions and in the cladistic analysis (see text for coding). **A**, multicaulate; panicles or clusters. **B**, rosette; thyrses, racemes, spikes or heads. **C**, subshrub; thyrses, racemes, spikes.

3-6: Hair types (Fig. 2; see Carolin 1970). The standard for hair types used in this analysis is that found on the outside of the corolla. On other parts of the plant they tend to vary more. The evolution of hair types is not clear. Fig. 2 shows the various possibilities. Five cladograms were generated using all the possible sequences of hair-type evolution, together with all the other 27 characters. The sequence which gave the most parsimonious tree is that shown with solid lines. This was adopted for the final analysis.

I-0000; II-1000; III-0100; IV-0110; V-0111

7. *Phyllotaxis: there are three main phyllotaxes found in the genus (Rajput & Carolin 1984). Since the $\frac{1}{2}$ phyllotaxis is absolutely correlated with flat stems and it is considered to be at the end of a transformation series here, it is not separated from its precursor in the series, $\frac{1}{3}$ phyllotaxis.

$\frac{2}{5}$ or less-0; $\frac{1}{3}$ & $\frac{1}{2}$ -1

8-10. *Stems: stems have been considered previously (Rajput & Carolin 1984) and it has been shown that the stem type correlates with the internal anatomy. Only the morphological appearance of the stem is scored in this analysis.

terete-000 5-ribbed-100 3-angled-110 flat-111

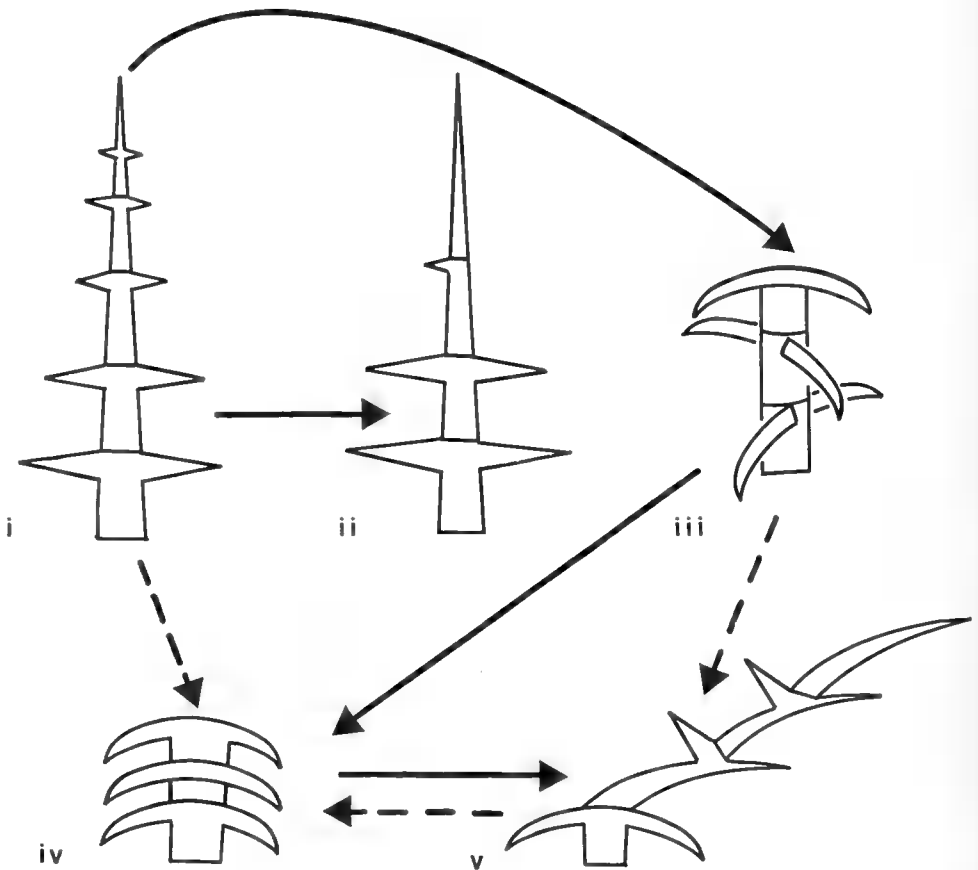


Fig. 2. Diagrammatic representation of hair types as used in the description and in the cladistic analysis (see text for coding). Broken lines represent possible phylogenetic connections; solid lines represent the phylogenetic series adopted for the final analysis.

11. Leaves flat-0; leaves revolute-1

Although the outgroups of *Dampiera* have revolute leaves, the outgroups of the clade in which *Dampiera* occurs (*Brunonia* and Campanulaceae) clearly show, by the first doublet rule of Maddison *et al.* (1984), that flat leaves are primitive.

12. *Leaves cauline-0; leaves basal-1**13.** *Leaves not in pseudowhorls-0; leaves tending to be in pseudowhorls-1

This describes the condition when the upper internodes of the main axis are reduced. The clustering of leaves in the axils is not included in the analysis.

14. Leaves \pm same size in inflorescence region-0; leaves reduced in inflorescence region-1.

The sister groups of *Dampiera* have bracts very reduced in size compared to the leaves. However, the sister clade of *Dampiera* and its allies indicates that the primitive inflorescences are cymes arising in the axils of the upper leaves (see Carolin 1967). The most parsimonious polarization is thus the one adopted here.

15. Leaves petiolate-0; leaves sessile-1

The same argument applies here as to character 14.

16-18. *Hairs on mature leaves.**16.** Glabrous-0; hairy on both surfaces-1**17.** Hairy on both surfaces-0; glabrescent above-1**18.** Hairy on either or both surfaces-0; glabrescent above and below-1

These three characters present a problem for polarization. Neither of the outgroups provides a satisfactory solution because, although simple and glandular hairs are found in the outgroups, these branched types of hairs are not found elsewhere in the family or in the Campanulaceae. Thus, the outgroups indicate that lack of any of these hair types on the leaves is primitive. This is accepted. However, when hairs do occur on the leaves in *Dampiera*, they are present on both surfaces in the young leaf. Moreover, in those species with both surfaces of the leaf glabrescent, the hairs disappear from the upper surface first. Using the generality criterion of Nelson (1978), the transformation series indicated in the coding is arrived at.

Many species are described as having glabrous leaves even when young. This is not strictly true since in all cases, except that of *D. diversifolia* the youngest leaves have at least a few hairs on both surfaces.

19-21. *Inflorescence. Since the inflorescence types are considered to represent a transformation series they are coded additively. Panicles or clusters are used to describe the situation illustrated by Carolin (1967, Fig. 6A). In many cases, however, more than one partial inflorescence appears to arise in the axil. This is due to the presence of a lateral branch which bears one or more partial inflorescences lateral to itself so near its base as to appear to occur in the axil of the main leaf (see Fig. 1).

000	100	110	111
panicles or clusters	thyrses	racemes	heads

22. *Sepals: present or absent-0; sepals replaced or surmounted by long hairs-1

23. *Corolla large (mostly > 5 mm long)-0; corolla small (mostly < 5 mm long)-1
24. *Ovary 2-locular-0; ovary 1-locular-1
25. *Ovary straight-0; ovary gibbous-1
- 26-27. *Ovule shape: a transformation series from straight through bent to U-shaped or horseshoe-shaped is indicated and the character is coded additively.
 straight-00; bent-10; U-shaped or horseshoe-shaped-11

Table 1. Name codes used in Figs 3 and 4 and Appendix 2, showing the species represented by each code.

ADPR	<i>D. adpressa</i>
ALAT	<i>D. alata</i> , <i>D. sacculata</i>
ALTI	<i>D. altissima</i> , <i>D. salahae</i> , <i>D. tephrea</i>
ANGU	<i>D. angulata</i>
ATRI	<i>D. atriplicina</i>
CAND	<i>D. candicans</i>
CARI	<i>D. carinata</i>
CINE	<i>D. cinerea</i>
CONO	<i>D. conospermoides</i>
CORO	<i>D. coronata</i> , <i>D. heteroptera</i>
DECU	<i>D. decurrens</i> , <i>D. latealata</i>
DENT	<i>D. dentata</i>
DISC	<i>D. discolor</i>
DIVE	<i>D. diversifolia</i>
ERIA	<i>D. eriantha</i>
ERIO	<i>D. eriocephala</i>
FASC	<i>D. fasciculata</i>
FUSC	<i>D. fusca</i>
HAEM	<i>D. haematotricha</i> , <i>D. dura</i>
HEDE	<i>D. hederacea</i>
INCA	<i>D. incana</i>
KRAU	<i>D. krauseana</i>
LANC	<i>D. lanceolata</i> , <i>D. fitzgeraldensis</i>
LAVA	<i>D. lavandulacea</i> , <i>D. rodwayana</i> , <i>D. dysantha</i> , <i>D. rosmarinifolia</i>
LEPT	<i>D. leptoclada</i> , <i>D. galbraithiana</i> , <i>D. loranthifolia</i>
LIND	<i>D. lindleyi</i> , <i>D. deltoidea</i>
LINE	<i>D. linearis</i> , <i>D. pedunculata</i>
MARI	<i>D. marifolia</i> , <i>D. roycei</i>
OBLI	<i>D. obliqua</i>
OLIG	<i>D. oligophylla</i> , <i>D. juncea</i> , <i>D. glabrescens</i>
ORCH	<i>D. orchardii</i>
PARV	<i>D. parvifolia</i> , <i>D. sericantha</i>
PLUM	<i>D. plumosa</i>
PURP	<i>D. purpurea</i> , <i>D. ferruginea</i>
RAMO	<i>D. ramosa</i>
ROSM	<i>D. rosmarinifolia</i>
SCAE	<i>D. scaevolina</i>
STEP	<i>D. stenophylla</i> , <i>D. tomentosa</i> , <i>D. luteiflora</i>
STES	<i>D. stenostachya</i> , <i>D. spicigera</i>
STRI	<i>D. stricta</i> , <i>D. sylvestris</i> , <i>D. triloba</i>
TENU	<i>D. tenuicaulis</i>
TERE	<i>D. teres</i>
TRIG	<i>D. trigona</i>
TRIL	<i>D. triloba</i>
WELL	<i>D. wellsiana</i>

Terminal taxa

A number of species are omitted from appendix 2 and from the calculations and cladograms because they were either exactly the same as other species in terms of the characters used in the analysis or they were distinguished by only autapomorphies from one of the recognized clades. Where such species (or groups of species) form unresolved polychotomies with other terminal taxa, however, they have been included in Figs 3 and 4. It is often not possible to resolve most of the terminal taxa containing several species because the characters which distinguish the constituent species cannot be satisfactorily polarized. Each terminal taxon, which thus may consist of several species, is identified by a four letter code. These codes, together with the species that they represent, are given in Table 1.

D. diversifolia is entirely glabrous and was included in the analysis omitting the characters on hair type.

Results

One of the trees generated is shown in Fig. 3 and the strict consensus tree is shown in Fig. 4. Most of the 100 trees which were generated represent rearrangements of the various polychotomies. None of them differed significantly from the one shown. The consensus tree indicates that homoplasies make resolution of the tree difficult without weighting characters. We would suggest that this can be done only in one case with any confidence. Giving extra importance to the small flowers of *D. candicans* and *D. cinerea* above their other characters resolves part of the polychotomy there (Fig. 5). No other species in the genus has such small flowers. *D. ramosa*, indeed, has smaller flowers than in most other species but they are still significantly larger than in *D. candicans* and *D. cinerea*. There is a significant anomaly in the reappearance of the bilocular ovary along the *D. trigona*-*D. decurrens* clade. Many workers would find this reversal unacceptable, arguing that the several independent morphogenetic events required to bring this about are unlikely to arise and reproduce the primitive condition. This is possible but at present undemonstrable. However, it is instructive to redraw the cladogram, in this case, bearing this in mind. If the whole clade above the * on Fig. 4 is redrawn so that the most parsimonious solution is obtained whilst allowing for no reversal to the bilocular condition of the ovary, the result in Fig. 5 is obtained. This lengthens the tree by three steps. They are: characters 15 and 17 along the clade including subsect. *Angulares* and character 24 along the clade including sect. *Linschotenia*. Character 17 is 'mature leaves hairy on both surfaces; mature leaves glabrescent above'. Indeed, it is an additive precursor to character 18 which is 'mature leaves glabrescent above; mature leaves glabrescent on both surfaces'. The leaves of subsect. *Angulares* only have a few hairs on both surfaces in the very young stages and they are lost at more or less the same time on both surfaces, whereas the leaves of subsect. *Dampiera* are more densely hairy and lose the hairs first from the upper surface and then from the lower surface if they lose them at all.

The indication is that the state of 'mature leaves glabrescent on both surfaces' may not be strictly homologous in the two subsections. That is, in subsect. *Angulares* glabrescence on both surfaces is probably a single evolutionary change, whilst in subsect. *Dampiera* it probably arose separately by first the loss of hairs on the upper surface and then the loss of hairs on the lower surface.

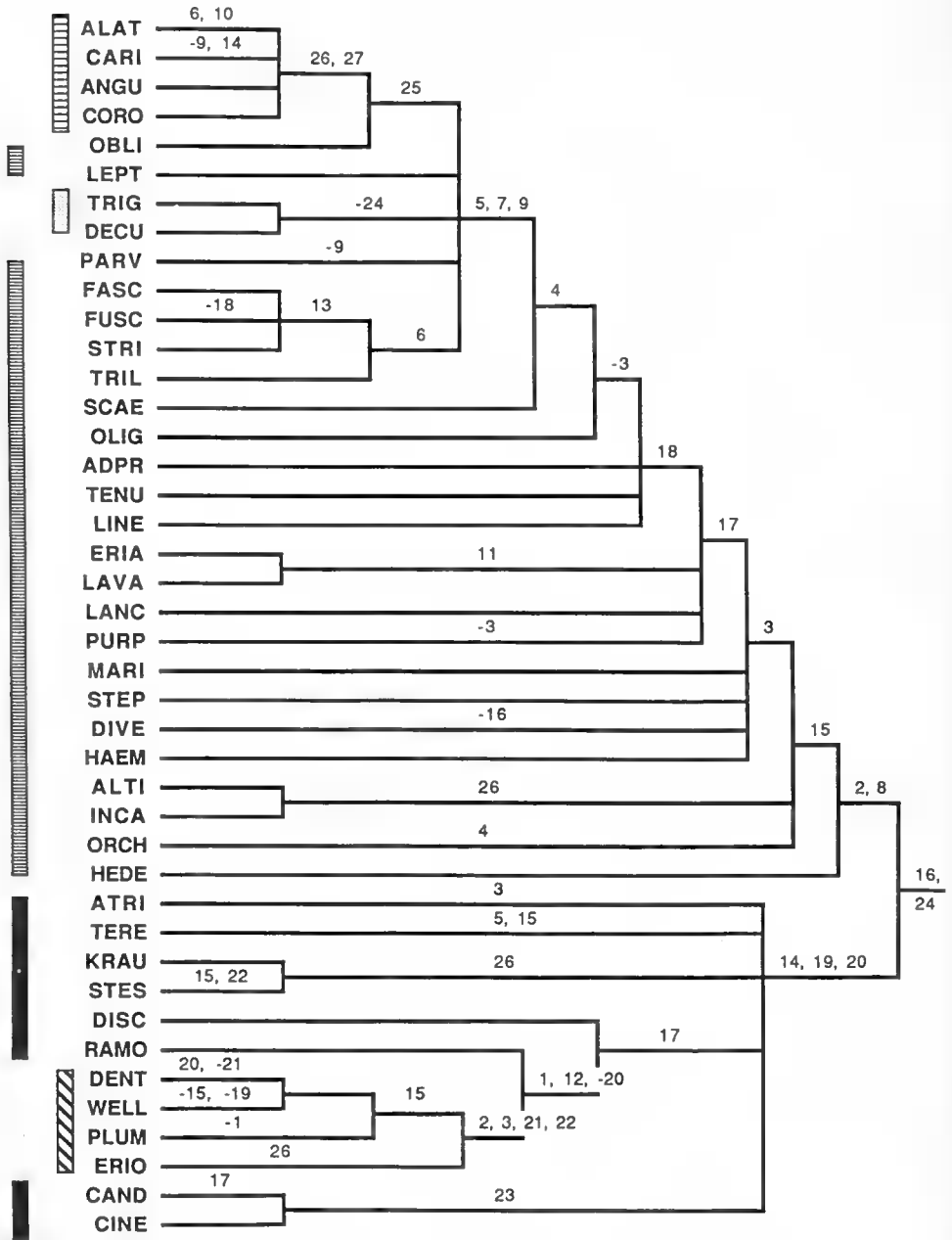


Fig. 3. One of the most parsimonious cladograms generated by PAUP (see Table 1 for key to codes of terminal taxa). Numbers indicate characters changing state from primitive to advanced, negative signs indicate reversals. Sections according to Bentham (1868) shown at top.

- | | | | | | |
|---------------------|--|---------------------|--|--------------------|--|
| <i>Camptospora</i> | | <i>Dicoelia</i> | | <i>Cephalantha</i> | |
| <i>(Eu)Dampiera</i> | | <i>Linschotenia</i> | | | |

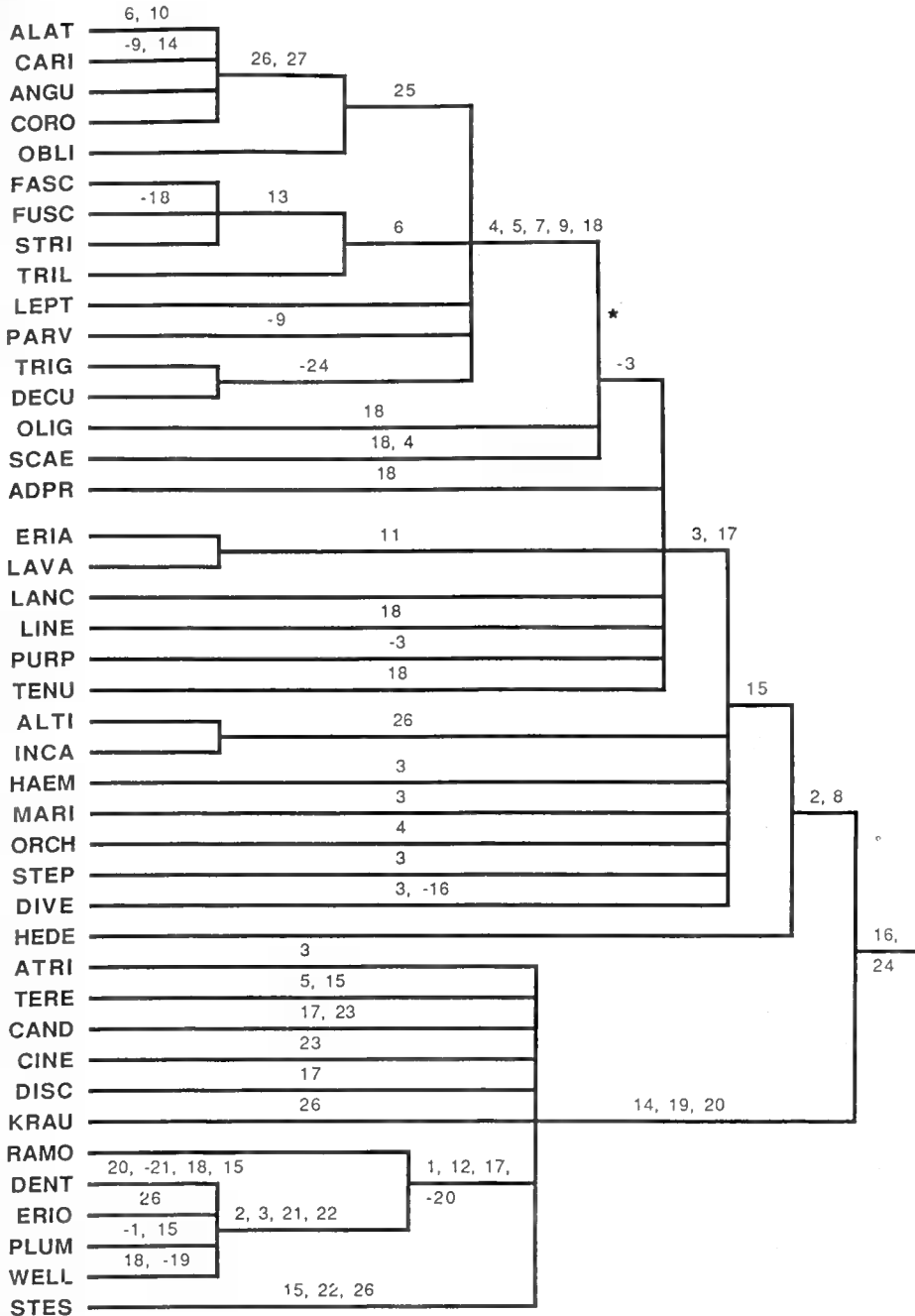


Fig. 4. Strict consensus cladogram from 100 trees generated by PAUP. Codes are the same as in Fig. 3. * = point at which cladogram is redrawn to produce Fig. 5.

Character 24 is the change to a unilocular ovary. In sect. *Linschotenia* the insertion of the ovule is often 'lateral' (Carolin 1959). This, again, may be due to a separate origin of the unilocular condition from those in sect. *Dampiera*. If these separate origins of characters 24 and 17 do, in fact, represent 'mistakes' in the recognition of homologies, then there is only one extra step involved in redrawing the cladogram as suggested. That is character 15, the change to a sessile leaf, a feature which might well be rather homoplastic. Fig. 5 is our preferred cladogram since we think that more weight should be given to the non-reversal of the ovary condition than to a separate origin of the petiolate condition. In that case some taxonomic adjustment is necessary.

Sects. *Cephalantha* and *Linschotenia* were separated by Bentham (1868) on the basis of the former having a head of flowers. They should be grouped together. *D. plumosa*, for instance, has an inflorescence sometimes condensed into a head and sometimes spread into a thyrse. The basal leaves (character 12) also are not particularly distinctive since *D. ramosa* also has basal leaves. Moreover, the heads of flowers within the clade representing sect. *Cephalantha* are not exactly homologous since in *D. eriocephala* the head is formed from a thyrse like that of *D. plumosa*, whilst in *D. dentata* it is clearly a condensed spike; it is possible that this clade is more heterogeneous than the present analysis shows. Both cladograms also indicate that sect. *Dicoelia* and sect. *Camptospora*, as recognized by Bentham (1868) and Krause (1912), make sect. (*Eu*)*Dampiera* paraphyletic. Indeed *D. obliqua* represents an almost intermediate species between sects. *Camptospora* and (*Eu*)*Dampiera* of those authors. The proposed classification is shown on Fig. 5 and formally set out below.

Two sections are recognized. There is a fairly clear subdivision of sect. *Dampiera* into two subsections. Two names are available at section level for the subsection not containing the type species. They are sect. *Dicoelia* and sect. *Camptospora*. Both are inappropriate for the clade as a whole and a new name is proposed at subsectional level. Bentham's sect. *Camptospora* is a relatively clear 'grade' although *D. obliqua* does represent a transitional condition of the ovary. We are therefore proposing this as a series separate from the paraphyletic series *Angulares*. There is no doubt that grades are useful in some situations and it is counterproductive to discard the concept altogether. It does not seem necessary, however, to recognize sect. *Cephalantha* at any level at present.

Systematic arrangement

Dampiera R. Br., Prodr.: 587 (1810)

TYPE: *D. incana* R. Br., here nominated.

Sect. *Dampiera*

Multicaulate plants often woody towards the base. Stems ribbed, grooved, triangular or flat. Phyllotaxis $\frac{2}{5}$ or more. Flowers in panicles, often appearing to be clustered, or solitary in the leaf axils.

(i) Subsect. *Dampiera*

Stems ribbed and/or grooved, sometimes triangular above. Phyllotaxis $\frac{2}{5}$.

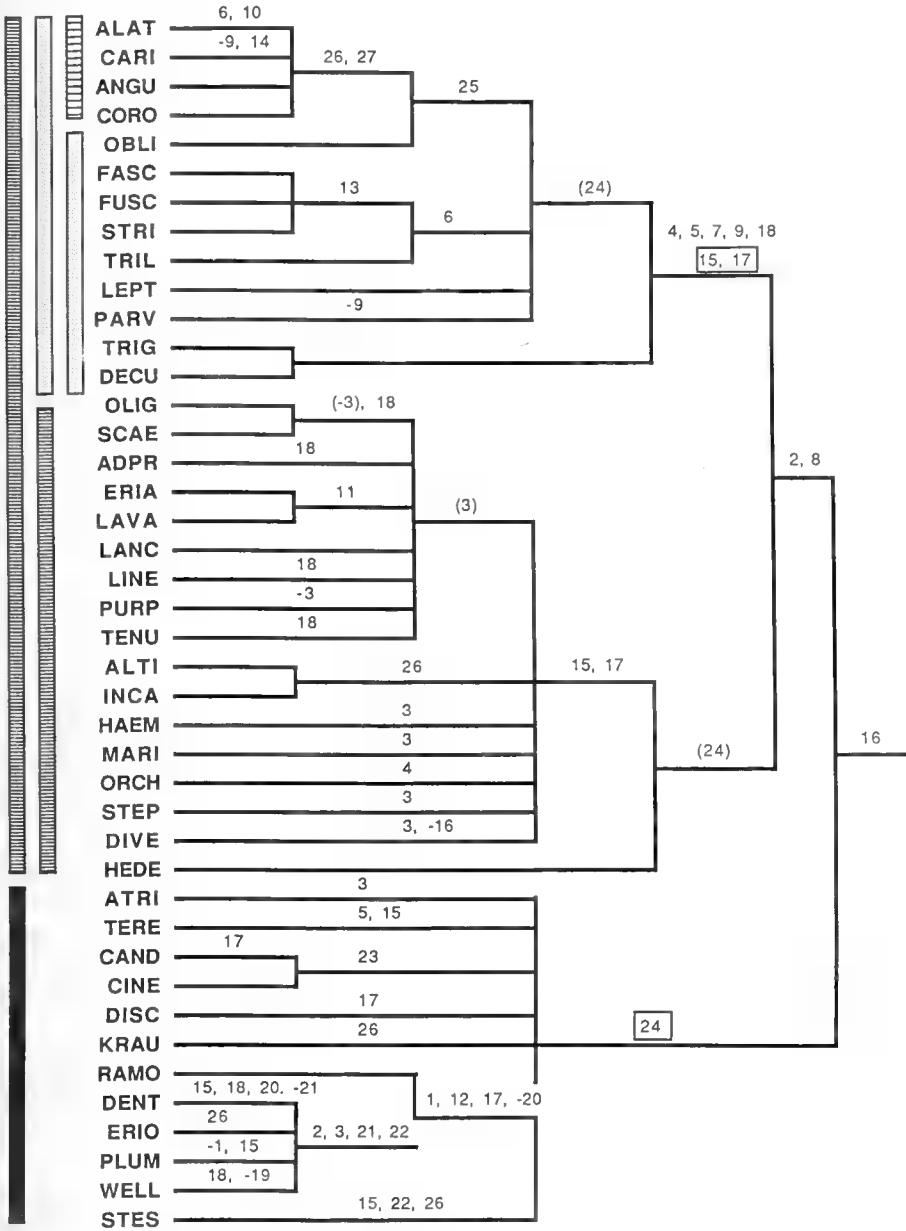


Fig. 5. Cladogram of Fig. 4 redrawn to eliminate the reversal of the ovary condition to bilocular. Differences in character state changes from Fig. 4 shown. Numbers in parentheses represent character state changes that cancel out; those which are enclosed in rectangles represent increases in length of the tree. Symbols at left represent sections, subsections and series respectively from left to right, as recognized here:

- | | | | |
|--------------------|--|---------------------|--|
| <i>Camptospora</i> | | <i>Angulares</i> | |
| <i>Dampiera</i> | | <i>Linschotenia</i> | |

(ii) Subsect. **Angulares** Rajput & Carolin, **subject. nov.**

TYPE: *D. stricta* R. Br.

Plantae multicaulatae. Caules triangulares vel compressi. Phyllotaxis $\frac{1}{3}$ vel $\frac{1}{2}$. Flores in paniculis vel fasciculis in axillis superioribus.

Stems triangular or flat. Phyllotaxis $\frac{1}{3}$ or $\frac{1}{2}$.

The name refers to the angled stems of the members of this Subsection.

Series *Angulares*

Sect. *Dicoelia* Benth. in Hook., Icon. Pl.: t.1026 (1866). TYPE: *D. trigona* De Vriese, **here nominated**.

Stems triangular. Ovary straight or oblique but not gibbous. Ovule straight.

Series **Camptospora** (Benth.) Rajput & Carolin, **stat. nov.**

BASIONYM: sect. *Camptospora* Benth. in Hook., Icon. Pl.: t.1027 (1866). TYPE: *D. alata* De Vriese, **here nominated**.

Stems triangular, flat or compressed. Ovary gibbous. Ovule horseshoe-shaped.

Sect. **Linschotenia** Benth., Fl. Austral. 4: 107 (1868)

TYPE: *D. discolor* De Vriese, **here nominated**.

Sect. *Cephalantha* Benth., Fl. Austral. 4: 120 (1868). TYPE: *D. eriocephala* De Vriese, **here nominated**.

Subshrubs to rosette herbs. Stems terete. Phyllotaxis $\frac{1}{5}$ or less. Flowers in racemes or thyrses, sometimes condensed into heads.

Typifications, new taxa and nomenclatural notes

The species are arranged in the preferred taxonomic sequence derived from the results of the last section.

In this section holotypes are not considered unless we think a problem may exist. They will be indicated in the forthcoming volume of the 'Flora of Australia' and those species in which no such problems arise are not dealt with here.

When only one collection relates to the protologue this is shown by "*" after the type statement.

Lectotypes are here nominated. They may have had to be selected from more than one collection relating to the protologue. This is shown by '#' following the type statement. There may be more than one sheet of the lectotype collection and where this choice is necessary it is indicated by the citation of isolectotypes. In all cases the specimen agreeing most closely with the protologue description is selected and where all agree well the most complete specimen is selected.

Preiss's collections, described in 'Plantae Preissianae', were distributed to the contributors as whole collections. Therefore the complete set of replicates was available to them in casting their descriptions. Subsequently a reference collection was lodged at LD (Crisp 1983). Whenever a specimen at LD is satisfactory it is selected as the lectotype.

Robert Brown's collections also were distributed after they had served as the basis for his descriptions in the *Prodromus*, the reference set being lodged at BM. Other things being equal, we have selected the BM specimen as lectotype.

E. Pritzel's collections, described in Pritzel (1905), were also distributed after he used them for his descriptions. Unfortunately the reference set at B was destroyed during the 1939–1945 war. Duplicates of these specimens in other herbaria are selected as lectotypes with the usual restrictions stipulated by the Code.

Chromosome counts given here are from Peacock (1963).

The geographical range for each of the newly described species is given using the regions currently in use in the various State Herbaria, see Beard (1980) for W.A., Chippendale (1972) for N.T., Jessop & Toelken (1986) for S.A., Beaglehole (1980) for Vict., Anderson (1961) for N.S.W. and MacLean (1886) for Qld.

In some cases only selected specimens are cited, with (in parentheses) the number cited followed by a '/' and the total number examined.

Sect. *Dampiera*

(i) Subsect. *Dampiera*

D. oligophylla Benth., Fl. Austral. 4: 115 (1868).

LECTOTYPE: *Drummond 4th coll. no. 193* (K). ISOLECTOTYPES: BM, MEL. Bentham also cites 'Gordon and Kalgan River' with the protologue. We have found specimens labelled with this locality information in MEL, but none in K, and have identified them as *D. lavandulacea*.

D. juncea Benth., Fl. Austral. 4: 115 (1868).

LECTOTYPE: *Dummond no. 168* (K). ISOLECTOTYPE MEL#

D stenophylla Krause, Pflrch. 54: 187 (1912).

LECTOTYPE: Victoria Desert, Camp 58, *Helms*, 1891 (K). ISOLECTOTYPES: AD 96620155, AD 97715448, MEL 516705*.

D. linearis R. Br., Prodr.: 588 (1810).

LECTOTYPE: King Georges Sound, *R. Brown*, Dec. 1801 (BM)*.

D. azurea De Vriese in Lehm., Pl. Preiss. 1: 400 (1845).

LECTOTYPE: in arenosis ad flumen Cygnorum, *Preiss 1475*, 25 juni, 1839 (LD 0489).

ISOLECTOTYPES: L 903311...215, L 903311...216, MEL 516715, W*.

D. eriophora De Vriese, op. cit.: 401.

LECTOTYPE: In solo turfoso arenosa ad Stirlings Terrace, Plantagenet, *Preiss 1500*, sept. 1842 (LD 0492). ISOLECTOTYPES: L 90962...297, MEL 516696, W*.

D. lanuginosa De Vriese, Nat. Verh. Holl. Maats. Wet. Haarlem 2: 81 (1854).

LECTOTYPE: Swan River, *Drummond 127* (K)#.

D. incana R. Br., Prodr.: 588 (1810).

LECTOTYPE: Nov. Hollandia (occident.), *W. Dampier*, Herb. Sherrard 24, 1699

(BM)*. There is only one specimen at BM but it is probable that Brown used the rest of Dampier's collection, now at Oxford and of which this is a fragment, to cast his diagnosis. Apparently Brown also had access to a specimen collected at Shark Bay by Baudin's expedition. This is also in BM.

D. incana var. **fuscescens** Benth., Fl. Austral. 4: 111 (1868).

HOLOTYPE: Murchison River, *Oldfield*(K)*. There are three sprigs mounted on the same sheet at K. The uppermost two seem to be *D. spicigera*, the lowest one is this holotype.

D. scaevolina *Gardner ex Rajput & Carolin, sp. nov.*

Ascendens ad 60 cm caulibus teretibus costatis glabris vel sulcis tomentosis albidis. Folia sessilia lineari-oblonga 5–10 mm longa 1–5 mm lata \pm concava glabra fasciculata integra. Bracteolae 4–6 mm longae herbaceae. Corolla extus pilis appressis argenteis.

HOLOTYPE: WESTERN AUSTRALIA: Canna Siding, C.A. Gardner, Sept. 1934 (PERTH). ISOTYPE: PERTH.

Multicaulate perennial to 70 cm. Stems terete, ribbed, glabrous except for the tomentose grooves. Leaves sessile, fasciculate, linear-oblong, 5–10 mm long, 1–1.5 mm wide, \pm concave, glabrous, entire. Peduncles 2–4 mm long, 2–3 together bearing a single flower, pubescent with silvery hairs; bracteoles 2, leaf-like, 4–6 mm long, c. 1 mm wide, glabrous on both surfaces. Sepals linear, 0.2–0.5 mm long, covered with silvery hairs. Corolla lobes blue or white, linear-oblong, with silvery-white appressed type III hairs outside; inferior lobes 4.5–5.5 mm long, 0.5–0.7 mm wide; connate part of inferior lobes 2–3 mm long; superior lobes 6–7 mm long, 0.5–0.7 mm wide; auricle purplish, 0.5–1 mm wide; wing slightly veined, 1–1.5 mm wide, shorter above the auricle, obtuse at the top. Ovary 1-locular, c. 1.5 mm long, covered with appressed white hairs; ovule single, linear, c. 1 mm long, erect, basifixed; style 2.5–3 mm long, glabrous; indusium c. 0.5 mm diam., glabrous. Fruit similar to ovary.

RANGE: Irwin, Avon and Roe regions of Western Australia.

HABITAT: Sandy and gravelly soils.

DISCUSSION: This species resembles *D. diversifolia* but the former is distinguished by having erect stems, linear-oblong leaves and appressed silvery hairs on the outside of the corolla. See also *D. fitzgeraldensis*. The specific epithet refers to the resemblance of the flowers to those of some species of *Scaevola*, mainly due to the obtuse wings.

SELECTED SPECIMENS EXAMINED (5/10): WESTERN AUSTRALIA: Waddouring, W.B. Alexander 1241, x-1915 (PERTH); Beacon, C.F. Jenkins, 16-x-1960 (PERTH); 3 miles (4.2 km) E of Bencubbin, W.E. Blackall 3422, xi-1937 (PERTH); Approaching Wyalkatchem, M.E. Phillips, 19-ix-1962 (NSW 100413); NE of Newdegate and SE of Hyden, W.E. Blackall 1380, 19-ix-1931 (PERTH).

D. fitzgeraldensis *Rajput & Carolin, sp. nov.*

Planta erecta ad 60 cm. Caules canaliculati infra teretes sed versus apicem triangulares tomento albedo in sulcis. Folia spatulata vel oblongo-elliptica 4–16 mm longa \pm revoluta tomentosa in pagina inferna. Bractee atque bracteolae tomentosae in pagina externa. Sepala inaequalia. Corolla callis 6–13 atque pilis albidis appressis externis.

HOLOTYPE: WESTERN AUSTRALIA: Ongerup–Ravensthorpe, Fitzgerald River, R.C. Carolin 3564, 11-9-1961 (NSW).

Erect subshrub to 70 cm. Stems terete, sometimes triangular above, ribbed, whitish pubescent in grooves. Leaves sessile, fasciculate, spatulate or oblong-elliptic, 4–16 mm long, 1.5–6 mm wide, greyish-white or brownish-white tomentose below, glabrous above at maturity, dentate, slightly recurved. Flowers in cymes of 2–3 together; pedicels 1–3 mm long, hairy in patches; bract linear-oblong, 4–5.5 mm long, hairy outside; bracteoles 2, linear-oblong, 1–3 mm long, c. 0.5 mm wide, hairy outside. Sepals unequal, 0.5–1 mm long, c. 0.2 mm wide, hairy with silvery white hairs. Corolla lobes with \pm appressed silvery-white type II hairs outside; inferior lobes oblong-lanceolate, 3–4 mm long, 1–1.5 mm wide; connate part of inferior lobes 3–4 mm long; superior lobes falcate, 5–6 mm long, 1–1.2 mm wide; auricle purplish, c. 1.5 mm wide; wing slightly veined, c. 2 mm wide, slightly shorter above the auricle; calli 6–13 in each row. Ovary 1-locular, c. 1.5 mm long, covered with short whitish-grey appressed hairs; ovule single, oblong, c. 0.7 mm long, erect, basifixed; style 2–2.5 mm long, glabrous; indusium 0.8 mm diam., glabrous. Fruit similar to ovary.

RANGE: Eastern part of Darling–Menzies region of Western Australia. Known only from the type collection.

HABITAT: Sand plain heath.

DISCUSSION: This species is related to *D. scaevolina* but can be distinguished by its spatulate to oblong-elliptic leaves, which are tomentose below and have slightly revolute margins.

This species is named for the Fitzgerald River where the type specimen was collected.

***D. orchardii* Rajput & Carolin, sp. nov.**

Caules costati glabri teretiusculi internodiis longis atque tomentosis albidis ad nodos. Folia sessilia oblongo-elliptica lata ad basin 0.5–1.5 mm longa, 0.5–0.7 mm lata. Flores solitarii pedunculo 1–1.5 mm longo. Bracteae herbaceae. Corolla ovariumque pilis dendriticis adpressis stramineis obtecta. Calli corollae 5–9 parvi. Ovarium 3.5–4.5 mm longum.

HOLOTYPE: WESTERN AUSTRALIA: South-West Division, Shire of Oldfield, c. 58 km north of mouth of Oldfield River, *A.E. Orchard 1709*, 21-x-1968 (PERTH).

ISOTYPE: AD 97108544.

Stems erect, ribbed, branched, glabrous, golden-yellowish tomentose when young, whitish tomentose on the nodes, glabrescent or slightly whitish tomentose in the grooves. Leaves sessile, oblong-elliptic, 0.5–1.5 mm long, 0.5–0.7 mm wide, with wide base, pale yellowish tomentose or glabrescent, entire. Flowers solitary or in cymes; peduncles tomentose with golden-yellow short dendritic hairs, 1–1.5 mm long; pedicel 0.5–1 mm long, tomentose with short golden-yellow hairs; bract leaf-like, slightly tomentose outside or glabrescent, 1–2 mm long, 0.5–0.6 mm wide; bracteoles usually 2, oblong to narrow-elliptic, irregularly tomentose outside with golden-yellow dendritic hairs, 1–1.2 mm long, c. 0.5 mm wide. Sepals tomentose with golden-yellow hairs, 0.2–0.5 mm long, c. 0.3 mm wide. Corolla lobes with short appressed yellowish type III hairs outside; inferior lobes oblong-lanceolate, 3–4 mm long, c. 1 mm wide; connate part of inferior lobes 4–4.5 mm long; superior lobes falcate, 4–5 mm long, 1–1.5 mm wide; auricle brown c. 1.5 mm wide; wing 1.5–2 mm wide, slightly shorter above auricle; calli 5–9 in each row. Ovary 1-locular, 3.5–4 mm long, hairy as corolla; ovule single, linear, 2–3 mm long, erect,

basifixed; style 3–4 mm long, glabrous; indusium c. 1 mm diam., glabrous. Fruit obovoid, 4–5 mm long, hairy.

RANGE: Eyre and Roe regions of Western Australia.

DISCUSSION: This species can be recognized by the tuft of whitish tomentum at the nodes and the almost golden-yellow hairs on the flowers. It is possibly close to *D. tenuicaulis*.

It is named for the collector of the holotype, A. Orchard, who is at present the Curator of the Tasmanian Herbarium.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: towards Tone River, *Muir*, 1880 (MEL 25733); Lake King to Ravensthorpe, *B. Benn*, 7-xi-1963 (SYD).

D. salahae Rajput & Carolin, sp. nov.

Frutex adscendens. Caules teretes canaliculati tomento incano. Folia ovata ad obovata supra glabrescentia infra tomento incano margine papillata crassa integra. Sepala obsoleta. Corolla extus pilis longis typis II cinereis divergentibus instructa.

HOLOTYPE: WESTERN AUSTRALIA: Between Yula–Mullewa road [sic], *A.M. Ashby* 1591, 14-vii-1965 (MEL 516689).

Ascending closely pale grey to whitish (or yellowish when young) tomentose multicaulate perennial to 60 cm. Stems terete, ribbed. Leaves sessile, ovate to obovate or elliptic-spathulate, 7–39 mm long, 5–21 mm wide, tomentose on both surfaces when young but glabrescent above, entire, with a thick papillate margin. Peduncles 15–55 mm long, 1–3 together, each with 1–3 flowers; pedicels 1–3 mm long, tomentose; bract 4–8 mm long, leaf-like, tomentose; bracteole oblong, 3–5 mm long, tomentose. Sepals obsolete. Corolla lobes with a dense indumentum of spreading silky greyish type II hairs outside; inferior lobes oblong-lanceolate, 5–7 mm long, 1–1.5 mm wide; connate part of inferior lobes 3.5–4.5 mm long; superior lobes falcate, 4.5–5.5 mm long, 1.5–2 mm wide; auricle purplish, 1.5–2 mm wide; wing slightly veined, 1.5–3 mm wide, usually shorter above the auricle; calli 5–9 in each row. Ovary oblique, 1-locular, to 2.5 mm long, hairy as corolla; ovule single, bent, 1–1.5 mm long, basifixed; style 3–3.5 mm long, glabrous; indusium c. 1 mm diam., 2-lipped, glabrous. Fruit globular-oblique, c. 3 mm long, hairy.

RANGE: Irwin region of Western Australia.

HABITAT: Sand plains and lateritic soils.

CHROMOSOME NUMBER: $n = 18$, Peacock 60841.1 (SYD), as *D. altissima*.

DISCUSSION: This species is similar to *D. altissima* but can be distinguished from that species by its ovate to obovate leaves, which are entire and thickened at the margin and glabrous above at maturity. In addition the sepals are obsolete and the hairs on the outside of the corolla are silky.

The species is named for the beloved wife of the senior author who has helped so much with his researches.

SELECTED SPECIMENS EXAMINED (11/22): WESTERN AUSTRALIA: East Yuna, NE of Geraldton, *A.C. Burns* 15, 5-vi-1966 (PERTH); Pindar, *Sharr* 2716, 1968 (PERTH); Pindar just E of Mullewa, *W.E. Blackall* 680, 20-ix-1931 (PERTH); 3 miles (4.8 km) from Mullewa towards Pindar, *M.E. Phillips*, 20-ix-1968 (SYD); Wilroy c. 96 km E of Geraldton, *A.M. Ashby* 328, 6-ix-1963 (AD 9640054); Tardun, *J.B. Cleland*, 26-viii-1948

(AD 97234190); Canna, *J.L. McMullan*, 28-vii-1959 (PERTH); 17 miles (27.2 km) E of Mingenew, *K. Newby 2124*, 26-vii-1965 (PERTH); Morawa, *B. Benn*, 10-x-1963 (SYD); Irwin River, *F.W. Went 240*, 5-ix-1962 (PERTH); 6 miles (9.6 km) from Three Springs towards Arrino, *M.E. Phillips*, 14-ix-1968 (PERTH).

***D. tephrea* Rajput & Carolin, sp. nov.**

Frutices tomentoso cinerei obtecti et caulibus striatis teretibus. Folia obovata elliptica plerumque dentata glabrescentes in pagina dorsali. Flores 2–3 in ramis brevibus foliosis dispositi. Bracteae ovato-ellipticae tomento albicanti obtectae. Corolla pilis dentriticis et plumosis extus. Ovarium oblongum vel obscure gibbosum c. 2.5 mm longum ovulo solitario hippocrepico in loculo.

HOLOTYPE: WESTERN AUSTRALIA: 7 miles (11.2 km) from Dongara towards Eneabba, *M.E. Phillips s. d.* (CANB). ISOTYPE: SYD.

Ascending to erect multicaulate perennial to 60 cm. Stems terete, ribbed, pale-grey tomentose. Leaves sessile, spatulate, 15–47 mm long, 5–15 mm wide, fasciculate, closely ashy-grey tomentose below, glabrous or glabrescent above, dentate or sometimes entire. Peduncles 9–20 mm long, 1–3 together, usually with a single flower, tomentose; bracts ovate-elliptic, 2–3.5 mm long, tomentose on both surfaces; bracteoles linear-oblong, 1.5–6 mm long, tomentose on both surfaces. Sepals obscured by hairs, 0.7–1.4 mm long, c. 0.5 mm wide. Corolla lobes narrow-oblong, with loose ash-grey type I and II hairs outside; inferior lobes 5.5–6 mm long, 1.2–1.5 mm wide; connate part of inferior lobes 4–4.7 mm long; superior lobes 7.5–8 mm long, 1.3–1.6 mm wide; auricle purple to red, c. 1.5 mm wide; wing veined, 1.7–2 mm wide, smaller above the auricle; calli 2–7 in each row. Ovary 1-locular, oblong or very slightly gibbous, c. 2.5 mm long, loosely tomentose; ovule single, curved, c. 2 mm long, basifixed; style 3–4 mm long, glabrous; indusium 1.2–1.5 mm diam, glabrous. Fruit globular-oblique, c. 2 mm diam., hairy, ± rugose.

RANGE: Irwin region of Western Australia around Dongara and Eneabba.

HABITAT: Heath.

DISCUSSION: This species can be distinguished from *D. incana* var. *fuscescens* by its spatulate leaves which are glabrescent above at maturity. It is also similar to *D. salahaе* but the close pale grey to whitish tomentum of the latter distinguishes it. The specific epithet refers to the grey colour of the hairs on the leaf.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: Dongara, *R.C. Carolin 10673*, 12-viii-1978 (SYD); c. 10 km N of Eneabba, *R.C. Carolin 10628*, 12-viii-1978 (SYD).

***D. tenuicaulis* E. Pritzell, Bot. Jahrb. Syst. 35: 580 (1905).**

TYPE: Coolgardie, *C.L. Webster*, 1898 (B—destroyed). No other specimens from this collection have been traced to date. The following specimen has been selected to replace the type because, of the collections made to date, it agrees most closely with Pritzell's description and was collected in the same area. NEOTYPE: Coolgardie, *C.A. Gardner*, Sept. 1934 (PERTH). ISONEOTYPE: K.

***D. purpurea* R. Br., Prodr.: 588 (1810).**

LECTOTYPE: Banks of the Grose River, forest land, *R. Brown*, 1803 (BM). ISOLECTOTYPES: K, MEL 516699*.

D. ovalifolia R. Br., op. cit.: 588.

LECTOTYPE: Lane Cove, *R. Brown*, 1803 (BM). ISOLECTOTYPE: K*.

D. rotundifolia R. Br., op. cit.: 587.

LECTOTYPE: Grose and Portland Head, *R. Brown* (BM). ISOLECTOTYPE: K*.

D. undulata R. Br., op. cit.: 587.

LECTOTYPE: Georges River, *R. Brown*, Oct. 1803 (BM). ISOLECTOTYPE: K*.

D. nervosa De Vriese, *Nederl. Kruidk. Arch.* 2: 12.

LECTOTYPE: Glenbrook, *R. Cunningham* (W)#.

D. omissa De Vriese, op. cit.: 10.

LECTOTYPE: Argyll-Paramatta, *Huegel* (W)#.

D. melanopogon De Vriese, op. cit.: 12 (1851), *nom. illegit.*

Since De Vriese cites *D. omissa* De Vriese in the protologue of this name, it is superfluous.

D. brownii F. Muell., *Fragm.* 6: 29 (1866), *nom. illeg.*

Since Mueller cites *D. undulata*, *D. rotundifolia*, *D. ovalifolia*, and *D. purpurea* in the protologue of this name, it is superfluous and thus illegitimate. Mueller's description clearly refers to the species now known as *D. purpurea*.

D. ferruginea R. Br., *Prodr.*: 588 (1910).

LECTOTYPE: Shoalwater passage, *R. Brown*, 26-8-1802 (BM). ISOLECTOTYPE: MEL*.

D. pedunculata Rajput & Carolin, *sp. nov.*

Caules teretes basaliter sed triangulares versus apicem. Folia sessilia glabra linearia vel lineari-oblonga fasciculata dentata. Flores in pedunculis 16–48 mm longis dispositi. Sepala obsoleta. Corolla extra pilis brevis denticulata nigra atque longis plumosis griseis. Ovarium 3–4 mm longum.

HOLOTYPE: WESTERN AUSTRALIA: Ruabon, *R.D. Royce 4516*, 29-9-1953 (PERTH).

Ascending to decumbent multicaulate perennial to 70 cm. Stems triangular above terete below, glabrous. Leaves sessile, very rarely in whorls, linear to linear-oblong, 10–35 mm long, 1.5–4 mm wide, glabrous, dentate. Peduncles 16–18 mm long, 1–4 together in the axils of the upper leaves, glabrous or slightly tomentose each with 3–4 flowers; bract linear, 4–9 mm long, 1–2 mm wide, glabrous; bracteole linear-oblong, 5–7 mm long, 1.5–2 mm wide, glabrescent or

hairy outside, glabrous inside. Sepals obsolete. Corolla lobes linear-lanceolate, with short dark grey to black type I and long grey type II hairs outside; inferior lobes 6.5–7.5 mm long, c. 1 mm wide; connate part of inferior lobes 4–5 mm long; superior lobes 7–8.5 mm long, c. 1.5 mm wide; auricle light brown to yellow, c. 1.5 mm wide; wing veined, c. 2.5 mm wide, tapering towards the apex above the auricle; calli 7–12 in each row. Ovary unilocular, hairy as corolla, 3.5–4 mm long; ovule single, linear, 2.5–3 mm long; ovule single, linear, 2.5–3 mm long, basifixed, erect; style glabrous, 3.5–4 mm long; indusium glabrous, 2-lipped, brown, c. 1 mm diam. Fruit similar to ovary.

RANGE: Drummond, Darling–Menzies and Warren regions of Western Australia.

HABITAT: In swampy and sandy soils.

DISCUSSION: This species is close to *D. linearis*, but it can be distinguished from that species by the linear-oblong leaves, which are distinctly dentate, and the long peduncles to which the specific epithet refers.

SELECTED SPECIMENS EXAMINED (3/12): WESTERN AUSTRALIA: Welshpool to Kalamunda, *J.H. Maiden*, ix-1909 (NSW); NE of Albany at Oyster Harbour, *A.M. Ashby*, 1978 (AD 96732185); Bayonet Head Track c. 8 km NE of Albany, *A.M. Ashby* 1998, 11-x-1966 (AD, SYD).

D. lavandulacea Lindl., *Swan River App.*: 27 (1839).

LECTOTYPE: Swan River, *Drummond*, 1839 (CGE)#. Three specimens are mounted on this sheet. One is *D. linearis*, the other two are *D. lavandulacea*. It is probable that both these specimens of *D. lavandulacea* were used by Lindley to cast his diagnosis. The Drummond specimen is selected since it agrees most closely with his description.

D. preissii De Vriese in *Lehm.*, *Pl. Preiss.* 1: 403 (1845).

LECTOTYPE: In solo limoso-calculoso sylvae districtus York, *Preiss 1481*, 12 Sept. 1839 (LD 0493). ISOLECTOTYPE: MEL 516672*. The sheet *L 903311*...220 bears two Preiss numbers, 1501 and 1481, but only one specimen. This specimen is *Goodenia incana*. In fact De Vriese, *loc. cit.*, identified *Preiss 1501* as *Scaevola pterygosperma*, a synonym of *G. incana*. It seems the specimen of *Preiss 1481* in L is mislaid.

D. rosmarinifolia var. ***dysantha*** Benth., *Fl. Austral.* 4: 144 (1868).

LECTOTYPE: Grampians, *Wilhelmi* (K)#.

D. rodwayana *Rajput & Carolin*, *sp. nov.*

Caules teretiusculi vel angulati versus apicem tomento cineraceo. Folia sessilia linearia recurvata interdum fasciculata ad oblongo-lanceolata glabra in pagina supra sed tomento cineraceo infra. Bractee lineari-oblongae. Corolla pilis brevis dendriticis ad plumosis tenuibus argenteis.

HOLOTYPE: NEW SOUTH WALES: ca. 15 miles (24 km) SW of Nowra, Nowra–Nerriga road, Turpentine Range, *E.F. Constable*, 27-x-1957 (NSW 45259). ISOTYPE: MEL 75406.

Erect multicaulate perennial to 60 cm. Stems terete below, \pm triangular above, white-greyish tomentose. Leaves sessile, linear to linear-oblong or oblong-lanceolate or rarely oblong to narrow-elliptic, 9–30 mm long, 1–6 mm wide, with scattered hairs above when young but glabrous when mature, whitish tomentose below, entire or with a few teeth, recurved, tending to be fasciculate in the axils of the leaves on the main stem. Peduncles 1–5 mm long, covered with fine villous whitish hairs, each with 1–3 flowers; pedicels 1–2 mm long, covered with fine plumose or villous hairs; bract linear-oblong, 2–4 mm long, c. 1 mm wide, covered with pale grey hairs; bracteoles 1–2, linear-oblong, 3–6.5 mm long, 0.7–1 mm wide, 1–2 together, covered outside with plumose hairs. Sepals concealed under the hairs of the ovary, 0.5–1 mm long, 0.1–0.3 mm wide. Corolla lobes with fine silvery-grey type II hairs outside; inferior lobes oblong-lanceolate, 5.5–7 mm long, 1–1.2 mm wide; connate part of the inferior lobes 3.5–4 mm long; superior lobes falcate, 6–7 mm long, 1–1.3 mm wide; auricle purple-red, 1.2–1.4 mm wide; wing veined, 1.5–2.5 mm wide; calli obsolete. Ovary unilocular, covered with short dendritic and long plumose hairs, 2–2.5 mm long; ovule single, oblong, c. 1.5 mm long, basifixed; style 3.5–4 mm long, glabrous; indusium 0.7–1 mm long, c. 1 mm wide, glabrous. Fruit obovoid, 3–3.5 mm long, hairy as the ovary.

RANGE: South coastal region of New South Wales.

HABITAT: Sclerophyll woodland and heath on sandstone.

CHROMOSOME NUMBER: $n = 18$, Peacock 6110.17.1 (SYD) as *Dampiera* sp.

DISCUSSION: This species is related to *D. rosmarinifolia* but can be distinguished by the tomentose stems, the linear or linear-oblong leaves which are glabrous on the upper surface and tomentose on the lower surface and which have margins recurved but not so as to hide the lower surface, and the fine type II silvery hairs on the outside of the corolla.

This species is named in the honour of F.A. Rodway, who collected many plants in the Nowra region, amongst them the present species, but unfortunately none of his specimens is suitable as a type.

SELECTED SPECIMENS EXAMINED (6/12): NEW SOUTH WALES: 8 km W of Nowra on Yalwal road, *D.F. Blaxell* 447, 7-xii-1970 (NSW); 5 miles (8 km) W of Nowra, *Herbarium F.A. Rodway* 5484-5, (NSW); Flat Rock Dam, 2 miles (3 km) SW of Nowra, *Herbarium F.A. Rodway* 14612 (NSW); Turpentine Range, Nowra to Nerriga road c. 15 miles (24 km) SW of Nowra, *E.F. Constable*, 27-x-1957 (NSW 45259, MEL 75406); Jervis Bay, *F.A. Rodway* 5488, 15-ix-? (NSW); Box Point to Barbers Creek, *J.H. Maiden*, 10-1898 (NSW).

D. lanceolata A. Cunn. ex DC., Prodr. 7: 503 (1839).

LECTOTYPE: ad vallem Wellingtonianum et in siccis circa Bathurst, *Cunningham* (BM). ISOLECTOTYPE: K*. Three sprigs are mounted on the sheet at K but only one, labelled Wellington Valley, appears to be an isolectotype.

D. maideniana Krause, Pflrch. 54: 189 (1912).

NEOTYPE: 50 miles north of Rylestone, *R.T. Baker* (NSW). It is not clear whether Krause saw this duplicate of the specimen in B which has been destroyed#.

D. diversifolia De Vriese in Lehm., Pl. Preiss. 1: 403 (1845).

LECTOTYPE: In regionibus interioribus Aust. Occ., *Preiss 1469* (LD 0494).
 ISOLECTOTYPES: L 90962...293, *pro parte*, MEL 516677. Two elements occur on the sheet at Leiden. One appears to be a portion of *Preiss 1504* which is a type of *D. prostrata*; the other part agrees well with De Vriese's description of *D. diversifolia*.

D. marifolia Benth., Fl. Austral. 4: 114 (1868).

LECTOTYPE: Wimmera, *Dallachy* (K). ISOLECTOTYPE: MEL#.

D. haematotricha De Vriese, Nederl. Kruidk. Arch. 2: 12 (1851).

NEOTYPE: *Drummond suppl. 56, no. 105*, 1843 (MEL 516692). We have been able to locate only this one duplicate of the type collection and De Vriese probably did not see it.

(ii) Subsect. AngularesSeries *Angulares***D. prostrata** De Vriese in Lehm., Pl. Preiss. 1: 403 (1845).

LECTOTYPE: In solo arenoso prope Avondale, 10 Aprilis 1840, *Preiss 1504* (LD 0494). ISOLECTOTYPE: L 90962...292. This is a *Scaevola* species which cannot be identified at present, see below.

D. decurrens Rajput & Carolin, sp. nov.

Caules triangulares glabri subalati prope basin folii cujusque. Folia glabra ovata vel ovato-elliptica basibus latis dentata 12–41 mm longa 5–23 mm lata. Pedunculus glaber. Bractaeae atque bracteolae glabrae. Sepala obsoleta. Corolla pilis adpressis griseis extus oblecta. Ovarium biloculatum glabrum.

HOLOTYPE: WESTERN AUSTRALIA: Lucky Bay, Esperance, *E.M. Bennett 882*, 10 Sept. 1966 (PERTH).

[MISAPPLIED NAME: *D. prostrata* auct. non De Vriese: Benth., Fl. Austral. 4: 110 (1868).]

Stiff erect multicaulate perennial to 1 m. Stems triangular, slightly winged near the leaf base, glabrous. Leaves sessile, ovate or ovate-elliptic with a broad base, 12–41 mm long, 5–23 mm wide, with a few scattered hairs when young but glabrescent, dentate to lobed. Peduncles 11–17 mm long, glabrous, mostly in the upper axils; pedicels 3.5–5.2 mm long, glabrous or glabrescent; bract linear, 5.5–6.7 mm long, 1–1.2 mm wide, glabrous; bracteole linear-oblong, 3.2–4.7 mm long, 0.5–0.7 mm wide, glabrous. Sepals obsolete. Corolla lobes covered outside with fine appressed grey type IV hairs; inferior lobes 9–10.5 mm long, 1.2–1.5 mm wide; connate part of the inferior lobes 3–4.2 mm long; superior lobes 10–12.5 mm long, 1.7–2 mm wide; auricle purple, 1.7–2 mm wide; wing distinctly veined, 3.5–4 mm wide, short or sometimes obsolete above auricle; calli 2–5 in each row. Ovary bilocular, glabrous, 3.5–4 mm long; ovules 1 in each loculus, oblong, erect, 2.7–3.2 mm long, basifixed; style 2.7–3.5 mm long, glabrous; indusium dark brown, 1.4–1.5 mm diam.

RANGE: Eyre region of Western Australia.

HABITAT: On granite.

DISCUSSION: This species has previously been referred to *D. prostrata* De Vriese. The types of *D. prostrata* De Vriese in Lehm. (see above), however, belong to a *Scaevola* species. Subsequently De Vriese (Nat. Verh. Holl. Maats. Wet. Haarlem, 2: 83; 1854) altered the circumscription of *D. prostrata* and cited one specimen alone, 'Drummond no. 364'. It is this latter concept, that apparently does not include the lectotype, which Bentham accepted. A name is supplied here for this second species. The specific epithet refers to the decurrent leaf margins. *D. decurrens* is quite different from the only other species with a 2-locular ovary, *D. trigona* which is a much smaller, more herbaceous plant.

SELECTED SPECIMENS EXAMINED: (6/9): WESTERN AUSTRALIA: Cheyne Beach fishery, Maxwell (MEL 42165); Recherche Archipelago, Sandy Hook Island, J.H. Willis, 10-xi-1950 (MEL); Drummond 364 (MEL 42166); Mt. Gardner, Maxwell (MEL 42163); Lucky Bay, A.S. George 7461, 21-i-1966 (PERTH, SYD); Cape Le Grande, J.W. Wrigley, 30-x-1968 (CBG 028785, SYD).

D. trigona De Vriese in Lehm., Pl. Preiss. 1: 401 (1845).

LECTOTYPE: In depressis humosis hiems aqua inundatis haud longe a praedio rustico Maddington, Preiss 1471, 2-11-1839 (LD 0499). ISOLECTOTYPES: L 903311...225, L 903311...226, L 903311...300, MEL 516710, MEL 516711, W*.

D. latealata (E. Pritzel) Rajput & Carolin, stat. nov.

BASIONYM: *D. trigona* var. *latealata* E. Pritzel, Bot. Jahrb. Syst. 35: 578 (1905).

HOLOTYPE: WESTERN AUSTRALIA: in Dist. Coolgardie per Dundas in granitica inter frutices, Diels 5257 (B-destroyed).

NEOTYPE: WESTERN AUSTRALIA: 27 miles (43 km) north on Eyre Highway, J.H. Willis, 3-x-1961 (MEL 1510118).

D. repanda De Vriese in Lehm., Pl. Preiss. 1: 400 (1845).

LECTOTYPE: In arenosis ad rivulam inter urbículas Perth et Guildford, Preiss 1518, 29 Nov. 1839 (LD 0495). ISOLECTOTYPES: K, L 90962...338, W*.

D. parvifolia R. Br., Prodr.: 589 (1810).

LECTOTYPE: Bay 1 Ora Austral: N. Holl.; R. Brown, 13 January 1802 (BM). ISOLECTOTYPE: MEL 516698*.

D. galbraithiana Rajput & Carolin, sp. nov.

Caules glabri triangulares foliis sessilibus oblongo-ellipticis glabris ad marginem grosse dentatis ac recurvatis incrassatis. Pedunculis uno ad tribus in axillis quoque idem flore solitario. Corolla extra tomentosa pilis adpressis cinereis typis IV.

HOLOTYPE: VICTORIA: 2.5 miles (4 km) E of Cheynes Bridge on Macalister River on N-S track, *J.H. Willis*, 20-10-1973 (MEL 503635). ISOTYPES: AD, CANB, MEL 75410.

[MISAPPLIED NAME: *D. scottiana* auct. non F. Muell.: Galbraith, Victorian Naturalist 93:161 (1976).]

Erect multicaulate perennial to 1 m. Stems \pm ribbed, triangular, glabrous. Leaves sessile, oblong-elliptic rarely rhomboid or lanceolate, 12–45 mm long, 3–17 mm wide, glabrous or slightly tomentose when young, deeply dentate with a prominent mid-rib, recurved or thickened at the margin. Peduncles 3–9 mm long, 1–3 in the axils of the upper leaves each usually with one flower, hairy with appressed grey hairs; bracts oblong-elliptic, 1.5–3 mm long, c. 0.5 mm wide, glabrous; bracteoles 1–2, linear-oblong, c. 1 mm wide, glabrescent. Sepals usually unequal, 0.5–1 mm long, irregularly covered with grey hairs. Corolla lobes with appressed very dark grey type IV hairs outside; inferior lobes linear-oblong, 5.5–7 mm long, 0.7–1 mm wide; connate part of inferior lobes 3–4 mm long; superior lobes slightly falcate, 7–8 mm long, 1.5–2 mm wide; auricle purple to deep red 1.5–2 mm wide; wing veined, 1–1.5 mm wide, as wide as others above auricle; calli 5–6 in each row. Ovary 1-locular, hairy with dark grey hairs, 2–3 mm long; ovule single, linear-oblong, 1.5–2 mm long, erect, basifixed; style glabrous, 3.5–4 mm long; indusium glabrous, c. 1 mm diam. Fruit obloid, to 3 mm long, glabrescent or less hairy than the ovary.

RANGE: Eastern Region of Victoria.

DISCUSSION: This species can be distinguished from *D. stricta* by its deeply dentate leaves and the appressed grey hairs on the outside of the corolla. Moreover the leaves are very seldom found in pseudowhorls as in *D. stricta*.

The species is named for Jean Galbraith, the Victorian naturalist.

SPECIMENS EXAMINED: VICTORIA: Grid S 27 between Mt. Wellington and Mt. Kent, *Jean Galbraith*, 18-vi-1973 (MEL 57409); c. 9.5 miles (15.2 km) SSE of Licola, *J.H. Willis & A.C. Beaglehole & E.A. Chesterfield* ACB 43382, 21-x-1973 (SYD); a mile (1.6 km) or more E of McMillans Lookout, *E.A. Chesterfield*, 21-x-1973 (MEL 75408).

***D. fusca* Rajput & Carolin, sp. nov.**

Caules triangulares papillati tomentosi pilis fuscis vel glabrescentes. Folia oblongo-lanceolata vel rhombo-spathulata irregulariter utrinque tomentosa. Folia summa pseudo-fasciculata. Flores in cymis condensatis dispositi bracteolis duabus oblongis, corolla extus pilis semiadpressis fuscis.

HOLOTYPE: NEW SOUTH WALES: Kydra Peaks, *K.C. Rogers & J.H. Willis*, 11th Jan. 1970 (MEL 501963).

Erect multicaulate perennial to 30 cm. Stems triangular, slightly ribbed, tomentose with light-brown to grey dendritic hairs or glabrescent, papillate. Leaves sessile, oblong-lanceolate or spathulate-rhomboid, 8–22 mm long, 2–8 mm wide, irregularly tomentose on both surfaces or glabrescent, papillate, slightly recurved, dentate; upper leaves usually in pseudowhorls. Peduncles 4–15 mm long, clustered in the upper axils, each with 1–3 flowers, with brown dendritic hairs; pedicels 1–2.5 mm long, covered with brown-grey hairs; bract oblong-lanceolate, 5–7 mm long, 1.5–2 mm wide, covered with brown-grey dendritic hairs or glabrescent; bracteoles 2, oblong, 6–7.5 mm long, 1–1.2 mm wide, covered outside with brown-grey hairs, glabrous inside. Sepals obscured by hairs, 0.4–0.7 mm long, c. 0.3 mm wide. Corolla lobes oblong-lanceolate, with semi-appressed brown-grey type V hairs outside; inferior lobes 4–6 mm

long, 0.7–1 mm wide; connate part of the inferior lobes 3–3.5 mm long; superior lobes slightly falcate, 5–6.5 mm long, 0.7–1 mm wide; auricle purple, 1–1.2 mm wide; wing veined, 1–2 mm wide, slightly shorter above auricle; calli 0–2 in each row. Ovary unilocular, covered with brownish appressed hairs, 1.5–2 mm long; ovule single, oblong, 1.2–1.5 mm long, erect, straight, basifixed; style glabrous, 3–3.5 mm long; indusium glabrous, dark-brown, 2-lipped, 0.4–0.5 mm long, c. 1 mm diam. Fruit obloid, usually less tomentose than the ovary or glabrescent, 2–3 mm long.

RANGE: South coast region and adjacent tablelands of New South Wales.

HABITAT: On sandstone.

DISCUSSION: This species is close to *D. stricta*, but it can be distinguished from that species by its stems and leaves which are tomentose at first, by the two bracteoles, which are tomentose, and by the brown-grey semi-appressed dendritic hairs on the outside of the corolla, which are referred to by the specific epithet.

SPECIMENS EXAMINED: NEW SOUTH WALES: 1.5 miles (2.4 km) from Diggers Hole Track, A.C. Beaglehole ACB 41403, 6-ii-1972 (MEL 518208).

***D. stricta* var. *laxa* Benth.**, Fl. Austral. 4: 116 (1868).

LECTOTYPE: Mt. Macedon, *F. Mueller* (K)#.

***D. scottiana* F. Muell.**, Fragm. 11: 120 (1881).

LECTOTYPE: Port Jackson, *Woolfs* (MEL 16702). ISOLECTOTYPE: K*. There are two specimens in MEL. One has a letter from Harriet Scott pinned to it indicating that she first sent the specimen of this species to Mueller via Woolfs and thanking him for naming the species after her. The letter is dated 15-8-1881. It seems that Mueller used only the specimen from Woolfs to cast his description. Although the specimen at K has corolla hairs intermediate between those typical of *D. stricta* and those described in Mueller's diagnosis of *D. scottiana*, it is probable that this specimen was used by Mueller in casting his description and subsequently was sent to Bentham.

***D. sylvestris* Rajput & Carolin, sp. nov.**

Caules acute triangulares. Folia lineari-oblonga ad oblongo-elliptica plerumque integra. Sepala lineari-oblongi. Flores pilis divergentibus cinereis obtecti. Ovarium oblongum uniloculatum.

HOLOTYPE: NEW SOUTH WALES: Peach Mountain, Whian Whian State Forest, 15 miles (24 km) North of Lismore, *K. Grieves*, 3-10-1967 (NSW 138381).

Erect multicaulate perennial to 70 cm, \pm woody at the base. Stems triangular with \pm acute angles, branched, glabrous. Leaves sessile, rarely in pseudowhorls, linear-oblong, oblong-lanceolate or oblong-elliptic, 51–79 mm long, 8–31 mm wide, with a few scattered hairs when young but glabrescent, usually entire or slightly dentate. Peduncles 21–31 mm long, 1–4 in leaf axils, each with 4–5 flowers, glabrescent or hairy with brown-grey hairs; pedicels hairy with long yellow-grey hairs, 1–3 mm long; bract linear, 4–6 mm long, 0.7–1 mm wide, glabrescent or hairy with light brown-grey hairs; bracteole oblong-elliptic, 3–3.5 mm long, 1–1.5 mm wide, with grey hairs outside, glabrous inside. Sepals

linear or linear-oblong, 1.5–2 mm long, 0.3–0.5 mm wide, tomentose outside with grey hairs. Corolla lobes linear-lanceolate, with long spreading grey type V hairs outside; inferior lobes 7.5–9 mm long, 2.2–2.6 mm wide; connate part of the inferior lobes narrow-oblong, 5.7–6.5 mm long; superior lobes 6.2–6.8 mm long, 2–2.5 mm wide; auricle purple, 1.3–1.6 mm wide; wing veined, 3.8–4.2 mm wide, smaller above auricle; calli 3–7 in each row. Ovary unilocular, with grey spreading hairs, 2.8–3.1 mm long; ovule single, oblong, 1–1.3 mm long, erect, basifixed; indusium glabrous, dark-brown, 0.7–1 mm long, 1–1.2 mm diam. Fruit similar to ovary.

RANGE: Port Curtis, Wide Bay and Moreton regions of Queensland, and North and Central Coast regions of New South Wales.

HABITAT: Forests and woodland.

DISCUSSION: This species is possibly close to *D. stricta*, but it can be separated by the long spreading greyish hairs on the outside of the corolla, and also by leaves which are usually entire, longer and wider than those of *D. stricta* and not usually grouped into pseudowhorls although this may sometimes occur.

The specific epithet refers to the usual habitat of this species.

SELECTED SPECIMENS EXAMINED (10/18): NEW SOUTH WALES: Chatsworth to Woodburn, *J.H. Maiden & J.L. Boorman*, (NSW 83447); Wellington Mt., *J. Wedd*, x-1891 (NSW); Bucca Creek, *J. Boorman*, 11-xii-? (NSW 83444); Wardell, *W. Baeuerlen*, xi-1893 (NSW 83446); Near Dunwich, *R. Perry 456*, 28-ix-1947 (CANB); The Plain Green Hills, c. 10 miles (16 km) directly N of Woolgoolga, *D.J. McGillivray 16*, 19-iii-1965 (NSW 97503); Booti Booti, *H. Johnson*, 13-x-1953 (NSW 83437); Bullahdelah, *H.M.R. Rupp*, ix-1923 (NSW 83438). QUEENSLAND: c. 2 miles (3.2 km) S of Tewantin, *P. Baxter & B. Lebler 1104*, 1-x-1968 (CANB); Elimbah, *H.S. McKee 9724*, 4-xii-1962 (CANB, NSW).

D. loranthifolia F. Muell. ex Benth., Fl. Austral. 4: 115 (1868).

LECTOTYPE: among rocks, Phillips River, *Maxwell* 1861 (K). ISOLECTOTYPE: BM#.

D. fasciculata R. Br., Prodr.: 588 (1810).

LECTOTYPE: King George IIIrds Sound, *R. Brown* Dec. 1801 (BM). ISOLECTOTYPE: K*.

D. glabrescens Benth., Fl. Austral. 4: 119 (1868).

LECTOTYPE: *Drummond 4th coll. 194* (K). ISOLECTOTYPE: BM#.

D. subverticillata De Vriese in Lehm., Pl. Preiss. 1: 403 (1845).

LECTOTYPE: In rupestris collinum Konkoberuphills Kent, *Preiss 1510*, 19 Nov. 1840 (LD 0497). ISOLECTOTYPE: MEL 1669*.

D. leptoclada Benth., Fl. Austral. 4: 116 (1868).

LECTOTYPE: King Georges Sound, *Mueller* (K)*.

D. trialata De Vriese in Lehm., Pl. Preiss. 1: 401 (1845).

LECTOTYPE: In arenosis umbrosis inter frutices densos sylvae prope urbiculam Perth, *Preiss 1444*, 6 Aug. 1839 (LD 0498). ISOLECTOTYPES: L 903311...202, MEL 516670, W*.

D. obliqua Rajput & Carolin, sp. nov.

Caules triangulares. Folia lineari-oblonga ad oblongo-lanceolata integra. Corolla pilis adpressis argenteis obiecta; lobi superiores falcati parte distali unius alae ad auriculam obsoleto. Ovarium obliquum, indusium bilabiatum.

HOLOTYPE: WESTERN AUSTRALIA: 17 miles (27.2 km) east of Pingelly, *R.D. Royce 7601*, 19 Sept. 1962 (PERTH).

Erect multicaulate perennial to 70 cm. Stems triangular with acute angles, glabrous. Leaves sessile, linear to linear-oblong or oblong-lanceolate, very rarely oblong-elliptic, 11–65 mm long, 1.5–21 mm wide, with a few scattered hairs when young but glabrescent, entire, acute. Peduncles glabrous or with a few small silvery grey hairs, 3.5–5.5 mm long; bract oblong-elliptic, 1.2–1.6 mm long, 0.7–1 mm wide, glabrous; bracteole oblong to narrow-elliptic, 1–1.5 mm long, 0.3–0.5 mm wide, glabrescent outside. Sepals unequal, 0.4–0.6 mm long, 0.3–0.5 mm wide, glabrous. Corolla lobes linear-oblong, with silvery to grey appressed type IV hairs outside; inferior lobes 4.5–5.2 mm long, 1–1.2 mm wide; connate part of the inferior lobes 3–4 mm long; superior lobes 6–7 mm long, 1–1.2 mm wide; auricle purple-red, 1–1.4 mm wide; wing veined, 2.4–3 mm wide, almost obsolete above auricle; calli to 3 in each row. Ovary unilocular, oblique at top, covered with appressed silvery-white to grey short hairs, 1.6–2 mm long; ovule single, oblong, erect or very slightly bent, 1.5–1.9 mm long, basifixed; style glabrous, 3.5–4 mm long; indusium red-brown, 0.7–1 mm long, 0.6–0.9 mm diam.

RANGE: Dale and Darling–Menzies regions of Western Australia.

HABITAT: On sandplains.

DISCUSSION: A well defined species, distinguished by the oblique ovary to which the specific epithet refers.

SELECTED SPECIMENS EXAMINED (7/14): WESTERN AUSTRALIA: Congelin, W of Narrogin, *G. Heinsohn 129*, 24-viii-1967 (PERTH); West Popanyinning, *F. Lullfitz L1725*, 28-xi-1962 (PERTH); Near Narrogin, *N.T. Burbidge 2312*, 9-ix-1947 (MEL); Dryandra State Forest, Narrogin, *E.C. Nelson ANU 16899*, 10-xi-1972 (CANB 246999); Kukerin to Kalgan Road, *B. Benn*, 5-x-1963 (SYD); *Drummond 161* (NSW, MEL); 20 miles (32 km) SE of Wickepin, *K.M. Allan 136*, 4-ii-1969 (PERTH, SYD).

Series *Camptospora***D. epiphyloidea** De Vriese in Lehm., Pl. Preiss. 1: 402 (1845).

LECTOTYPE: In Australia occidentali, *Preiss 1494* (LD 0488). ISOLECTOTYPES: L 90962...71, MEL 516676, W*.

D. lindleyi De Vriese in Lehm., Pl. Preiss. 1: 402 (1845).

LECTOTYPE: In limosa calculosis sylvarum, York, *Preiss 1514*, 13 Sept. 1839. (L 90962...83 (second specimen from the right)). De Vriese cited the specimen

as 'Preiss 1574' in the protologue but subsequently corrected this to 1514 in Lehm., Pl. Preiss. 2: 242 (1848). ISOLECTOTYPES: L 903311...201, MEL 516695, W*.

***D. deltoidea* Rajput & Carolin, sp. nov.**

Caules parce ramosi alis duabus uterque 3–4 mm latis. Folia triangularia oblonga vel elliptica integra basim latitudine caulem aequantes. Flores plerumque in fasciculis axillaribus ad trium dispositi. Pedicellus 2–3 mm longus. Alae petalorum distincte venosae. Ovarium gibbosum.

HOLOTYPE: WESTERN AUSTRALIA: Mt. Drummond, south west of Ravensthorpe, K. Newbey 2697, 13th August 1967 (PERTH).

Multicaulate perennial, to 35 cm. Stems 2-winged, glabrous, sparsely branched; wings 3–4 mm wide. Leaves sessile, \pm triangular to oblong-elliptic, 10–16 mm long, 6–9 mm wide, with a few scattered hairs when young but glabrescent, entire, as wide as the stem at base. Peduncles 2.2–2.5 mm long, 1–3 together in the upper axils, each bearing a single flower, covered with appressed grey hairs; bract oblong, 1–1.2 mm long, c. 0.3 mm wide, with grey hairs outside, glabrous inside; bracteoles oblong, 0.7–1.1 mm long, c. 0.2 mm wide, hairy outside. Sepals ovate-elliptic, 0.5–0.7 mm long, c. 0.2 mm wide, glabrous. Corolla lobes linear, with appressed grey type IV hairs outside; inferior lobes 6–7 mm long, 0.7–1 mm wide; connate part of the inferior lobe 4–4.5 mm long; superior lobes 7–8 mm long, 1.5–1.7 mm wide; auricle purple, 1–1.2 mm wide; wing distinctly veined, 2.7–3.2 mm wide; calli to 3 in each row. Ovary unilocular, gibbous, with similar but fewer hairs compared to the petals, 1.7–2 mm long; ovule single, horseshoe-shaped, 1.7–2 mm long, basifixed; style glabrous, 4.7–5.2 mm long; indusium glabrous, brown, c. 1 mm long, 0.3–0.5 mm diam. Fruit \pm orbicular, 2–3 mm diam., glabrescent, veined.

RANGE: Eastern part of Darling–Menzies region of Western Australia.

HABITAT: In sandy loams.

DISCUSSION: This species is distinguished from others with a gibbous ovary by the short triangular to oblong-elliptic leaves, which are the same width at their base as the broadly winged stem. It is related to *D. alata* Lindl., but it can easily be separated from that species by the closely appressed hairs on the corolla and the distinctly veined wings of the corolla lobes.

The specific epithet refers to the deltoid shape of the leaves.

SELECTED SPECIMENS EXAMINED (2/5): WESTERN AUSTRALIA: Fitzgerald River, c. 70 miles (112 km) ESE of Ongerup, T.E.H. Aplin, I. Lethbridge & R. Coveny 3258, 8-xi-1970 (NSW); $\frac{1}{2}$ mile (0.8 km) E of Elverton Mine, K. Newbey 945, 15-ix-1963 (PERTH).

***D. angulata* Rajput & Carolin, sp. nov.**

Caules glabri triangulares sed teretes ad basin. Folia sessilia glabra linearia vel lineari-oblonga 17–29 mm longa. Pedunculus pedicellusque pilis appressis incanis obtectus. Corolla pilis appressis cinereis extus; alae distincte venosae. Ovarium gibbosum pilis appressis obtectum.

HOLOTYPE: WESTERN AUSTRALIA: NE of Ravensthorpe, Blackall & Gardner 1854, 22 Sept. 1925 (PERTH).

Erect multicaulate perennial to 50 cm. Stems triangular but terete at the base, 17–29 mm long, 2–3.5 mm wide, glabrous. Leaves sessile, linear to linear-oblong rarely the lower few oblong-lanceolate, 15–30 mm long, 2–4 mm wide, with a few scattered hairs when young but glabrescent, entire. Peduncles 8–13 mm long, 1–3 together in the upper axils, usually each with 1 or rarely 2–3 flowers, hairy with pale hairs; pedicels 3–5.5 mm long; bract oblong to narrow-elliptic, 1–1.5 mm long, 0.5 mm wide, hairy outside; bracteole linear-oblong, 1–1.5 mm long, 0.3–0.5 mm wide, with pale grey hairs. Sepals obscured by hairs, 0.2–0.4 mm long, c. 0.1 mm wide. Corolla lobes linear, with grey appressed type IV hairs outside; inferior lobes 5–5.5 mm long, 1–1.2 mm wide; connate part of the inferior lobes 4–4.5 mm long; superior lobes 6–7 mm long, 1–1.2 mm wide; auricle purple, 1–1.2 mm wide; wing distinctly veined, 2.5–2.7 mm wide, only slightly smaller above auricle; calli 0–3 in each row. Ovary unilocular, gibbous, covered with pale grey appressed hairs, 1.5–1.7 mm long, 1.7–2 mm wide; ovule single, horseshoe-shaped, 1.7–2.2 mm long, basifixed; style glabrous, 2.2–2.7 mm long; indusium glabrous, 0.8–1 mm long, 0.5–0.7 mm diam. Fruit broad-ovoid, 2 mm diam., glabrescent.

RANGE: Austin, Avon, Roe and Eyre regions of Western Australia.

HABITAT: On lateritized sandy soil.

DISCUSSION: This species is close to *D. sacculata*, but it can be easily separated by its triangular stem, and the paler grey hairs on the outside of the corolla. The specific epithet refers to the angular stem.

SELECTED SPECIMENS EXAMINED (10/31): WESTERN AUSTRALIA: Wongan Hills, W of Elphin, *R.D. Royce 6637*, 11-ix-1961 (PERTH); Merredin, 4 miles (6.4 km) on Narrembeen Road, *W.J. Peacock 6087.2 (a)*, 6-ix-1960 (SYD); Parker's Range, *E. Merrill*, 1890 (MEL); c. 2 km N of Lake King, *R.H. Kuchel 1862*, 10-ix-1964 (AD 96531226); S of Grass Patch, main road from Norseman to Esperance, *J.H. Willis*, 1-ix-1947 (MEL); Stokes Inlet, ca. 75 km W of Esperance, *A.E. Orchard 1638*, 18-x-1968 (PERTH); Ravensthorpe, *Gardner & Blackall*, ix-1925 (PERTH); 40 km ENE of Fitzgerald, c. 30 km WSW of Ravensthorpe, *A.C. Beauglehole ACB 49287*, 28-viii-1974 (SYD); 40 miles (64 km) E of Ongerup, at rabbit proof fence, *J. Peacock 6092-2*, 1-ix-1960 (SYD); 31 miles (49.6 km) N of Esperance, *B.L. Turner 5554*, 12-ix-1965 (PERTH).

D. sacculata F. Muell. ex Benth., Fl. Austral. 4: 111 (1868).

LECTOTYPE: Upper Kalgan River, *Oldfield* (K)*.

D. mooreana E. Pritzel, Bot. Jahrb. Syst. 35: 579 (1905).

LECTOTYPE: In distr. Irwin australi pr. Watheroo, *Pritzel 993*, Nov. 1901 (AD 97715446). ISOLECTOTYPES: BM, K, L 903311...208, PERTH*.

D. tenuicaulis var. ***curvula*** (*Krause*) *Rajput & Carolin*, comb. et stat. nov.

BASIONYM: *D. curvula* Krause, Pflrch. 54: 197 (1912).

D. heteroptera *Rajput & Carolin*, sp. nov.

Caules complanati una costa distincte in quoque latere. Folia linearia.

Pedunculi 11–36 mm longi. Ala super auriculum lobi superioris obsoleta. Ovarium gibbosum fere glabrum in gibbo. Fructa glabrescentes.

HOLOTYPE: WESTERN AUSTRALIA: near Augusta, *A.M. Ashby* 3696, 21 Oct. 1970 (PERTH). ISOTYPE: SYD.

Erect multicaulate perennial to 60 cm. Stems flat, sparsely branched, not winged but with a distinct rib on either side, glabrous, internodes often up to 20 cm long. Leaves sessile, linear, with a few scattered hairs when young but glabrescent, 10–55 mm long, 1.5–3.7 mm wide, entire. Peduncles glabrous, usually 1–3 in each axil each with 2–5 flowers, 11–36 mm long; pedicels 8–10.5 mm long, glabrous; bract linear-oblong, 3.5–5.2 mm long, 0.5–1 mm wide, glabrous; bracteole linear, 1.5–1.7 mm long, 0.3–0.5 mm wide, glabrous. Sepals glabrous, linear, c. 0.5 mm long, c. 0.4 mm wide. Corolla lobes linear-lanceolate, with appressed grey type IV hairs outside; inferior lobes 5.5–6.2 mm long, 1–1.2 mm wide; connate part of the inferior lobe 2.2–2.7 mm long; superior lobe 5–5.7 mm long, 1.2–1.6 mm wide; auricle purple-red, 1.2–1.5 mm wide; wing distinctly veined, 2.3–2.7 mm wide, almost obsolete above auricle; calli 0–3 in each row. Ovary unilocular, gibbous, hairy except for the gibbosity which is almost or quite glabrous, 1.2–1.5 mm long, 1.7–2 mm wide; ovule single, horseshoe-shaped, 1.5–1.7 mm long, basifixed; style glabrous, 2–3 mm long; indusium dark brown, swollen towards the base, 0.5–0.7 mm long, 1.2–1.5 mm diam. Fruit orbicular, 2–3.5 mm in diam., glabrescent.

RANGE: Irwin and western parts of Darling–Menzies and Warren regions of Western Australia.

HABITAT: In swamps and marshy places.

DISCUSSION: This species is distinguished from the other species with a gibbous ovary by its sparsely branched stems with internodes 6–20 cm long; its linear leaves; and the almost glabrous gibbosity of the ovary. The specific epithet refers to the different sizes of the wings on the superior corolla lobes.

SELECTED SPECIMENS EXAMINED (5/9): WESTERN AUSTRALIA: 30 miles (48 km) W of Nannup, *A.R. Fairall* 826, 18-x-1962 (PERTH); Cowaramup, *R.D. Royce* 2832, 15-x-1948 (PERTH); Scott River, *Susan Paust* 240, 8-ix-1971 (PERTH); Wanra Glen, E of Karridale, *R.D. Royce* 2431, 28-x-1947 (PERTH); S of Blackwood River, *R.D. Royce* 2948, 24-x-1948 (PERTH).

Sect. *Linschotenia*

***D. atriplicina* Gardner ex Rajput & Carolin, sp. nov.**

Plantae erectae vel adscendentes lignosae tomentosae. Caules teretes. Folia ovata vel obovato-elliptica 17–65 mm longa utrinque tomentosa. Flores in racemis scapiformis 60–90 cm longis tomentosis dispositi. Bractae lineares tomentosae 6–8 mm longae. Sepala 5–7 mm longa. Auricules duae in quoque lobus superior corollae dispositae.

HOLOTYPE: WESTERN AUSTRALIA: 4 miles (6.4 km) N of well no. 12, Canning Stock Route, *H.M. Wilson* 6, 5-x-1942 (PERTH).

Ascending closely greyish or pale brownish tomentose subshrub probably to 60 cm. Stems terete. Leaves with petioles to 11 mm long, ovate or obovate-elliptic, 17–65 mm long, 7–28 mm wide, tomentose on both surfaces, entire or dentate. Flowers in scapiform racemes; scape 6–9 cm long, pedicels 1–1.5 mm

long, with \pm plumose hairs; bract linear, 6–8 mm long; bracteoles 3–4 together, linear, 5–8 mm long. Sepals linear, 5–7 mm long, with plumose hairs. Corolla lobes oblong to lanceolate, with spreading pale grey to pale brown type II hairs outside; inferior lobes oblong, 3.5–4.5 mm long, 1–1.2 mm wide; connate part of inferior lobes 3.5–4 mm long; superior lobes oblong-lanceolate, 5–5.5 mm long; auricles brownish, two on each superior lobe, 1.5–2 mm wide; wing scarcely veined, c. 0.5 mm wide; calli obsolete. Ovary 1-locular, 2.5–3.2 mm long, hairy as corolla; ovule single, oblong, c. 2 mm long, erect, basifixed; style 4–4.5 mm long, glabrous; indusium c. 1 mm diam, glabrous. Fruit unknown.

RANGE: Canning, Keartland and Mueller regions of Western Australia.

HABITAT: Sand dunes.

DISCUSSION: This species differs from all others in this Section in the grouping of 3–4 bracteoles together. The superficial similarity to *Atriplex* species, because of the close grey indumentum and the leaf shape, is very characteristic. Although there are few collections, it appears to be very widespread but constant in its characters. The name was suggested by C.A. Gardner on collections in PERTH.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: E of Gregory Range on rabbit-proof fence, R.D. Royce 1980, 22-v-1947 (PERTH); 19 miles (30.4 km) NNE of Jupiter Well, Gibson Desert, A.S. George 9066, 28-vii-1968 (PERTH).

D. cinerea Ewart & Davies, Fl. N. Terr.: 269 (1917).

LECTOTYPE: NW by N of Meyers Hill Macdonnell Ranges, G.F. Hill 212, 1-6-1911 (MEL 16669)*.

D. conospermoides W.V. Fitzg., Journ. Roy. Soc. W. Austral. 3: 216 (1918).

LECTOTYPE: Dillons Springs, W.V. Fitzgerald, x-1906 (NSW 83460). ISOLECTOTYPES: NSW 76561, BM*. It is likely that Fitzgerald used at least both specimens in NSW when casting his diagnosis.

D. candicans F. Muell., Fragm. 10: 86 (1876).

LECTOTYPE: Inter montes Alfred-Maries et Rawlinsons Ranges, E. Giles (MEL 516671). ISOLECTOTYPES: K, NSW*.

D. stenostachya E. Pritzel, Bot. Jahrb. Syst. 35: 577 (1905).

LECTOTYPE: in distr. Coolgardie pr. Southern Cross, Pritzel 864 (K). ISOLECTOTYPES: BM, L 903311...207, W*.

D. krauseana Rajput & Carolin, sp. nov.

Frutex caulibus teretibus tomento brevi flavide-albicanti obtectibus. Folia sessilis spathulata dentata in pagina dorsali glabrescentia. Flores in racemis dispositi. Corolla pilis flavide-brunnis dendriticis multiramosis extus callisque obsoleti. Labia indusii plus minusve pubescens.

HOLOTYPE: WESTERN AUSTRALIA: Ajana, C.A. Gardner, 27-x-1926 (PERTH).

Erect, branched hairy shrub to c. 60 cm high. Stem terete, closely tomentose with yellowish grey hairs. Leaves sessile, obovate, 11–28 mm long, 3–15 mm wide, light grey to brownish grey tomentose on both surfaces when young but glabrescent on the upper surface, deeply dentate distally. Flowers arranged in a loose raceme to 20 cm long; pedicels tomentose, 1–4 mm long; bracts oblong-elliptic, 1–3 mm long, to 0.7 mm wide, tomentose outside; bracteole linear, to 2 mm long, tomentose as bract. Sepals attached halfway up ovary, 0.5–0.7 mm long, usually with plumose silky hairs towards top. Corolla lobes tomentose with much-branched spreading grey type I hairs outside; inferior lobes linear-oblong, 5–6 mm long, to 1 mm wide; connate part of inferior lobes 2.5–4 mm long; superior lobes oblong-lanceolate, 6–7 mm long, to 1 mm wide; connate part of superior lobe 1–1.5 mm long; auricle purple-red, to 1.5 mm wide; wing veined, 2–3 mm wide, short above the auricle; calli obsolete. Ovary unilocular, densely tomentose as corolla, to 2 mm long; ovule solitary, linear-oblong, basifixed, to 1 mm long; style glabrous, 3–3.5 mm long; indusium red-brown, glabrous except for the hairy lips, c. 0.5 mm diam. Fruit ovoid, similar to ovary.

RANGE: Irwin region of Western Australia.

HABITAT: Sandy heaths.

CHROMOSOME NUMBER: $n = 9$, Peacock 60846.1 and 60853.2 (SYD), as *D. stenophylla*.

DISCUSSION: This species is related to *D. spicigera* but can be distinguished by its obovate deeply dentate leaves, the absence of calli, and the much-branched dendritic grey hairs on the outside of the corolla.

The species is named in honour of K. Krause who revised the genus in 1912.

SELECTED SPECIMENS EXAMINED (2/9): WESTERN AUSTRALIA: East Yuna Reserve, A.C. Burns 2, 5-vi-1966 (PERTH); Geraldton to Mullewa road, c. 32 km from Geraldton, Jean Galbraith WA170, 20-vii-1964 (MEL).

D. linschotenii F. Muell., *Fragm.* 6: 28 (1867).

This name is superfluous since *Linschotenia discolor* De Vriese (= *Dampiera discolor* (De Vriese) Benth.) is cited as a synonym.

D. ramosa Rajput & Carolin, *sp. nov.*

Herbae scapiformes perennes villosae ad basim. Folia basalia petiolata obovata usque spathulata 2.5–9 cm longa 12–41 mm lata tomento flavida in pagine inferiore sed glabra in pagine superiore. Flores in thyrsis 2.2–4.5 cm longis. Bracteae bracteolaeque lineari-oblongae. Sepala 2–4.5 mm longa. Petala flavide tomentosa extus pilis brevis dendriticis alisque 1–1.7 mm latis. Ovarium loculo una.

HOLOTYPE: WESTERN AUSTRALIA: 3 miles (4.8 km) NE of Beegull Rock Hole, Laverton–Warburton road, A.S. George 8122, 29-ix-1966 (PERTH). ISOTYPE: SYD.

Erect perennial herb to 40 cm with a thick tufted densely villous rootstock. Leaves mostly basal, with a petiole 25–58 mm long, obovate to spathulate, 2.5–9 cm long, 12–41 mm wide, very pale yellowish tomentose below, glabrescent above, entire or dentate. Flowers in leafless racemes to 4.5 cm long

often branched at the base and on scapes to 45 cm; pedicels 2–3 mm long, tomentose or glabrescent; bracts linear-oblong, 3–9 mm long, acute, mostly glabrescent; bracteoles 2, linear-oblong, 2–7 mm long, mostly glabrescent. Sepals linear, hairy, 2–4.5 mm long, attached halfway up ovary. Corolla lobes oblong to lanceolate, with spreading yellowish type I hairs outside; inferior lobes 3–5 cm long; connate part of inferior lobes 1.5–2.5 mm long; superior lobes \pm falcate, 3–5 mm long; auricle purplish, 1–2 mm wide; wing mauvish, scarcely veined, 1–1.5 mm wide, shorter above auricle; calli obsolete. Ovary 1-locular, 2–3 mm long, slightly oblique, hairy as corolla; ovule single, oblong, broader towards apex, c. 2 mm long, usually laterally attached a little above the base; style 5–6 mm long, glabrous; indusium c. 1 mm diam., glabrous. Fruit ovoid, 4–5 mm long.

RANGE: Helms region of Western Australia.

HABITAT: Sand dunes.

DISCUSSION: This species is superficially rather like *D. eriocephala* but the flowers are arranged in a loose raceme and the hairs are pale yellow. The specific epithet refers to the branching of the scape and the inflorescence.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: 30 miles (48 km) W of Neale Junction Great Victoria Desert, A.S. *George 8401*, 10-x-1966 (PERTH); between Tjidileburra Rock Hole and Serpentine Lakes, *D.E. Symon 12672*, 26-viii-1980 (ADW 55188), SYD).

D. eriocephala De Vriese, Nat. Verh. Maats. Wet. Haarlem 2: 118 (1854).

LECTOTYPE: *Drummond 397* (K). ISOLECTOTYPE: MEL.

D. eriocephala* var. *concolor F. Muell. ex Benth., Fl. Austral. 4: 120 (1868).

LECTOTYPE: *Drummond no. 162* (MEL 16712)*.

D. humilis F. Muell. ex E. Pritzel, Bot. Jahrb. Syst. 35: 582 (1905).

NEOTYPE: Parkers Range, *E. Mirral*, 1890 (MEL 42151)*. There is no certainty that Pritzel used this specimen, at present in MEL, to cast his diagnosis of this species although it appears to be the same collection as the one he cites. It agrees well with the description.

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Appendix 1

Summary of characters used in phylogenetic analysis

1. Habit: sub-shrub; rosette
2. Habit: sub-shrub; multicaulate
- 3-6. Hair types on corolla (see Fig. 2)
7. Phyllotaxis: 2/5 or less; 1/3 or 1/2
- 8-10. Stem section: terete; 5-ribbed; 3-angled; flat
11. Leaves: flat; revolute (recurved)
12. Leaves: cauline; basal
13. Leaves: not in pseudowhorls; tending to be in pseudowhorls
14. Leaves: all \pm same size; reduced in inflorescence region
15. Leaves: petiolate; sessile
- 16-18. Hairs on leaves: glabrous; hairy on both surfaces; glabrescent above; glabrescent above and below
- 19-21. Inflorescence (see Fig. 1)
22. Sepals: present or absent; replaced or surmounted by tuft of hairs
23. Corolla: large; small

24. Ovary: 2-locular; 1-locular

25. Ovary: straight; gibbous

26–27. Ovule shape: straight; bent; horseshoe-shaped

Appendix 2

Character state codes of terminal taxa used in cladistic analysis

ALAT	010111111100001111000001111
ANGU	010110111000001111000001111
CARI	010110110000011111000001111
CORO	010110111000001111000001111
DECU	010110111000001111000000000
FASC	010111111000101111000001000
FUSC	010111111000101110000001000
LEPT	010110111000001111000001000
OBLI	010110111000001111000001100
PARV	010110110000001111000001000
STRI	010111111000101111000001000
TRIL	010111111000001111000001000
TRIG	010110111000001111000000000
ALTI	010000010000001100000001010
ADPR	011000010000001111000001000
ERIA	011000010010001110000001000
HAEM	011000010000001100000001000
HEDE	010000010000000100000001000
INCA	010000010000001100000001010
LAVA	011000010010001110000001000
LANC	011000010000001110000001000
LINE	011000010000001111000001000
MARI	011000010000001100000001000
OLIG	010000010000001111000001000
ORCH	010100010000001100000001000
PURP	010000010000001110000001000
SCAE	010100010000001111000001000
STEP	011000010000001100000001000
TENU	011000010000001111000001000
ATRI	001000000000010100110001000
CAND	000000000000010110110011000
CINE	000000000000010100110011000
DISC	000000000000010110110001000
KRAU	000000000000010100110001010
RAMO	100000000001010110100001000
STES	000000000000011100110101010
TERE	000010000000011100110001000
DENT	111000000001011111110101000
ERIO	111000000001010110101101010
PLUM	011000000001011110101101000
WELL	111000000001010111001101000
DIVE	019999010000001000000001000

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Re-evaluation of the characters used to distinguish *Enteropogon* from *Chloris* (Poaceae)

S.W.L. Jacobs and J. Highet

Abstract

Jacobs, S.W.L., and Highet, J. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1988. Re-evaluation of the characters used to distinguish *Enteropogon* from *Chloris* (Poaceae). *Telopea* 3(2): 217–221. — We examined the six characters that have been used to distinguish the genera *Enteropogon* and *Chloris*. Only two (fertile floret compression and relative embryo length) proved to be of any taxonomic value. Despite this reduction in the number of distinguishing characters we decided that there is an argument for maintaining the use of *Enteropogon* in Australia.

Introduction

The genus *Enteropogon* was established by Nees (Lindley 1836). It was not made clear how this genus was to be distinguished from *Chloris* as the original description contains comparisons only with *Dinebra* (as *Dineba*) and *Heterosteca* (as *Heterostega*). Clayton (1967), in reviewing a group of genera including *Enteropogon*, commented that the distinction between *Chloris* and *Enteropogon* had usually been based on inflorescence form, that of species of *Enteropogon* being a solitary spike. He cast doubt on the possession of a solitary spike as the delimiting character by adding to *Enteropogon* a species that frequently had two or three spikes. In that paper, where he discussed the problem of distinguishing satellite genera from large polymorphic genera, Clayton suggested the use of the compression of the fertile floret as a character with potential for distinguishing *Enteropogon* (dorsally compressed) from *Chloris* (laterally compressed).

Lazarides (1972) expanded the concept of *Enteropogon* by delimiting the genus on the dorsal compression of the fertile floret. He dismissed inflorescence form as a delimiting character for the genus, elaborated on the compression character by including a description of the caryopses and added two further characters: (i) the length of the embryo relative to the caryopsis, and (ii) the development of the second floret. *Enteropogon* was characterised by him as having an embryo no more than one third the length of the caryopsis and a poorly developed upper floret. *Chloris* was characterised by having an embryo one half to two thirds the caryopsis length and ‘. . . a usually well-developed second floret or lemma’.

Anderson (1974) followed Lazarides in the broader treatment of *Enteropogon*, adding another character by contrasting the simple angular starch grains of *Enteropogon* with the exclusively compound grains of *Chloris*. Anderson extracted his data about this character from a paper by Tateoka (1962) even though Tateoka had concluded that some of the reported differences (those repeated by Anderson) were not taxonomically significant.

Clayton (1982) took up the circumscription used by Lazarides (1972) and Anderson (1974) and implied a further character, ‘long drooping racemes’, to

help delimit *Enteropogon*. This addition was ascribed to Lazarides (1972) but that author did not mention this character.

Although some Australian species have been placed in the genus *Enteropogon* (Simon 1984) several authors have either not accepted this (Jacobs & Pickard 1981; Wheeler, Jacobs & Norton 1982; Beadle, Evans & Carolin 1982) or accepted it with apparent reservation (Tothill & Hacker 1983). This hesitancy has been due, at least partly, to some dissatisfaction with the documentation of the characters and some doubt as to the accuracy and/or taxonomic reliability of the characters cited. The characters that have been used to distinguish the two genera break down most commonly in the Australian species. Understanding the character variation in the Australian species is critical for assessing the status of *Enteropogon*.

We decided that the most appropriate action was to examine the characters used to substantiate the maintenance of *Enteropogon* as a separate genus and to measure their variability in the Australian species and hence assess the taxonomic value of the characters.

Methods

Thirty specimens representing seven species of *Enteropogon* and three species of *Chloris* were compared; all were species native to Australia. Details of voucher specimens are available from the authors; all specimens are held at NSW.

As many of the following characters as possible (e.g. not all inflorescences contained caryopses) were recorded from each of ten inflorescences for each species:

- (i) spike number (Clayton 1967)
- (ii) spike rigidity (Clayton 1982)
- (iii) fertile floret compression (Lazarides 1972)
- (iv) embryo length relative to the caryopsis (Lazarides 1972)
- (v) starch grain shape (Anderson 1974), and
- (vi) development of the second floret (Lazarides 1972).

Observations of most of these characters required no special preparation of material. Starch grain type was assessed by soaking seeds in warm water for a few hours, squashing the seeds on microscope slides in water-soluble mounting medium and examining the slides under the light microscope.

Results and discussion

The results recorded (Table 1) are those observed on the specimens used and in no way are meant to describe the total range of variation of any character for any taxon.

- (i) **Spike number.** This character has already been discussed by most authors and the results here reinforce that.
- (ii) **Spike rigidity.** A character used by Clayton (1982) without explanation. It has no validity as a delimiting character as both states occur in each genus.

Table 1. Comparison of characters used to separate the genera *Enteropogon* and *Chloris*

Species E = <i>Enteropogon</i> C = <i>Chloris</i>	Spike number	Spike rigidity	Floret compression	Embryo length relative to caryopsis % (range) n = sample size	Starch grain shape	Relative development of second floret
<i>E. dolichostachyus</i>	5-6	drooping	dorsal	25(22-30) n = 12	simple, rounded + angular	infertile, smaller
<i>E. acicularis</i>	13-15	rigid	dorsal	29(22-34) n = 12	simple, angular + a few rounded	infertile, smaller
<i>E. sp. (S. Jacobs 1571)</i>	2(-3)	drooping	dorsal	29(24-32) n = 4	simple, angular + a few rounded	infertile, smaller
<i>E. ramosus</i>	3-4	rigid	dorsal	33(30-38) n = 11	simple, angular + a few rounded	± fertile, smaller
<i>E. paucispiceus</i>	1-2	drooping	dorsal	35(29-42) n = 4	simple, angular + a few rounded	infertile, much smaller
<i>E. minutus</i>	2-4	drooping	dorsal	37(32-40) n = 8	simple, angular + a few rounded	infertile, smaller
<i>E. unispicea</i>	1	drooping	dorsal	37(35-39) n = 3	simple, rounded + a few angular	infertile, much smaller
<i>C. divaricata</i> var. <i>divaricata</i>	4-6	rigid	lateral	42(33-55) n = 9	simple, angular + a few compound	infertile, smaller
<i>C. divaricata</i> var. <i>cynodontoides</i>	5-6	rigid	lateral	46(42-54) n = 10	simple, angular + a few compound	infertile, smaller
<i>C. ventricosa</i>	2-4	drooping	lateral	49(38-57) n = 9	simple, angular	infertile, smaller
<i>C. truncata</i>	7-9	rigid	lateral	50(44-56) n = 9	simple, angular	infertile, smaller

(iii) **Fertile floret compression.** As indicated by Lazarides (1972) this character does indeed distinguish the two genera. It can be difficult to assess as an immature floret from a species of *Enteropogon* may look very similar to a floret from a species of *Chloris*. In the Australian species at least, the distinction is best observed by examining the caryopses (Lazarides 1972). The caryopsis is quite distinctly dorsally flattened with a shallow ventral groove in species of *Enteropogon*, whereas in the species of *Chloris* examined there may still be a shallow ventral groove but the caryopsis is triangular in trans-section.

(iv) **Embryo length relative to caryopsis.** This character does indicate a distinction when the mean is considered but the difference is not statistically significant when the variation in each species and the small number of *Chloris* species examined are considered. Although the means are not distinct, when the species are ordered on the embryo length (Table 1) there is an obvious trend in this non-dependent character to larger embryos in *Chloris* and smaller in *Enteropogon*. There is no clear break in the figures and individuals do overlap. Nonetheless the trend does support the distinction based on spikelet compression.

(v) **Starch grain shape.** We found no clear distinction between those species with simple angular starch grains and those with compound grains. Often both were present in one seed, as well as within one species. Distinctions based on this character may reflect inadequate sampling rather than a real difference.

(vi) **Development of the second floret.** This is a subjective character and one that we were not able in any way to correlate with the distinction based on the compression of the fertile floret. The second floret was infertile and much reduced in all of the material examined, except in one specimen of *E. ramosus*, which produced a mature, but small, caryopsis in the second floret.

Of the six characters used by various authors to delimit the genera *Enteropogon* and *Chloris*, four (i, ii, v and vi) are quite useless, one (fertile floret compression) seems reliable, and another (embryo length), while not discontinuous enough to be of practical value in distinguishing the genera, shows a trend that supports the division based on compression of the fertile floret.

Conclusions

This reduction in the number of diagnostic characters does cast some doubt on the value of recognising *Enteropogon* as a genus distinct from *Chloris*. The remaining characters, fertile floret compression (best determined from the shape of the mature caryopsis) and the trend in *Enteropogon* to shorter embryos relative to the length of the mature caryopsis, are probably adequate, following the philosophy expressed by Clayton (1967) on the separation of satellite genera from large polymorphic genera, to maintain a distinction between *Enteropogon* and *Chloris* in Australia.

Acknowledgements

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Eucalyptus recurva (Myrtaceae), ■ new species from the Southern
Tablelands of New South Wales

M.D. Crisp

Abstract

Crisp, M.D. (Australian National Botanic Gardens, G.P.O. Box 1777, Canberra, Australia 2601) 1988. *Eucalyptus recurva* (Myrtaceae), a new species from the Southern Tablelands of New South Wales. *Telopea* 3(2): 223–230. — A remarkable mallee eucalypt discovered recently near Braidwood is described and named. It is placed in sect. *Maidenaria*, and its affinity to other species discussed. Conservation status of the new species, which is known only from a single small stand, is assessed.

In August 1985, Ms. R. Jean, a landholder from near Braidwood, New South Wales, brought to the Australian National Botanic Gardens a fragment of a very odd mallee eucalypt that she had found in her local area. With its small, crowded, recurved leaves, the specimen presented such an unusual aspect that at first glance, it looked as though it belonged to the Rutaceae. A closer examination of the specimen, followed by a visit to the population in the field, revealed that Ms. Jean had in fact discovered a very distinctive new species of *Eucalyptus*. Seed was collected but only with some difficulty was it propagated and a seedling established. Together with adult parts, the seedling provided evidence as to the relationships of the new mallee to other eucalypts.

This paper describes *E. recurva*, suggests its most likely affinity, and discusses aspects of its horticulture, genetic variability and conservation status.

***Eucalyptus recurva* Crisp, sp. nov.**

Frutex 'mallee' ad 1.7 m altus, lignotuber formans, cortice laevi, partibus omnibus praeter illas magis ligneas glandibus oleosis abundantibus prominentibus; cotyledonibus leviter bilobis; caule plantulae anguste quadrialato; foliis juvenilibus intermediisque decussatis, sessilibus, apicibus recurvatis, obovatis, 4–21 x 1.5–7 mm, hebetato-virentibus, nervo mediano conspicuo flavo, venis obscuris; foliis adultis ut videtur non evolutis; foliis in planta matura ad initium tempus anni crescendi folia intermedia simulantibus, postea magis patentibus, angusto-ellipticis, usque ad 28 x 7 mm, acuminatis, venis visibilibus; internodiis brevibus (2–12 mm); inflorescentiis in axillis singulis, 3-floris, pedunculis 4–5.5 mm longis; alabastris subsessilibus, late obovoideis, inter hypanthium operculumque leviter constrictis, usque ad 6 x 5 mm; hypanthio hemisphaerico; operculo hemisphaerico, breviori angustiorique; operculo exteriori scarioso, in 4–5 lobos persistentes deltoideos mature findenti; filamentis staminum in alabastro inflexis; antheris versatilibus; ovario 3–4 loculari; stylo clavato brevi; fructu subsessili, depresso-hemisphaerico, 2.5–3.5 x 4.5–6 mm, disco angusto, valvis vix inclusis; semine irregulariter depresso-ellipsoideo, badio, hilo ventrali.

HOLOTYPE: NEW SOUTH WALES: NE of Braidwood, *M.D. Crisp* 7698 & *I.R. Telford*, 11.11.1985 (CBG). ISOTYPES: CBG, HO, K, MEL, NSW.

Mallee to 1.7 m tall; bark smooth, decorticating in ribbons, green when freshly exposed, weathering through orange-brown to grey, lacking oil glands; forming a lignotuber; stems slender, crooked; canopy rather open; whole plant except the woodier parts abundantly dotted with large (c. 0.25 mm diam.) oil glands. Cotyledons slightly bilobed. Seeding-leaves (to 11th node) decussate, sessile, spreading, obovate or narrow-obovate, rounded and recurved at apex, tapered to base, decurrent, 4–21 x 1.5–7 mm, dull green; stem quadrangular, narrowly winged, abundantly glandular. Coppice (intermediate) leaves decussate, sessile, ascending, obovate, rounded to acute and recurved at apex, minutely crenulate at margins, shortly tapered to base, 6–13 x 4–6 mm, abundantly glandular, dull green; mid-rib conspicuous, yellow; veins obscure; stem obscurely quadrangular, with short (2–6 mm) internodes. Adult leaves apparently not developed; leaves on mature plant resembling coppice leaves early in season's growth, becoming more spreading, narrow-elliptic, up to 28 x 7 mm, acuminate, tapered to both ends, with main lateral veins more or less visible above; internodes increasing to 12 mm. Unit inflorescences one per axil; peduncles compressed, becoming terete, 4–5.5 mm long, c. 1.5 mm broad. Buds 3 per unit inflorescence, broad-ovoid, slightly constricted between hypanthium and operculum, up to 6 x 5 mm, pitted with dense oil glands; middle bud shortly (1 mm) pedicellate; lateral buds sessile; hypanthium hemispherical, to 3 x 5 mm; operculum hemispherical, shorter and narrower than hypanthium, to 2 x 3.5 mm; outer operculum scarious, splitting to base into 4–5 persistent, irregular, deltoid lobes soon after bracts have fallen. Stamens: filaments mostly inflexed in bud, white; anthers versatile, very broad-ovate to square in outline, opening in vertical slits, 0.5 mm long. Ovary with 3 or 4 locules; ovules in 4 longitudinal rows on lower part of placenta; style clavate, short (c. 2.5 mm); stigma blunt with a lobed surface and short papillae. Fruit sessile, depressed-hemispherical, slightly constricted at orifice, 2.5–3.5 x 4.5–6 mm; hypanthium pitted with oil glands; disc narrow (0.75 mm), \pm level; valves just below rim, 3 or 4. Seed irregularly ellipsoid, depressed, 0.8–1.3 mm long, 0.7–1.0 mm broad, 0.3–0.4 mm thick, shallowly reticulate, semi-lustrous, dark red-brown; hilum ventral. Figs 1, 2.

FLOWERING PERIOD: January.

ETYMOLOGY: The specific epithet is Latin, meaning 'curved backwards', and refers to the leaf apices. Conspicuously recurved leaf apices are very rare in eucalypts, and are much more developed in *E. recurva* than in any of its close relatives.

DISTRIBUTION: known only from a single stand near Braidwood on the Southern Tablelands of New South Wales.

SPECIMENS EXAMINED: NEW SOUTH WALES: **Southern Tablelands:** NE of Braidwood, *G. Baker* & *R. Jean*, 8.1985 (CBG 8502702); *M.D. Crisp* 7699 & *I.R. Telford*, 11.11.1985 (CBG, MEL, NSW); *M.D. Crisp* 7725 & *I.R. Telford*, 14.2.1986 (CBG, MELU, MO); *R. Jean*, 31.1.1986 (CBG 8600351).

HABITAT: The type locality is a low ridge in undulating tableland country. There, *E. recurva* is growing in pale sandy clay, which supports a low heathland dominated by *Allocasuarina nana* (Sieber ex Sprengel) L. Johnson and *Hakea dactyloides* (Gaertn.) Cav.

CONSERVATION STATUS: Endangered, coded 2E (criteria from Leigh *et al.*

1984). *Eucalyptus recurva* is known only from a single stand, which apparently consists of five individuals. It appears to be the rarest species in the genus; *E. carnabyi* Blakely & Steedman is known from one individual in Western Australia, but is generally supposed to be a hybrid (Pryor & Johnson 1971, Chippendale 1973).

Even in the absence of external threats, the single known population of *E. recurva* must be endangered by its extremely narrow genetic base. Estimates of the number of individuals necessary to maintain a viable population vary widely (Fisher 1978, Ellyard 1987 and references cited in these), but by any standard, five may be too few. In fact, there is evidence that *E. recurva* is suffering the effects of inbreeding. Very few seeds are set (about one per capsule), and a good proportion of those appear to lack embryos. Attempts by M.A. Clements to germinate seed at the Australian National Botanic Gardens have met limited success. After stratification, seven out of ten seeds germinated but only one established a seedling. The survivor struggled to produce three pairs of leaves over several months, and then died. Subsequently, another batch of seed treated similarly produced a single seedling which grew slowly, reaching 10 cm in height after four months (Fig. 2F). The lack of seedling vigour suggests that a post-zygotic lethality system may be operating in this taxon.



Fig. 1. *Eucalyptus recurva* Crisp. A, branchlet with developing buds (x 0.9). B, branchlet with fruit (x 0.9). (Both from life; R. Jean del.)

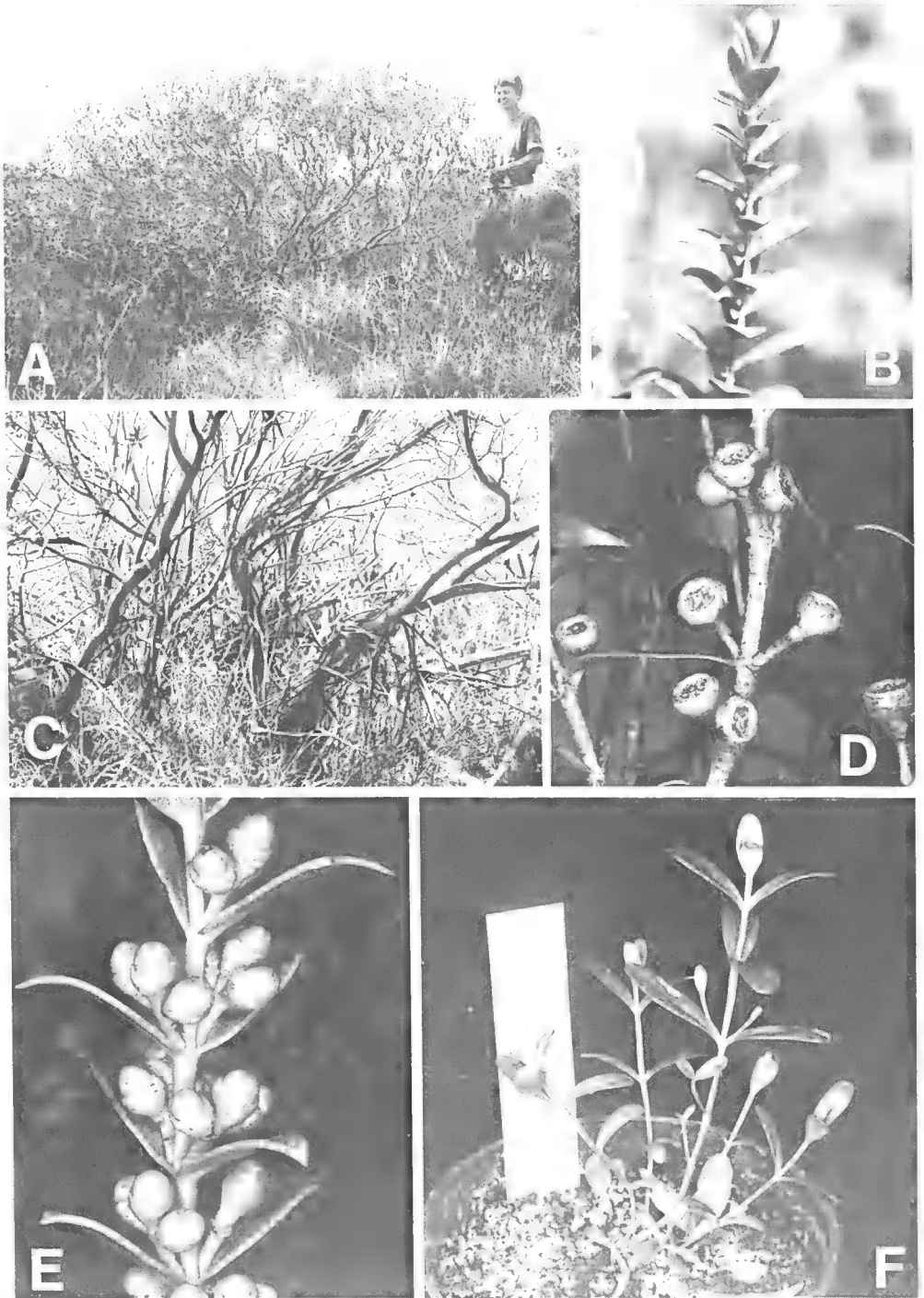


Fig. 2. *Eucalyptus recurva* Crisp. **A**, habit. **B**, coppice shoot from lignotuber, showing early intermediate leaves (x 1). **C**, stems. **D**, fruit (x 1.3). **E**, buds and late intermediate leaves (x 1.3). **F**, seedling (scale in cm). (All from life.)

It is quite likely that the five plants in the natural stand comprise a clone. They form a circular patch no more than 7.5 m in diameter, which could have originated by peripheral growth and central decay of a single parental lignotuber. Leaf samples were taken from each plant in January 1987 and subjected to an allozyme analysis by G. Moran (CSIRO Division of Forest Research, Canberra). All ten enzymes analysed were uniform and homozygous in all five plants. While such a result is consistent with the plants belonging to a clone, it is not conclusive.

Eucalyptus recurva occurs on private land that at present is largely undisturbed. However, the lignotuber of one individual has been disturbed by vehicles. As far as is known, the present landholder intends to preserve the population of *E. recurva* but, as long as the site is unreserved, it must have a degree of insecurity.

There has been only a partial search for additional stands of *E. recurva* in the surrounding district. The present site is similar to other heathlands around Braidwood that are dominated by *Allocasuarina nana*. A good proportion of these localities has been explored by botanists already, and it seems unlikely that extensive populations of *E. recurva* remain undiscovered.

AFFINITY: *Eucalyptus recurva* belongs in Pryor and Johnson's (1971) informal sect. Maidenaria but may be taxonomically rather isolated there. According to Boland *et al.* (1984), sect. Maidenaria is diagnosed by reniform or bilobed cotyledons and more or less sessile juvenile leaves. In both characters, *E. recurva* is typical of this section. Similarly shaped cotyledons do occur in closely related sections, such as Exsertaria and Adnataria. Sessile juvenile leaves also are found, although rarely, in these and other sections of *E.* subgen. *Symphyomyrtus*. Thus, these characters may be synapomorphies at a higher taxonomic level than that of sect. Maidenaria, and should not be relied upon exclusively in diagnosing the group.

Carr and Carr (1969) suggested that the presence of oil glands in the bark probably was diagnostic for a 'natural' group, which they defined by excluding certain taxa from Blakely's (1955) *E.* sect. 'Macrantherae Normales'. Their group corresponded closely with that which Pryor & Johnson (1971) later circumscribed informally as sect. Maidenaria. Carr & Carr reported that only a handful of species lacked bark glands while otherwise appearing to belong in the group. Thorough examination of the bark of *E. recurva* from all parts of the stems, as well as the lignotuber, has failed to reveal any oil glands. Possibly, *E. recurva* develops glands only in the older plant, like *E. globulus* Labill. subsp. *bicostata* (Maiden *et al.*) Kirkpatrick, *E. rubida* Deane & Maiden and *E. viminalis* Labill. (Carr & Carr 1969: 477); however, the plants at Braidwood appeared to be quite mature. Despite its apparent lack of bark glands, *E. recurva* is so similar to certain species in sect. Maidenaria that there can be little doubt that it belongs there.

Within sect. Maidenaria, the affinities of *E. recurva* are less clear. Table 1 compares *E. recurva* with some other taxa from this section. Several characters shown by *E. recurva* are otherwise virtually unknown in the section: a scarious, dehiscent outer operculum; markedly recurved leaves and obovate juvenile to early intermediate leaves (Figs 1–2). Such characters are scarcely informative about affinity, since they serve mainly to diagnose the species itself.

More or less scarious outer opercula occur in three other members of sect. Maidenaria: *E. nitens* (Deane & Maiden) Maiden, *E. quadrangulata* Deane &

Table 1. Comparison of *Eucalyptus recurva* with some other taxa in sect. Maidenaria

Characters	States in taxa			
	<i>E. recurva</i>	<i>E. vernicosa</i>	<i>E. johnstonii</i>	<i>E. parvifolia</i>
Plant height (m)	1.3–1.7	0.3–5	20–50	5–10
Bark glands	–	+	+	+
Leaves recurved	all stages	occasional in seedlings	–	intermediate (slightly)
Leaf type in adult plant	intermediate	intermediate to adult	adult	intermediate to adult
Internode length in adult plant (mm)	6–12	2–15	10–25	3–20
Seedling stems quadrangular	+	+	+	–
Seedling stems winged	+	+	+	–
Seedling stems glandular	+	+	+	–
Seedling leaf length, 6th node (mm)	18	22 ¹	36 ¹	19 ¹
Juvenile leaf shape	obovate to narrow-obovate	ovate to orbicular	ovate to orbicular	ovate to orbicular
Intermediate leaf length (mm)	6–13	10–40	12–50	10–40
Maximum adult leaf length (mm)	inapplicable	50	150	70
Number of buds in uniflorescence	3	1–3	3	7
Outer operculum type	scarious, persistent, dehiscing irregularly	coriaceous, caducous, intact	coriaceous, caducous, intact	coriaceous, caducous, intact

¹ Population means, n = 6 (unpublished data provided by J. Chappill).

Maiden and *E. benthamii* Maiden & Cambage var. *benthamii*. However, in the latter two taxa, the outer operculum differs from that of *E. recurva* in subtleties of texture and colour, in ultimately falling off, and in not always dehiscing. The outer operculum of *E. nitens* is very similar in all respects to that of *E. recurva*, but marked differences in many other characters suggest that these species are not closely related.

Neotenus retention of intermediate leaves in the mature plant, an obvious feature of *E. recurva* (Figs 1, 2E), occurs sporadically through sect. Maidenaria, and has probably evolved in parallel more than once. The same can be said of 3-flowered unit inflorescences. Bud and fruit shapes in *E. recurva* (Fig. 2D–E) are broadly similar to those in a number of species in sect. Maidenaria, and thus are not informative about affinity.

By its diminutive habit, small leaves, short internodes and retarded development of adult leaves, *E. vernicosa* Hook. f. resembles *E. recurva* (Table 1). However, all these traits may be correlated with extreme environmental

conditions. It has been suggested that *E. vernicosa* is only one end of an altitudinal cline which grades through *E. subcrenulata* Maiden & Blakely to *E. johnstonii* Maiden (Potts & Jackson 1986). Individuals of *E. johnstonii* are very tall forest trees with longer internodes and normally developed adult leaves (Table 1). Therefore, it seems unwise to postulate that diminutive habit, short internodes and delayed development of adult leaves are evolutionary novelties defining a monophyletic group composed of *E. recurva* and *E. vernicosa*.

There are a number of similarities between *E. recurva* and *E. parvifolia*. Pryor & Johnson (1971) placed the latter in sect. Maidenaria, between *E. sturgissiana* L. Johnson & Blaxell and *E. crenulata* Blakely & de Beuzeville, although Johnson (pers. comm.) no longer agrees with that particular placement. Among the characters held in common by *E. recurva* and *E. parvifolia* are small leaf size and retention of intermediate leaves in the mature plant (Table 1). Although *E. parvifolia* does eventually develop scattered, petiolate, lanceolate adult leaves, the petioles are very short, not exceeding about 5 mm. Moreover, these species have very similar intermediate leaves, except that those of *E. parvifolia* do not taper to the base nor are markedly recurved. No other member of sect. Maidenaria has leaves as small, particularly in length, except *E. vernicosa* (Table 1). Lower-altitude forms of the *E. vernicosa*-*E. johnstonii* cline have much larger intermediate and adult leaves (Table 1) because, as has been stated above, leaf-size in this complex is environmentally correlated. Environment is less likely to be affecting leaf size in *E. recurva* or *E. parvifolia*. Both grow at similar altitudes (600 and 1000 m respectively) on similar topography and soils on the eastern side of the Southern Tablelands of New South Wales, a more benign habitat than that of *E. vernicosa*. The habitat of *E. vernicosa* is extreme: very exposed rocky ridges in the Tasmanian alpine zone.

Seedlings of *E. recurva* and the *E. vernicosa* complex share some distinctive characters: stems which are quadrangular, narrowly winged and abundantly glandular (Table 1). All these characters are also seen in *E. imlayensis* Crisp & Brooker (1980), a close relative of the *E. vernicosa* complex. Quadrangular, winged seedling stems are not uncommon in sect. Maidenaria, but they are certainly not found in *E. parvifolia*. Nor does *E. parvifolia* have conspicuous glands along the stems of its seedlings. Although it is stated above that markedly recurved leaves are virtually unique in *E. recurva*, seedlings of *E. vernicosa* occasionally develop slightly recurved leaves (J. Chappill, pers. comm.). In *E. parvifolia* also, the intermediate leaves are slightly recurved. However, neither species shows the consistency (through all ontogenetic stages) or degree of recurvature seen in *E. recurva*. Therefore it is unclear whether these vague similarities represent genuine homologies.

In conclusion, it appears that *E. recurva*, while definitely belonging in the informal *Eucalytus* sect. Maidenaria, is taxonomically well distinguished from any known species, but perhaps is closest to the *E. vernicosa* complex.

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A revision of *Hicksbeachia* (Proteaceae)

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Abstract

Weston, Peter H. (*National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000*) 1988. A revision of *Hicksbeachia* (Proteaceae). *Telopea* 3(2): 231–239, figs 1–2. — The genus *Hicksbeachia* is revised and descriptions given of seedling and adult characters of both species. *Hicksbeachia pilosa* is described and its geographic variability discussed.

Introduction

Hicksbeachia has generally been regarded as a monotypic genus consisting of *H. pinnatifolia* F. Muell., a widespread species disjunctly distributed from the Nambucca River in north-eastern New South Wales to Tambourine Mountain in south-eastern Queensland and from the Cardwell Range to the Big Tableland in north-eastern Queensland (see e.g. Francis 1929, Floyd 1978). Although Sleumer (1955) transferred *Helicia diversifolia* C. White to *Hicksbeachia*, Johnson and Briggs (1975) subsequently described a new genus, *Athertonia*, to accommodate this species. Johnson and Briggs (1975) also suggested that the northern Queensland populations of *Hicksbeachia sens. strict.* constitute a different species from those in south-eastern Australia. In the course of preparing a treatment of *Hicksbeachia sens. strict.* for the 'Flora of Australia', I have confirmed that the northern Queensland populations are morphologically different from those in south-eastern Australia. Indeed, there may be more than one taxon in northern Queensland. At present, however, the northern Queensland populations are not known well enough to support any further distinction of taxa there.

Since the two taxa of *Hicksbeachia* are markedly allopatric, either specific or subspecific rank could be considered appropriate for them. However, according to the evolutionary species concept that I have adopted (Wiley 1978, 1981), morphologically different allopatric lineages should be given specific rank. Therefore I am describing a new species, *H. pilosa*, encompassing, for now, all of the north Queensland *Hicksbeachia* populations.

Hicksbeachia has not been critically studied since Maiden (1917) and since then herbarium collections of the genus have increased considerably. Moreover, study of seedlings has revealed additional characters for the discrimination of the genus and the species.

The nearest relative of *Hicksbeachia* is likely to be the subtribe Gevuiniinae or any genus, or a combination of genera, in the subtribe Hicksbeachiinae, or all of the above-mentioned taxa (Johnson & Briggs 1975). The Gevuiniinae and Hicksbeachiinae appear to form a clade characterised by the synapomorphous chromosome number of $n = 13$, reduced from $n = 14$, which is ancestral for the Macadamieae (Johnson & Briggs 1975).

Hicksbeachia is characterised by several likely synapomorphies. The cotyledons become prominently pilose after germination commences, a character that is otherwise unknown in the Macadamieae (unpublished observations).

Turrillia lutea has minutely pubescent cotyledons but this condition is unlikely, on morphological grounds, to be homologous with the pilose cotyledons of *Hicksbeachia*. The pronounced cauliflory of *Hicksbeachia* is likely to be a synapomorphy for the genus though several closely related genera such as *Virotia*, *Athertonia* and *Gevuina* exhibit ramiflory to some extent. The pattern of dissection of intermediate leaves in *Hicksbeachia* (see below) is different to that in all other genera of Macadamieae though the leaves of *Gevuina bleasdalei* and *G. papuana* approach it. The cladistic generality of this feature is unclear at present: the pinnatifid intermediate leaves of *Athertonia*, for example, could be a further derivation of it.

While a few specimens of *H. pilosa* have truly pinnate leaves (Fig. 1a), the majority of specimens of both species have what I have termed pinnate-pinnatifid leaves (Fig. 1b). In this latter condition the leaf is pinnate at the base and the pinnae there are shortly petiolulate. The leaf rachis may or may not be winged between the two most basal pairs of pinnae. More distally, the pinnae are replaced by pinnatisect lobes in which the serial homologue of each pinna is fused with the rachis wing immediately below it. The leaf tip is deeply pinnatifid, that is each pinna homologue is fused to the homologues of both adjacent rachis wings. The rachis wings and their homologues are much more strongly developed in *H. pinnatifolia* than in *H. pilosa*.

Several authors and collectors (e.g. Maiden 1917; Floyd 1978, letter in NSW; Lander specimen 324; B. Hyland pers. comm.) have reported or noted flowers of both species to emit a pungent odour, resembling honey, sour milk, mice or cat's urine, particularly around dusk. This prompted Floyd (letter in NSW) to speculate that the (unknown) pollination vectors might be moths. Johnson and Briggs (1975) suggest that some rainforest Grevilleoid genera with pendulous conflorescences, including *Hicksbeachia*, may be pollinated by fruit bats. *Hicksbeachia*, however, does not obviously fit any of the pollination syndromes described by Faegri & van der Pijl (1966).

Strohschen (1986) provides a detailed account of fruit and seed development in *H. pinnatifolia*. She classifies the fruit as a transitional stage between a follicle and nut.

Hicksbeachia F. Muell. (1883: 33)

Maiden (1917: 235–239); Johnson & Briggs (1975: 134–135); Floyd (1978: 20–21).

TYPE SPECIES: *Hicksbeachia pinnatifolia* F. Muell.

Small rainforest trees to 15 m, usually with one or a few unbranched stems arising from ground level; leaves restricted to near the tips of the stems. *Seedling leaves* simple, serrate to lacinate, acuminate, shortly petiolate with a prominent rounded base, with semicraspedodromous venation (Hickey 1973); first pair of seedling leaves opposite, ovate to elliptical; following seedling leaves alternate, progressively more narrow-obovate and with an increasing length/width ratio; intermediate leaves serrate to lacinate, pinnatifid to pinnate-pinnatifid, oblanceolate in general outline. *Adult leaves* alternate, pinnate to pinnate-pinnatifid with a winged rachis, serrate, narrow-obovate in general outline; pinnae oblong to narrow-oblong or sometimes ovate to narrow-ovate, acuminate, with strongly oblique bases, occasionally the most basal pinnae being trilobed to trifoliolate; venation of wings, lobes and pinnae

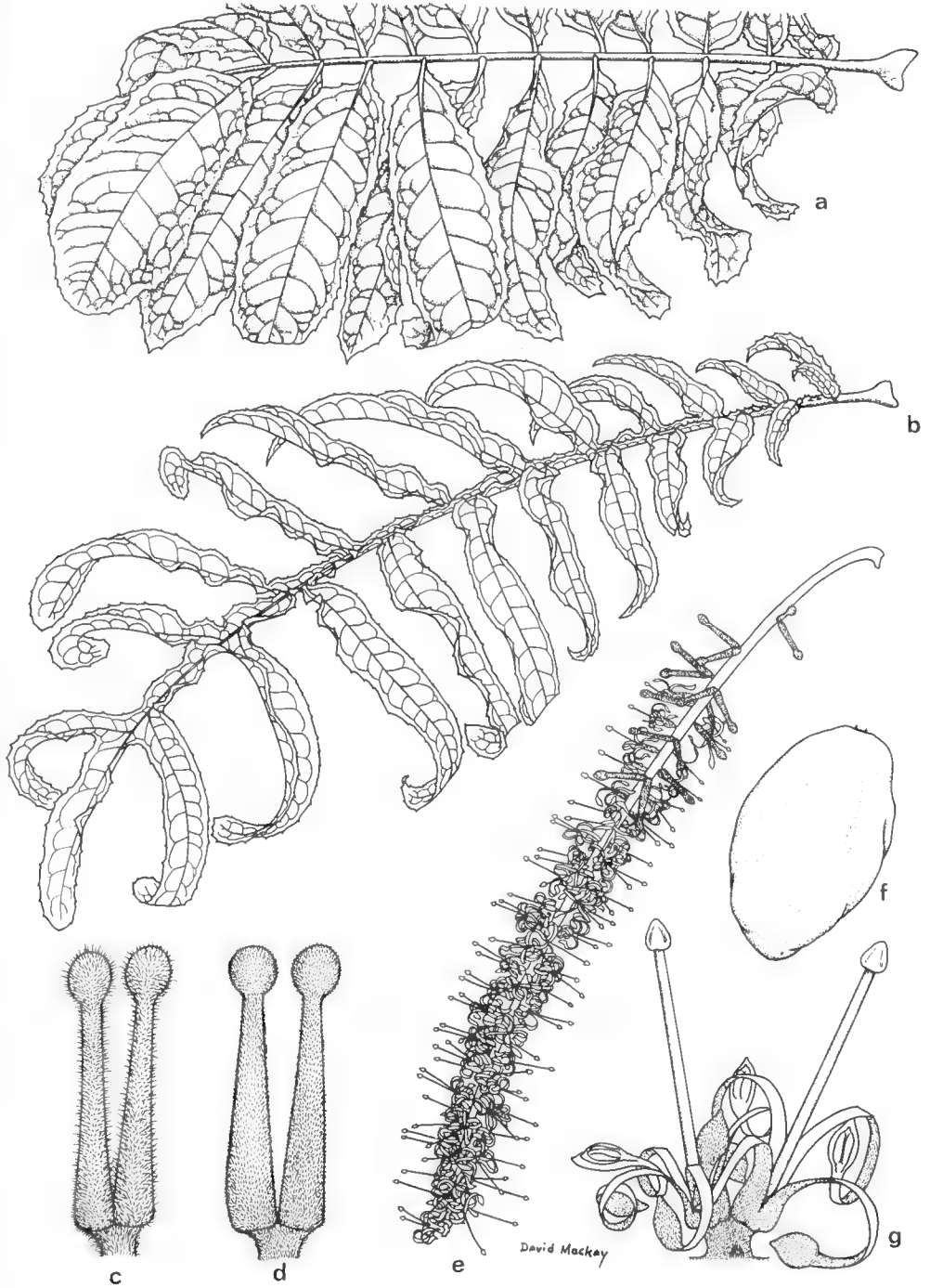


Fig. 1. a, adult leaf of *H. pilosa* ($\times \frac{1}{4}$). b, adult leaf of *H. pinnatifolia* ($\times \frac{1}{4}$). c, uniflorescence of flower buds of *H. pilosa* ($\times 3$). d, uniflorescence of flower buds of *H. pinnatifolia* ($\times 3$). e, conflorescence of *H. pinnatifolia* ($\times \frac{1}{2}$). f, fruit of *H. pinnatifolia* ($\times 1$). g, uniflorescence of flowers of *H. pinnatifolia* ($\times 3$). (Drawn from Hyland 6767 (a), Thorne, Jones & Tracey NSW 130729 (b), du Rietz 4340 (c), and fresh material cultivated at the Royal Botanic Gardens, Sydney — voucher Coveny 10187 (d–g).)

semicraspedodromous; leaf bases prominent, rounded. *Conflorescences* axillary, cauliflorous, pendulous, unbranched; flower pairs borne on short but distinct uniflorescence axes, bracteate. *Flowers* ebracteate, sessile to pedicellate, hermaphrodite, actinomorphic; floral orientation antero-posterior. Tepals not coherent, revolute. Staminal filaments almost completely adnate to the tepals; anthers free, oblong, apiculate. Hypogynous glands 4, free, fleshy, truncate, square in dorsal view, \pm triangular in cross-section. Ovary sessile. Style filiform, terminated by the ovoid pollen-presenter. Stigma terminal. *Fruit* ellipsoid to ovoid, indehiscent, with a prominent ventral suture at maturity, dehiscing along the ventral suture and dorsally on germination; outer mesocarp succulent, traversed by radially oriented fibres; inner mesocarp bony, consisting of closely packed, tangentially oriented, fibre-capped vascular bundles and lignified parenchyma. *Seed* solitary, wingless, fleshy; testa thin and papery. *Embryo* ellipsoidal, lacking endosperm; cotyledons 2 or rarely 3, hemi-ellipsoidal, white and glabrous before germination, green spotted with purple, shortly auriculate, hypogeal to scarcely epigeal, pilose after germination. $n = 13$ (Johnson & Briggs 1975: 169).

A genus of at least 2 species, endemic to eastern Australia. The embryo is an edible 'nut'.

Key to the species

1 Conflorescences and young shoots pubescent; leaves coriaceous; leaf rachis prominently winged throughout.

1. *H. pinnatifolia*

1* Conflorescences and young shoots pilose; leaves chartaceous; leaf rachis prominently winged only towards the tip.

2. *H. pilosa*

1. *Hicksbeachia pinnatifolia* F. Muell. (1883: 33); Bailey (1901: 1333–1334); Maiden (1917: 235–239); Floyd (1978: 20–21).

TYPE: NEW SOUTH WALES: near the Tweed. *C. Fawcett s.n.*; not found. The only material of *Hicksbeachia pinnatifolia* held by MEL, annotated by Mueller, precisely dated and agreeing with the protologue was collected by Fawcett a month or two after the publication of this name. No type material has been located elsewhere. There is, however, no doubt as to the correct application of this name. The type locality and Mueller's description of the leaves ('leaflets decurrent along the rachis'; 'of rigid texture'), conflorescence axes ('somewhat silky') and tepals ('outside slightly silky') are consistent only with the species from south-eastern Australia.

ILLUSTRATIONS: M. Flockton in Maiden (1917: pl. 222); E.R. Rotherham in Rotherham *et al.* (1975: figs. 330–331).

First internode and pair of seedling leaves moderately pilose when immature, glabrescent with age; later developed seedling leaves and internodes progressively more ferruginous-pubescent when immature. Adult branchlets moderately to densely ferruginous-pubescent when young, glabrescent with age. Adult leaves coriaceous, 34–90 cm long, pinnate-pinnatifid with 10–35 lobes and pinnae; rachis prominently winged throughout; pinnae 2–24; pinnatisect lobes 0–13; pinnatifid lobes 2–9; lobes and pinnae usually prominently recurved towards the tips, otherwise flat to concave, with flat to scarcely recurved and often sinuate margins, usually not bullate; largest pinnae 14–40 cm long, 2.5–5.5(–7) cm wide; secondary and tertiary veins prominently raised on both

surfaces. Conflorescence axes 14–50 cm long, densely ferruginous-pubescent; flower pair bracts 0.3–1 mm long; uniflorescence axes 0.3–3 mm long. Pedicels 0–1.5 mm long. Tepals 15–20 mm long, moderately ferruginous-pubescent, maroon outside, cream to pink inside. Gynoecium 14–19 mm long, maroon; ovary densely hairy. Fruit pinkish red to scarlet, 30–50 mm long, 20–28 mm wide. Fig. 1.

VARIATION: variation within regional populations seems to be about the same as that between them.

FLOWERING PERIOD: sporadically throughout the year but mainly from August to October.

NOTE: *H. pinnatifolia* often regenerates prolifically after felling by suckering from the base; it may be lignotuberous.

DISTRIBUTION: Occurs from Tambourine Mountain, south-eastern Queensland, to the Nambucca Valley of north-eastern New South Wales; in, and on the margins of, subtropical rainforest, from near sea level to 700 metres altitude. Fig. 2.

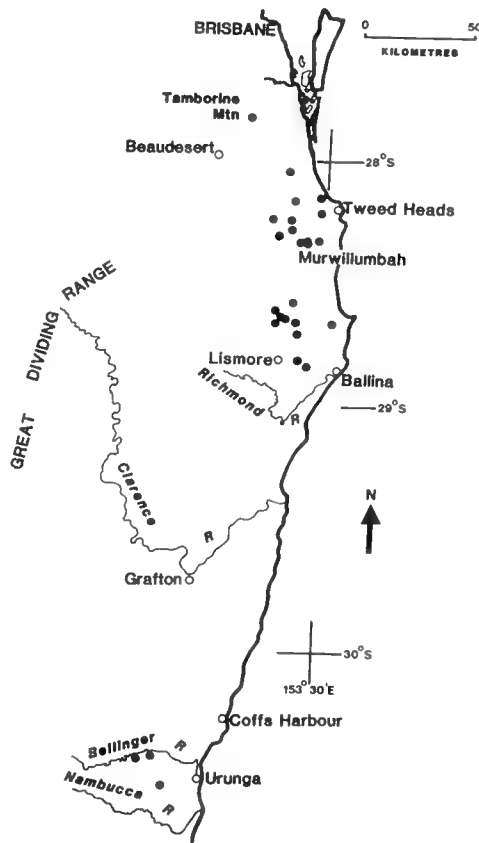


Fig. 2. Distribution of *H. pinnatifolia*.

NUMBER OF COLLECTIONS EXAMINED: 37.

SELECTED SPECIMENS: NEW SOUTH WALES: **North Coast:** Tweed River, *Fawcett s.n.* 3.1883 (MEL 109015); 17.6 km NNE of Lismore, 0.8 km past the Rocky Creek turnoff, 28°39'S 153°21'E, *Coveny 4440 & Rodd*, 3.9.1972 (BRI, NSW, QRS); Duroby Creek, on Bilambil-North Tumbulgum road, at falls, 28°15'S 153°27'E, *Lander 324*, 30.8.1973 (BRI, NSW); Kennaicke Ck road, 4.6 km from Missabotti, 30°32'S 152°49'E, *Weston 1077, Hill & Johnson*, 17.10.1987 (AK, BRI, CBG, K, MEL, MO, NSW, QRS).

QUEENSLAND: **Moreton:** upper Currumbin Creek, *White 6409*, 6.11.1929 (BRI).

2. *Hicksbeachia pilosa* P. Weston, sp. nov.

Differt a *H. pinnatifolia* surculis immaturis ferrugineopilosis, foliis chartaceis plerumque bullatis, rhachidi folii prominenter alata tantum versus apicem, conflorescentiis ferrugineopilosis, tepalis malvinis ad purpuratis.

HOLOTYPE: QUEENSLAND: **Cook:** Bobbin Bobbin Falls, 17°22'S 145°46'E, *P.H. Weston 959, G. Sankowsky & P. Hind*, 23.8.1986 (NSW — 5 sheets). ISOTYPES: BRI, QRS.

Seedling internodes and leaves moderately pilose when immature, glabrescent with age; seedling leaves 7–15. Adult branchlets moderately to densely ferruginous-pilose when young, glabrescent with age. Adult leaves moderately ferruginous-pilose when immature, glabrescent or retaining hairs only on the rachis and around the main veins when mature, chartaceous, (35–)54–90 cm long, pinnate to pinnate-pinnatifid with 7–32 lobes and pinnae; rachis prominently winged only towards the tip; pinnae 3–28; pinnatisect lobes 0–14; pinnatifid lobes 0–5; lobes and pinnae not recurved to moderately recurved towards the tips, convex with moderately to prominently recurved but scarcely sinuate margins, usually prominently bullate between the secondary and tertiary veins; largest pinnae (11–)18–34 cm long, (2.5–)4.5–8.5(–10) cm wide; secondary and tertiary veins prominently raised on the abaxial surface, usually only slightly raised on the adaxial surface. Conflorescence axes 15–30(–56) cm long, densely ferruginous-pilose; flower pair bracts 0.3–1 mm long; uniflorescence axes 0.3–3 mm long. Pedicels 0–1.5 mm long. Tepals 19–23 mm long, moderately ferruginous-pilose, mauve to deep purple. Gynoecium 18–23 mm long, mauve to deep purple with an orange pollen-presenter; ovary densely hairy. Fruit orange to scarlet, 40–47 mm long, 26–30 mm wide. Fig. 1.

The specific epithet refers to the pilose indumentum of the young shoots and conflorescences.

VARIATION: *H. pilosa* is much more variable over its range than *H. pinnatifolia*, though this could reflect the presence of more than one species within my current concept of *H. pilosa*. The only group of populations that I have seen in the field are on the western side of Mt Bartle Frere and nearby at Boonjee Logging Area. The flowers in these populations are mauve, the fruits scarlet and the conflorescences 15–30 cm long. Other regional variants are characterised below.

(i) *Big Tableland–Cedar Bay (Hyland 6784, Dick s.n.)*. These specimens have smaller, less bullate leaves than most other specimens. Flowers are stated to be 'purple'. Fruits have not been collected but Dick noted them to be 'brownish yellow and corrugated'.

(ii) *Noah Creek (Hyland 7034)*. This specimen has smaller, slightly coarser, less bullate leaves than most other specimens. Flowers and fruits are unknown.

(iii) *Stewart Creek* (Smith 4040, Sankowsky 566). Conflorences are much longer (35–56 cm) than in other specimens (15–30 cm). G. Sankowsky (pers. comm.) confirms the large conflorences in this population and notes also that the leaves are very large, the flowers are deep purple with an orange pollen-presenter and the fruits are orange.

(iv) *Mossman–Julatten* (Gray 1458, Carr 2). Flowers are of a similar colour to those of the Stewart Creek population but conflorences are an average size. Fruits are unknown.

The only specimen from the eastern side of the Bellenden Ker Range (Flecker *s.n.*, 29.8.1949) apparently resembles most closely those from the Mossman–Julatten area. Its flowers are noted as having a 'purple and orange colour'. Fruits from this population are unknown. Herbarium specimens from the Tully–Cardwell Range area are indistinguishable from those from the western side of Mt Bartle Frere but flower colour and fruits are unknown.

FLOWERING PERIOD: June to November.

DISTRIBUTION: Occurs from The Big Tableland to the Cardwell Range, north-eastern Queensland; in rainforest, from near sea level to 400 metres altitude. Fig. 3.

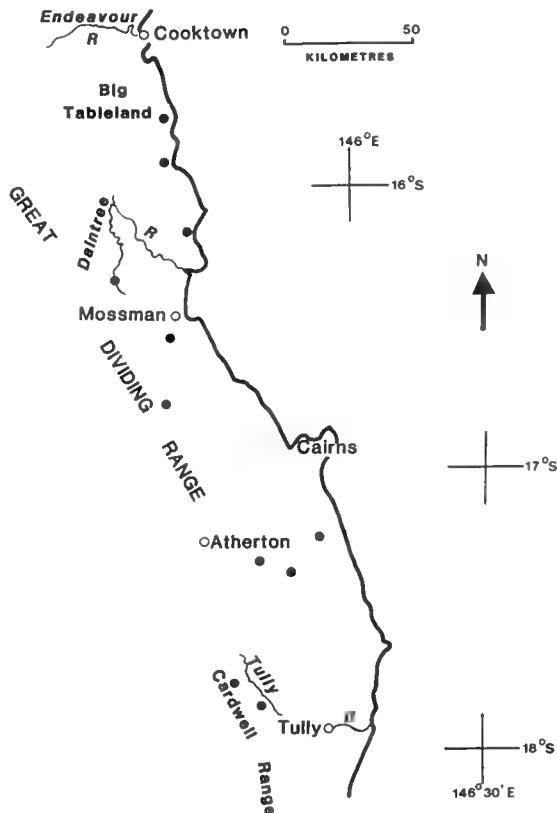


Fig. 3. Distribution of *H. pilosa*.

SPECIMENS EXAMINED: QUEENSLAND: Cook: Timber Reserve 146 Home Rule Logging Area, 15°45'S 145°20'E, *Hyland 6784*, 26.7.1973 (QRS); Cedar Bay, *Dick s.n.*, 12.1969 (BRI); V.C.L. Noah (near Noah Creek), 16°10'S 145°25'E, *Hyland 7034*, 7.11.1973 (QRS); Stewart Creek, *Smith 4040*, 8.9.1948 (BRI); Stewart Creek, 16°18.6'S 145°18.7'E, *Sankowsky 566*, 11.1986 (NSW); State Forest Reserve 143, Little Mossman Logging Area, 16°32'S 145°22'E, *Gray 1458*, 6.6.1979 (QRS); Julatten, Rumula, *Carr 2*, 4.1932 (BRI); Harveys Creek, *Flecker s.n.*, 29.8.1949 (BRI); cultivated, Atherton from seed collected from State Forest Reserve 310, Windin Logging Area, *Hyland 6767*, 20.7.1973 (NSW, QRS), *Hyland 9762*, 27.9.1978 (NSW, QRS); Bobbin Bobbin Falls, 17°22'S 145°46'E, *Weston 959a*, *Sankowsky & Hind*, 23.8.1986 (BRI, NSW); Mt Bartle Frere above Bobbin Bobbin Falls, *du Rietz 4340*, 8.1927 (BRI); Mt Kooroomool, Cardwell Range, *Flecker s.n.*, 12.11.1949 (QRS); Tully Falls, *Fielding s.n.*, 8.1949 (NSW).

Excluded species

Hicksbeachia diversifolia (C. White) Sleumer (1955: 6).

BASIONYM: *Helicia diversifolia* C. White (1918: 18).

HOLOTYPE: 'Atherton district, *H. W. Mocatta*' (BRI).

= *Athertonia diversifolia* (C. White) L. Johnson & B. Briggs (1975: 176).

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A revision of *Hoya* (Asclepiadaceae) in Australia

K.D. Hill

Abstract

Hill, K.D. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1988. A revision of *Hoya* (Asclepiadaceae) in Australia. *Telopea* 3(2): 241–255. — Australian representatives of the genus *Hoya* R. Br. (Asclepiadaceae) are reviewed. Three new species are described, one with two subspecies (*H. alata*, *H. rupicola*, *H. oligotricha*, *H. oligotricha* ssp. *tenuipes*); *H. sana* is reduced to subspecific status within *H. australis*; and *H. keysii* and *H. dalrympleana* are included in *H. australis* ssp. *australis*. A review of infrageneric division of *Hoya* is presented with reference to Australian species. Description of a further Australian species in a new genus is foreshadowed.

Introduction

Hoya is a predominantly South-East Asian genus of about 200 species, distributed from India, southern China and Japan through Indochina and Malesia to northern and eastern Australia and the south-west Pacific Islands. The taxonomy of the group is confused, with over 500 published names, many with inadequate (although valid) descriptions and incomplete types. Recent studies by Backer & Bakhuizen (1965) and Rintz (1978) have contributed some order to the Javanese and Malaysian representatives of the genus, but such regional works do not address the problem of the numerous different names existing in neighbouring areas for possibly identical species. Problems at generic and infrageneric levels also have not been resolved by regional studies.

Nomenclature in Papua New Guinea and the South Pacific remains chaotic, with a plethora of names, many of which have not been applied beyond the type specimen.

One group of taxa, represented in Australia by a single undescribed species, differs markedly in a range of key diagnostic characters from *Hoya sens. strict.* A study of *Hoya* and related genera has led to the removal of this group to a new genus (*Eriostemma* (Schltr.) K. Hill, Hill in prep.). The remaining species of *Hoya* in Australia are part of a clearly defined and natural group.

Hoya apparently reaches maximum diversity in New Guinea. The Australian species have arisen from sporadic dispersals from New Guinea, and represent several divergent lineages within the genus. Consequently, they are not particularly closely related to each other. The group has not diversified or dispersed extensively in Australia, and a number of species are restricted to Cape York. The limited botanical exploration of this area has meant that several of the Australian taxa have remained undiscovered until recently, and hence are undescribed.

The present study concerns the Australian representatives only. The Malesian and Pacific collections of LAE and CANB have been examined, and it has been established that the species herein described as new are not represented in those collections. Future studies may, however, establish that

these taxa occur outside Australia and do have earlier names. In the absence of resources to monograph the entire genus, a delimitation of the Australian species only is considered desirable and expedient. This will draw attention to these taxa, ensuring treatment in any future monographic study and consideration in relevant ecological, land use and conservation studies. The latter considerations in themselves justify the production of an interim study as part of an overall cataloguing of the biological resources of Australia.

This study is based on examination of living and preserved materials. All taxa have been studied as populations in the field. Herbarium collections from NSW, BRI, MEL, PERTH, CANB, CBG and LAE have been examined, including dried and spirit-preserved material. All types have been seen, unless otherwise indicated. A comprehensive living collection of all Australian taxa is maintained by the Royal Botanic Gardens, Sydney, and this collection has been studied in detail. Specimens marked '+' in the specimen citations are vouchers taken from cultivated specimens in this collection.

Taxonomic history

Hoya was described by Robert Brown (1810), although plants of the genus were known from well before that time (e.g. Rumphius 1749). Brown described two species, one of which has since been placed in another genus (*Hoya viridiflora* R. Br., = *Dregea volubilis* (L.f.) Benth. ex Hook. f.). The other was based on *Asclepias carnososa* L.f., with the cited locality in the original protologue of 'Habitat in China'. In his enlarged circumscription of *Hoya carnososa*, Brown included several taxa distributed from China to Australia, and noted that he thought a number of species might be involved. The first Australian species recognized was *H. australis*, which was separated from *H. carnososa* by Traill (1830), based on material collected by Banks and Solander in 1770 at the sites of Cooktown and Cairns (Britten 1898). This taxon had been distinguished by Brown, who had annotated herbarium sheets with the name but not published it. The same taxon was subsequently described (as *H. dalrympleana* F. Muell. and *H. keysii* Bailey) by other authors who thought that the name *H. australis* represented the common species in New South Wales and southern Queensland. The next Australian species was recognized by Mueller, who described *H. nicholsoniae* in 1866. Bentham (1869) recognized three taxa in 'Flora Australiensis'. These were *H. nicholsoniae*, *H. australis* (in which he included all species of the *H. australis* complex known at that time) and *H. carnososa* (erroneously — see discussion under that name). Subsequent treatments of the genus in Australia were largely abstracted from Bentham with some additions (e.g. Bailey described *H. keysii* in 1884 and *H. sana* in 1897). The most recent addition was *H. macgillivrayi*, described by Bailey in 1913.

Comparative morphology

Habit

Plants are usually climbers with long internodes and glabrous or hairy stems. Some extra-Australian species are secondarily shrubby, with short internodes. Climbing is by means of twining stems, 'anchor' leaves (see below) and short, branched adventitious roots. Many species germinate terrestrially and climb into trees, eventually losing contact with the original root system and becoming wholly epiphytic.

Plants of the *H. australis* complex display a dimorphic growth habit. Young plants have short internodes and are basally branched, to produce a multi-stemmed shrubby plant. Plants may remain as such in extremely harsh conditions, and reach full maturity as shrubs. In favourable conditions, the short shoots produce extended shoots apically, with long internodes and a twining habit. These vine growths take root by means of adventitious roots where they come in contact with suitable substrates, generating shrubby plants which repeat the cycle. Plants may thus vegetatively propagate to cover wide areas.

Leaves

Leaves are opposite and decussate, glabrous or hairy, and highly variable in size, shape and venation. Hairs are simple or uniseriate, thin-walled and sharp-pointed, and vary in size and degree of appression. Texture varies from moderately to extremely succulent, depending somewhat on the habitat. A group of possibly nectariferous glands is characteristically present at the junction of the petiole and the lamina.

Mesophyll varies from undifferentiated through weakly differentiated to strongly differentiated, with a gradual transition from palisade to spongy tissue in the differentiated types. Sclerenchymatous mesophyll fibres are usually present, and vary in abundance, length and wall thickness.

Leaves of some groups are distinctively spotted silver, grey or pale green due to irregularly concentrated chromoplasts in cells immediately underlying the adaxial epidermal cells. Primary venation may be brochidodromous (broadly pinnate with a looped intramarginal vein), or acrodromous (with three, five or seven principal veins arising near the junction of lamina and petiole). In many cases, petioles are held at right angles to the stem, and the leaf lamina is reflexed a further 90 degrees to the petiole. This structure creates an 'anchor' effect, by which the developing leaf pairs are entrapped in surrounding vegetation, and hence contributes to the climbing habit.

Inflorescences

Inflorescences are 'interpetiolar' (representing terminal shoots in a modified sympodial growth habit — see Demeter 1922), and are consequently produced only at the tips of actively growing branches. They are indeterminate and perennial, modified pseudo-monochasial cymes. Numerous successive flushes of flowers are produced over a number of years, during which time the rhachis continues to elongate (a few extra-Australian species have secondarily short-lived umbelliform inflorescences). Each flush of flowers appears as an umbel, due to extreme reduction of the penultimate floral internode. Individual flowers become apparently spirally inserted on the rhachis or on a short side-shoot on the rhachis as a consequence of this reduction.

Three types of inflorescence may be recognized:

1. Umbel globular with equal pedicels; ageotropic.
2. Umbel flat or concave, with pedicels longer to the outside; positively geotropic.
3. Umbel flat, with pedicels longer to the outside and rigidly erect; negatively geotropic.

Types 1 and 2 occur amongst the Australian species.

Flowers

Flowers are 5-merous and radially symmetrical, with valvate aestivation. Sepals are free, often with minute basal glands inserted either on the sepal margins or on the floral axis between the calyx and the corolla. The corolla is basally connate, glabrous or hairy, and may be campanulate or reflexed with the lobes further recurved. The corona is staminal in origin, usually large and prominent, and highly variable in shape and orientation. Each scale, which is derived from the staminal filament, has two proximal lobes or keels. These are inrolled to create a cavity (Fig. 1). Anthers are basally cleft, with lobes lying on either side of the filamental scale, and apically produced into a membranous wing which lies over the stigma. Pollen sac contents are fused into pollinia, and adjacent sacs of contiguous anthers are joined by caudicles to a corpuscle (Fig. 1). The caudicles and corpuscle are non-cellular, and generated by stigmatic secretion. Pollinia are erect and winged, the wings being composed of sterile pollen grains. Caudicles may or may not be winged.

Infrageneric classification

Within the Asclepiadaceae, *Hoya* is placed in the Tribe Tylophoreae, subfamily Asclepiadoideae. A subtribe Marsdeniineae has been recognized in the past, but this is defined by primitive characters (symplesiomorphies) of no grouping value. At this level, several groupings may be delineated on advanced characters (synapomorphies). One group is the *Hoya* 'alliance', characterized by valvate floral aestivation, a large staminal corona, shortly stalked pollinia and a flat, deeply lobed corolla. Within this group *Hoya* is defined by perennial but sometimes secondarily short-lived inflorescences; winged pollinia; linear fruit with limited pericarp; and deep, inrolled coronal keels.

A number of systems of infrageneric classification have been proposed in the past, but these have been largely incomplete. As with many such systems, several groups with distinctive advanced or primitive characters are established, and a large, amorphous remainder (paraphyletic residue) relegated to a category of convenience. Schlechter (1913) recognized seven Sections (based in part on Schumann, 1885) for the 50 species he recorded in German New Guinea, 25 of which fell into the residual Section 'Euhoya'.

A full revision of infrageneric classification is beyond the scope of this study, so Sections recognized by Schlechter (op. cit.) will be accepted with some modification. Sections present in Australia are as follows:

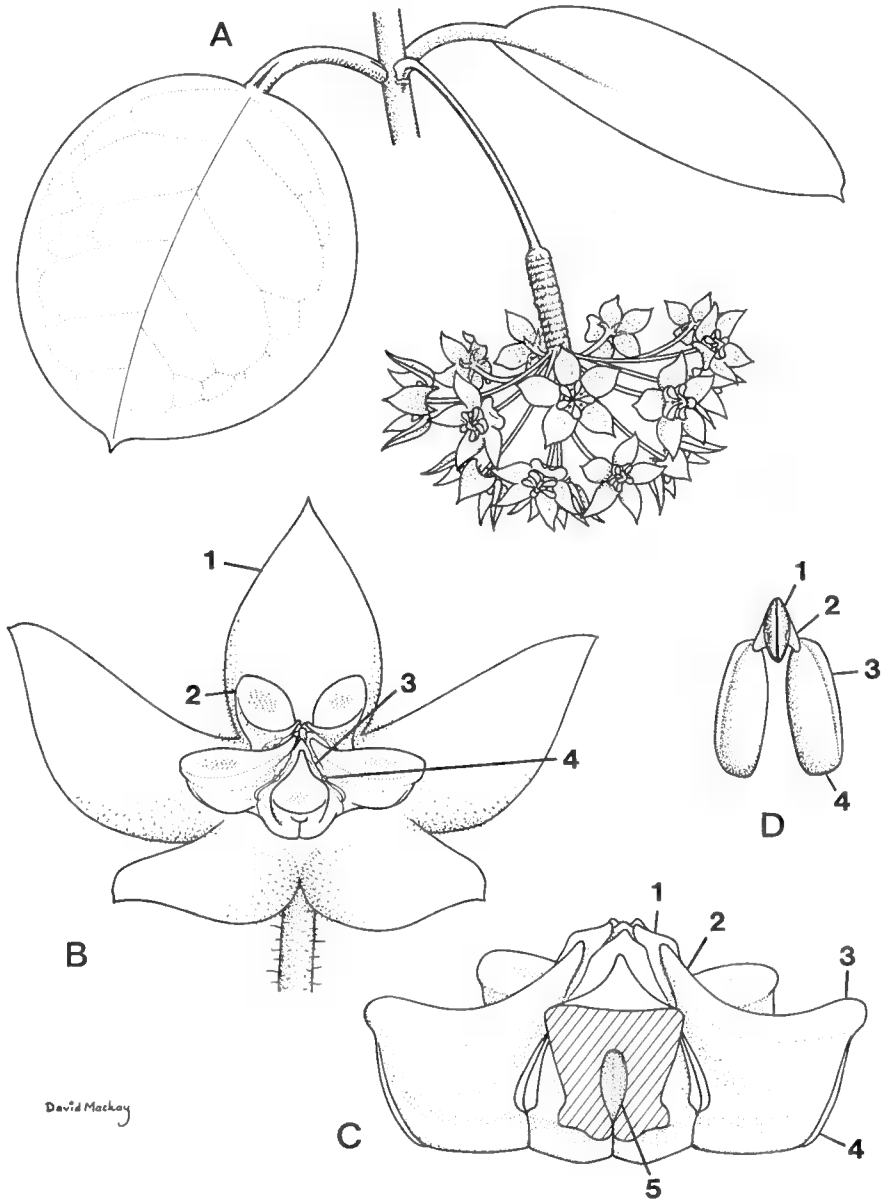
- 1) *Hoya* (in part *Euhoya* Miq., Fl. Ned. Ind. 2: 516 (1857), as treated by Schlechter).

Peduncles ageotropic. Pedicels equal. Corolla reflexed. Coronal scales narrowly to broadly trapezoidal, flat above with a slight median ridge, inner and outer angles acute. Caudicles unwinged. Mesophyll weakly differentiated or undifferentiated. Epidermal spotting often present (diffuse or sometimes absent in some Australian plants).

A large and widespread group, extending from China to the South Pacific. One species in Australia (*H. nicholsoniae*).

- 2) *Physostelma* (Wight) Schltr., Bot. Jahrb. Syst. 50: 105 (1913).

Peduncles ageotropic. Pedicels equal. Corolla campanulate. Coronal scales



David Mackay

Fig. 1. *Hoya australis* R. Br. ex Traill subsp. *australis*. **A**, habit (X .8): showing interpetiolar inflorescence, elongated rhachis with scars from previous flowerings, and rounded umbel with equal pedicels. **B**, flower (X 4): 1. Corolla lobe. 2. Corona scale. 3. Position of pollinia. 4. Corpuscle. **C**, corona (X 11): 1. Membranous apical anther wing. 2. Inner angle of corona scale. 3. Outer angle of corona scale. 4. Keel of corona scale. 5. Transverse section of scale, showing cavity enclosed by keels. **D**, pollinarium (X 23): 1. Corpuscle. 2. Caudicle. 3. Sterile wing. 4. Fertile body of pollinium. (From *P. Hind* 244.)

oblong-linear, rounded above, inner angle acute, produced forward, outer angle rounded, produced forward. Caudicles unwinged. Mesophyll strongly differentiated. Epidermal spotting absent.

A small group, distributed from Malaysia and the Philippines to the South Pacific. One species in Australia (*H. macgillivrayi*).

3) *Otostemma* (Bl.) Miq., Fl. Ned. Ind. 2: 525 (1857) (here including part of 'Euhoya' of Schlechter).

Peduncles geotropic. Pedicels unequal. Corolla reflexed. Coronal scales narrowly trapezoidal, flat above with a slight median ridge, inner and outer angles acute, inner angle somewhat raised. Caudicles winged. Mesophyll weakly differentiated. Mesophyll fibres abundant, long, thick-walled. Epidermal spotting present.

A small group with a similar range to the above. One species in Australia (*H. alata*).

4) *Pterostelma* (Wight) K. Schum., Nat. Pflanzenf. 4(2): 289 (1895) (in part as treated by Schlechter, and including the *H. australis* complex, which that author included in 'Euhoya').

Peduncles ageotropic. Pedicels equal. Corolla campanulate. Coronal scales ovate, concave above, inner angle apiculate, outer angle rounded. Caudicles unwinged. Mesophyll differentiated. Epidermal spotting absent.

A small group, centred on Australia and the South Pacific, with one species extending to Indochina. Four species and 3 subspecies in Australia (the *H. australis* complex).

Key to the sections

- 1 Caudicles winged, pedicels unequal Section **Otostemma**
- 1* Caudicles not winged, pedicels equal
 - 2 Corolla reflexed Section **Hoya**
 - 2* Corolla campanulate
 - 3 Corona scales oblong-linear, convex above, inner angle produced forward Section **Physostelma**
 - 3* Corona scales ovate, concave above, flat, inner and outer angles more or less level Section **Pterostelma**

Taxonomy

Hoya R. Br., Mem. Wern. Nat. Hist. Soc. 1: 27 (1810)

TYPE: *H. carnos*a R. Br.

Sperlingia Vahl, Act. Hafn. 6: 113 (1810)

TYPE: *S. verticillata* Vahl (*Hoya verticillata* (Vahl) G. Don)

Schollia Jacq. f., Ecl. Pl. Rar. 1: 5, t. 2 (1811)

TYPE: *S. crassifolia* Jacq. f. (*Hoya carnos*a R. Br.)

Pterostelma Wight, Contrib.: 39 (1834)

TYPE: *P. acuminata* Wight (*Hoya acuminata* (Wight) Benth.)

Physostelma Wight, op. cit.: 40

TYPE: *P. wallichii* Wight (*Hoya campanulata* Bl.)

Cyrtoceras Benn., Pl. Jav. Rar.: 90, t. 21 (1838)

TYPE: *C. reflexum* Benn. (*Hoya multiflora* Bl.)

Centrostemma Decne., Ann. Sci. Nat. (Paris) ser. 2(9): 271, t. 12 (1838)

TYPE: *multiflorum* (Bl.) Decne. (*Hoya multiflora* Bl.)

Cystidanthus Hassk. in Hoen. & de Vriese, Tijdschr. Natuurl. Gesch. Physiol. 10: 125 (1843)

TYPE: *C. campanulatus* (Bl.) Hassk. (*Hoya campanulata* Bl.)

Acanthostemma Bl., Mus. Bot. 1: 57, t. 10 (1850)

TYPE: *A. rumphii* (Bl.) Bl. (*Hoya rumphii* Bl.)

Cathetostemma Bl., op. cit.: 59, t. 13

TYPE: *C. laurifolium* (Decne.) Bl. (*Hoya laurifolia* Decne.)

Otostemma Bl., op. cit.: t. 11

TYPE: *O. lacunosum* (Bl.) Bl. (*Hoya lacunosa* Bl.)

Plocostemma Bl., Rumphia 4: 30 (1849)

TYPE: *P. lasiantha* Korth. ex Bl. (*Hoya lasiantha* (Korth. ex Bl.) Miq.)

[*Triacma* van Hass. ex Miq., Fl. Ned. Ind. 2: 523 (1857), in syn., nom. nud. (= *Sperlingia* Vahl)]

Glabrous or tomentose shrubs or twiners, terrestrial or epiphytic, with short or long internodes. White or clear latex present in all parts except flowers. Leaves succulent, opposite, decussate, with broadly pinnate or palmate, sometimes indistinct, primary venation; secondary venation reticulate. Inflorescences ageotropic or geotropic, pseudo-monochasial, perennial (short-lived in some extra-Australian species), interpetiolar (modified terminal), producing successive flushes of spirally inserted flowers in umbels. Pedicels unequal and forming a flat inflorescence, or equal and forming a globular inflorescence. Sepals free. Corolla connate, broad, campanulate or recurved, glabrous or puberulous, deeply lobed. Corona staminal, of variable shape and orientation, usually large and prominent; each scale with parallel, inrolled keels meeting beneath to create a cavity. Pollinia erect, oblong, winged on one side. Caudicles short, naked or winged. Corpuscle dark brown or black, triangular. Ovary superior, of two free carpels which are united at the stigma. Placentation axile, multiseriate on a single adaxial placenta. Fruit a linear follicle (rarely paired, one ovary usually aborting), adaxially dehiscent. Seeds oblong, with a multistranded silky coma.

Key to the species

- 1 Flowers more than 3.5 cm diam., red or purple **1. *H. macgillivrayi***
- 1* Flowers less than 3.0 cm diam., white, pink or yellow
 - 2 Venation acrodromous, leaves distinctly 3-veined above **2. *H. nicholsoniae***
 - 2* Venation not distinctly acrodromous
 - 3 Pedicels unequal; venation obscurely subparallel without a distinct midrib **3. *H. alata***
 - 3* Pedicels equal; venation pinnate or with a distinct midrib if obscure
 - 4 Leaves abaxially densely tomentose, with patent hairs **4. *H. australis***
 - 4* Leaves abaxially not densely patently tomentose

- 5 Leaves finely appressed silky-hairy; sepals projecting beyond corolla sinuses **5. *H. rupicola***
- 5* Leaves glabrous or with widely scattered erect hairs; sepals not projecting beyond corolla sinuses **6. *H. oligotricha***

Section *Physostelma*

1. *Hoya macgillivrayi* Bailey, Queensland Agric. J. n.s. 1: 190, fig. 14 (1914).

TYPE CITATION: 'Hab.: Claudie River, Lloyd Bay, *Dr. W. Macgillivray*'. HOLOTYPE: BRI.

A glabrous, twining epiphyte, rarely lithophytic or terrestrial. Leaves fleshy to coriaceous, broad-ovate to ovate, long-acute, cordate, broadly pinnately veined, shallowly concave above, 7–18 cm long, 3.5–8.0 cm wide; petioles 1.0–3.0 cm long, 3–7 mm diam. Peduncles 4–11 cm long, slender. Pedicels 6–10 cm long, slender. Umbels 4–15 flowered. Sepals broadly triangular, 2–4 mm long. Corolla campanulate, purple or reddish brown, often with white patches towards the centre, 3.5–8.5 cm diam. Corona to 1.2 cm diam., purple; segments oblong-linear, 4.5–6 mm long, 1–2 mm wide, convex above, with two longitudinal, inrolled keels extending the full length below, inner angle sharply raised, outer angle raised. Fruit 15–19 cm long, 1.2–1.5 cm diam.

Endemic in Queensland, occurring in the McIlraith and Iron Ranges of central Cape York Peninsula in dense monsoon rainforests.

SELECTED SPECIMENS: QUEENSLAND: Leo Creek road, *B.P.M. Hyland* 6378, 20.4.1972 (BRI, LAE, NSW); Massey Ck, *K. Hill & B. Wallace* NSW 192779, 8.1978 (NSW)†; Leo Ck, *K. Hill & B. Wallace* NSW 192778, 8.1978 (NSW)†; Lankelly Ck, *D. Liddle* IML 15, 9.1979 (NSW)†.

Section *Hoya*

2. *Hoya nicholsoniae* F. Muell., Fragm. 5: 159 (1866).

TYPE CITATION: 'In arboribus ad sinum litoreum Rockingham's Bay. *Dallachy*.' HOLOTYPE: MEL.

A glabrous, twining epiphyte, rarely lithophytic. Leaves fleshy to coriaceous, narrow-ovate to ovate, basally tapered, rounded or subcordate, usually green, red-brown when growing in strong light, 4–12 cm long, 2.5–7.0 cm wide; petioles 1.0–3.0 cm long, 4–8 mm diam., often with a pale brown corky surface. Peduncles 1–12 cm long, slender. Pedicels 6–10 cm long, slender. Umbels 10–30-flowered. Sepals triangular, 2–3 mm long. Corolla reflexed, pale yellow, 10–18 mm diam. Corona to 6 mm diam., flat, white; segments rhomboid, slightly longitudinally ridged above, with two longitudinal, inrolled keels extending the full length below, inner angle sometimes slightly lower, occasionally pale pink. Fruit 8–15 cm long, 0.7–1.2 cm diam.

A widespread and relatively abundant epiphyte or lithophyte in rainforests of northeastern Queensland, at low and high altitudes; also known in New Guinea but apparently not common. It also occurs epiphytically in mangrove communities.

Leaf shape and colour are highly variable, and largely dependent on environmental factors.

One plant in cultivation at the Royal Botanic Gardens, Sydney, has distinctly spotted leaves and a slightly duller upper epidermis. This plant (*D. Liddle IML 36*, from the Atherton Tableland) is reported to have somewhat broader and more rounded corona segments, and may represent another taxon in this group.

SELECTED SPECIMENS: QUEENSLAND: China Camp, S. of Cooktown, *D.F. Blaxell 1081*, 18.6.1973 (NSW); Black Mountain, SW of Cooktown, *A.N. Rodd 211*, 23.7.1965 (NSW); Pascoe River rockpile, *B. Wallace 83253*, 16.9.1983 (NSW)†; Cooper Ck, *P. Hind 190*, 1.1972 (NSW)†; Cape Tribulation, *W.W. Mason NSW 192780*, 1.2.1947 (NSW)†; Barong logging area, *P. Weston 979*, 23.8.1986 (NSW)†; Daintree Ferry, *K. Hill 2009*, 8.8. 1986 (NSW); Mt Lewis, *P. Hind 3621A*, 27.4.1984 (NSW)†; *D. Liddle IML 21* (NSW)†.

Section *Oreostemma*

3. *Hoya alata* K. Hill, sp. nov.

Ab *Hoya poolei* lobis coronae angustioribus, foliis latioribus et plus nitidis sed non basaliter auriculatis differt.

TYPE: QUEENSLAND: Pascoe River rockpile, *B. Wallace 83250*, 16.9.1983 (holo: NSW†; iso: BRI, K, L).

Latin *alata*, 'winged', referring to the winged caudicles occurring only in this species among the Australian members of this genus.

A glabrous lithophytic or terrestrial twiner. Leaves fleshy to coriaceous, ovate or rhomboid, acute, tapering to a narrowly cordate base, pale green, pink or pale bronze when growing in strong light, 3–7 cm long, 2.5–5.0 cm wide; margins and apex recurved; venation obscure, sub-parallel or somewhat palmate, petioles 3–8 mm long, 2–4 mm diam. Peduncles 4–7 cm long, slender, geotropic. Pedicels 1–3 cm long, slender, unequal. Umbels 4–10-flowered. Sepals triangular, 1–2 mm long. Corolla recurved, distinctly pilose, pale pink or almost white, 8–14 mm diam. Corona 4–7 cm diam., creamy-white; segments oblong-linear, convex above, with two longitudinal, inrolled keels extending the full length below, inner angle raised, outer angle laid back. Fruit 7–14 cm long, 0.7–1.2 cm diam.

Distinguished from the New Guinea species *H. poolei* C. White & Francis by the narrower corona lobes and the broader, glossier leaves without distinctly sagittate bases.

Endemic to Cape York Peninsula, Queensland, presently known only from the Iron Range area northward. Locally common on rocky slopes and headlands. Although abundant in this region, this species remained undiscovered until the early 1970s. It is usually lithophytic on jumbled granite rock piles which outcrop throughout the higher rainfall parts of the Iron Range region.

SELECTED SPECIMENS: QUEENSLAND: Iron Range, *B. Gray NSW 192781*, 1972 (NSW)†; Tozers Gap, *K. Hill 1870*, 29.7.1986 (NSW).

Section *Pterostelma*

The *Hoya australis* complex. This group of taxa is centred on Australia and the South Pacific, with one outlying species extending through Malaysia to Indochina. The species are difficult to separate, as the flowers are uniform and virtually identical throughout the group. However, vegetatively distinguishable forms occur sympatrically in various parts of the range of the group. These forms are reproductively isolated, and are hence regarded as distinct species. Where clearly vegetatively distinguishable entities are not sympatric, definition of relationships is difficult, and certain entities are here somewhat arbitrarily recognized as species. Morphologically different (although similar) groups which apparently intergrade where ranges meet are recognized as subspecies.

4. *Hoya australis* R. Br. ex Traill, Trans. Hort. Soc. 7: 28 (1830).

TYPE CITATION: '... native of the more northern part of New South Wales, with leaves varying from elliptic to obovate; this is in the herbarium of Mr. Robert Brown, and is named by him *Hoya australis*'.

TYPE: Typification is discussed by Britten (1898). The single collection in Brown's herbarium is apparently a Banks and Solander collection from 'Cape Grafton, Endeavour River' (two separate localities). This specimen (now in BM, *n.v.*) bears Brown's annotations 'H. carnosa' and 'H. australis', and can be regarded as the holotype. An isotype is in NSW.

A polymorphic taxon apparently distributed through Australia to New Guinea and some Pacific Islands. Several subspecies can be distinguished, all apparently intergrading to some extent. Two subspecies are recognized in Australia, with one more in New Guinea and an additional one in the Pacific Islands. The Australian representatives only are treated here.

Key to the subspecies

- 1 Leaves apically rounded, apiculate subsp. **australis**
 1* Leaves acute subsp. **sana**

4a. *Hoya australis* subsp. **australis**

Don, Gen. Syst. 4: 126 (1838); Decne. in DC., Prodr. 8: 640 (1844); Bentham, Fl. Austral. 4: 346 (1869); Britten, J. Bot. 36: 414 (1898); Bailey, Fl. Queensland 3: 1013 (1900); Domin, Bibl. Bot. 89: 1086 (1928); Smith, Sargentia 1: 110 (1942).

H. dalrympleana F. Muell., Rep. Burdekin Exped.: 16 (1861).

TYPE CITATION: 'On Granite Hills at Cape Cleveland'. HOLOTYPE: MEL.

H. keysii Bailey, Proc. Roy. Soc. Queensland 1: 87 (1884).

TYPE CITATION: 'Hab. Mount Perry, climbing over rocks (*Jas. Keys*)'. HOLOTYPE: BRI.

ILLUSTRATIONS: Britten, Illustr. Austral. Pl. Banks & Solander 2: 620, t. 203 (1900); Bailey, Compr. Cat. Queensland Pl.: 334, fig. 309 (1913), as *H. keysii*.

A pubescent lithophytic or terrestrial twiner or shrub. Leaves fleshy, broadly pinnately veined, elliptical, ovate or orbicular, 3–6 cm long, 2.0–5.0 cm wide, densely pubescent beneath, loosely pubescent or ± glabrous above; petioles 1.0–3.5 cm long, 3–7 mm diam. Peduncles 0.5–2.5 cm long, rachis cylindrical. Pedicels 1.5–2.5 cm long, slender. Umbels 12–30-flowered (rarely to

40). Sepals broadly triangular, 2–3 mm long, Corolla campanulate, minutely puberulous within, creamy-white with a pink or red spot at the base of each lobe, 1.5–2.5 cm diam. Corona to 4 mm diam., white; segments ovate, concave above, with two longitudinal, inrolled keels extending the full length below, inner angle apiculate, outer angle rounded. Fruit 10–15 cm long, 1.0–1.5 cm diam. Fig. 1.

Distributed from the Cooktown district in Queensland south to the headwaters of the Richmond and Clarence Rivers in northern New South Wales. It extends from coastal headlands to subcoastal ranges in the north, but from Fraser Island southwards it appears to be restricted to the ranges, and is replaced by *H. oligotricha* subsp. *oligotricha* in the more coastal sites. It is usually lithophytic, scrambling often considerable distances over exposed rock outcrops and cliff faces.

SELECTED SPECIMENS NEW SOUTH WALES: **North Coast:** Mt Sugarloaf, SW. of Casino, S. Clarke, J. Pickard & R. Coveny 1828, 28.7.1969 (NSW); Rivertree, upper Clarence River, R.H. Cambage 2883, 7.9.1911 (NSW); Glenugie Peak, near Grafton, C.L. Wilson 586, 7.4.1957 (NSW).

QUEENSLAND: Davies Ck, H.S. McKee 9335, 25.4.1962 (NSW); Hinchinbrook Island, P. Hind 244, 8.1972 (NSW)†; Paluma Range, P. Hind 2669, 31.8.1980 (NSW)†; Byfield, P. Hind 3599, 21.4.1984 (NSW)†; Blackdown Tableland, P. Hind 3476, 7.4.1983 (NSW)†; Canungra, J.L. Boorman NSW 192782, 4.1907 (NSW).

4b. *Hoya australis* subsp. *sana* (Bailey) K. Hill, **comb. nov.**

BASIONYM: *Hoya sana* Bailey, Queensland Agric. J. 1: 229 (1897).

TYPE CITATION: 'Hab.: Polo Creek, Somerset'. TYPE (holo?): BRI. A specimen in BRI which matches Bailey's description has been annotated 'possibly qualifies as lectotype if not holotype of *H. sana*/R. Henderson'. This specimen is from the type locality, but it bears no collector or date information.

ILLUSTRATIONS: Bailey, Compr. Cat. Queensland Pl.: 334, fig. 311 (1913).

A pubescent lithophytic or terrestrial twiner or shrub. Leaves fleshy, broadly pinnately veined, elliptical or ovate, 2–10 cm long, 1.5–6 cm wide, densely pubescent beneath, less so but still pubescent above; petioles 0.8–3.0 cm long, 3–7 mm diam. Peduncles 0.5–2.5 cm long, slender, rhachis cylindrical or subglobular. Pedicels 1.0–3.0 cm long, slender. Umbels 8–35-flowered. Sepals broadly triangular, 1–3 mm long. Corolla campanulate, minutely puberulous within, creamy-white with a pink or red spot at the base of each lobe, 0.8–2.0 cm diam. Corona to 4 mm diam., white; segments ovate; concave above, with two longitudinal, inrolled keels extending the full length below, inner angle apiculate, outer angle rounded. Fruit 7–15 cm long, 0.7–1.5 cm diam.

Ranges from the tip of Cape York and the Torres Strait Islands south to the Cooktown area. Zones of intergradation with subsp. *australis* occur around Cooktown and somewhat south of there. Subspecies *sana* is abundant in dense shrub heath on coastal dunes along the east coast of Cape York Peninsula, for example at McIvor River (to Cape Flattery) and Bolt Head. Plants are rooted in siliceous sand in these situations, climbing vigorously through the shrub canopy. This taxon also occurs lithophytically on exposed outcrops, rooting in small humus pockets and often forming small shrubby plants with short internodes and small leaves (e.g. upper Hann Creek).

SELECTED SPECIMENS: QUEENSLAND: Escape River, *J.R. Clarkson* 2083, 4.6.1978 (BRI, NSW); Huxley Hill, Carron Valley, *B. Wallace* 83215, 14.9.1983 (NSW)†; McIvor River heath, *K. Hill* 1091, 14.8.1984 (NSW)†; Captain Billy Creek, *D. Liddle* IML 31 (NSW)†; Upper Hann Creek, *K. Hill* 1782, 25.7.1986 (NSW, BRI); Dulhunty River crossing, *N. Ollerenshaw* 530, 10.7.1980 (NSW)†; Pascoe River rockpile, *B.J. Wallace* 831573, 8.1983 (NSW)†; *D. Liddle* IML 171 (NSW)†; Silver Plains, *P. Hind* 3139 (NSW)†*; Silver Valley, *D. Liddle* IML 6 (NSW)†*; Somerset, *P. Lavarack* NSW 193412 (NSW)†*.

Specimens marked '**' are distinctly hairier on the upper leaf surface. This represents both seasonal variation, and also the range of variation within this taxon.

5. *Hoya rupicola* *K. Hill*, sp. nov.

Hoya australis affinis sed caulibus atque foliis minute sericeis et foliis carnosissimis, rhachidibus crassis sphaericisque, lobis calycis maioribus distinguenda.

TYPE: NORTHERN TERRITORY: Deaf Adder Gorge, *R.E. Fox* 2548, 24 Feb 1977 (holo: NSW; iso: CANB, DNA, NT).

Latin *rupes*, *rupis*, 'rock' or 'cliff', with the Latin compound ending *-cola*, 'dweller', referring to the habitat of this species on sandstone cliffs.

A highly succulent, minutely silky-tomentose lithophytic shrub or twiner. Leaves extremely fleshy, obscurely broadly pinnately veined, narrow-ovate to ovate, acute, basally tapered, pale grey-green, 5–14 cm long, 3.0–7.0 cm wide; petioles 1.0–2.0 cm long, 6–10 mm diam. Peduncles 1.0–2.5 cm long, slender. Pedicels 1.5–2.5 cm long. Umbels 10–30-flowered. Sepals oblong, 4–5 mm long. Corolla campanulate, densely minutely puberulous within, creamy-white with a pink or red spot at the base of each lobe, 1.0–2.5 cm diam. Corona to 4 mm diam., white, flat; segments ovate, concave above, with two longitudinal, inrolled keels extending the full length below, inner angle apiculate, outer angle rounded. Fruit 9–15 cm long, 1.0–1.5 cm diam.

Distinguished within the *H. australis* group by the highly succulent leaves with a persistent coating of fine silky hairs, the thick, subglobular rhachis and the large calyx.

Occurs on headlands and sandstone escarpments in the north of the Northern Territory and the Kimberley region of Western Australia. It is extremely succulent and drought resistant, growing in small humus accumulations usually on sandstone rocks, often in full sun. This region often receives no rainfall through the dry stage of the monsoon cycle, often for up to six months.

SELECTED SPECIMENS: WESTERN AUSTRALIA: summit of Mt Trafalgar, Prince Regent Reserve, *A.S. George* 12800, 29.8.1974 (PERTH); near source of Calder River, Kimberley distr., *C.A. Gardner* 1394, 20.6.1921 (PERTH, NSW); E2, Prince Regent Reserve, *K.F. Kenneally* s.n., 18.8.1974 (PERTH); Prince Regent Gorge, *Bradshaw & Allen*, 4.4.1891 (MEL 73622).

NORTHERN TERRITORY: 2 miles [3 km] W. of old BHP airstrip, 12°54'S 135°28'E, *D.E. Symon* 7737, 12.12.1972 (ADW, PERTH); Umbrawarra Gorge, *K. Hill* 898, 14.7.1984 (NSW); Port Darwin, *M. Holtze*, 1890 (MEL 73611).

6. *Hoya oligotricha* K. Hill, sp. nov.

Inter species australiensis *Hoya australis* affinis foliis utrinque plus minusve glabris facile distinguenda.

TYPE: QUEENSLAND: Davies Creek, E. of Mareeba, D. Liddle NSW 193413 (holo: NSW†; iso: BRI, K, L).

Greek *oligos*, 'few', *thrix*, *trichos*, 'hairs', referring to the almost glabrous stems and leaves of this plant.

There are two subspecies, both endemic in Australia.

Key to the subspecies

- 1 New shoots distinctly loosely pubescent subsp. **oligotricha**
 1* New shoots glabrous subsp. **tenuipes**

6a. *Hoya oligotricha* subsp. *oligotricha*

A vigorous, glabrous or very sparsely and loosely pubescent lithophytic or terrestrial twiner or shrub. Leaves fleshy, broadly pinnately veined, elliptical, ovate or orbicular, 4–12 cm long, 3.0–8.0 cm wide; petioles 1.0–3.5 cm long, 3–7 mm diam. Peduncles 0.5–2.5 cm long, rhachis cylindrical. Pedicels 1.5–3.0 cm long; slender. Umbels 12–30-flowered. Sepals broadly triangular, 2–4 mm long. Corolla campanulate, minutely puberulous within, creamy-white with a pink or red spot at the base of each lobe, 1.5–2.5 cm diam. Corona to 4 mm diam., white; segments ovate, concave above, with two longitudinal, inrolled keels extending the full length below, inner angle apiculate, outer angle rounded. Fruit 10–15 cm long, 1.0–1.5 cm diam.

Distinguished by the broad leaves, the loosely pubescent new growth and the short, thick peduncles.

Many previous authors have mistakenly interpreted this taxon as representing *H. australis* (e.g. Bailey 1900).

Occurs on rocky outcrops in moist forests on and around the Atherton Tableland, extending south to Townsville. A disjunct occurrence further south extends from Fraser Island south to the Kempsey district. The southern occurrence is almost exclusively coastal, on headlands and on siliceous sand in littoral rainforests or wet sclerophyll forests. Plants growing on dune systems are rooted directly into sand and usually have a long-twining, scrambling habit. Plants growing on rock outcrops are rooted in small humus accumulations, and show stronger development of the short-internode growth phase.

SELECTED SPECIMENS: NEW SOUTH WALES: **North Coast:** Boonoo Boonoo, J.L. Boorman NSW 192783, 11.1904 (NSW); Brunswick Heads Nature Reserve, R. Coveny 9404, 4.5.1977 (NSW); Morgans Gully, Evans Head, R. Coveny 9374, 1.5.1977 (NSW); Iluka Nature Reserve, R. Coveny 9423, 6.5.1977 (NSW)†.

QUEENSLAND: Roaring Meg Falls, K. Hill 1974, 5.8.1986 (NSW)†; Walsh River, Atherton, R. Scott NSW 193091, 8.1978 (NSW)†; Rossville, P. Hind 3163, 12.6.1982 (NSW)†; Mt Fraser, P. Hind 3209, 16.6.1982 (NSW)†; Noosa National Park, L.A.S. Johnson NSW 192784, 27.5.1951 (NSW).

6b. *Hoya oligotricha* subsp. *tenuipes* K. Hill, ssp. nov.

A subspecies *oligotricha* foliis obovatis vel oblanceolatis utrinque glabris, pedunculis longioribus et tenuioribus differt.

TYPE: QUEENSLAND: Pascoe River Rockpile, *B. Wallace* 83252, 16.9.1978 (holo: NSW†; iso: BRI, K, L).

Latin *tenuis*, 'slender', and *pes, pedis*, 'foot', referring to the more slender peduncles of this subspecies in comparison to the type subspecies.

A vigorous lithophytic or terrestrial twiner. Leaves fleshy or coriaceous, broadly pinnately veined, elliptical, narrow-ovate or narrow-obovate, 6–14 cm long, 3.0–7.0 cm wide; petioles 1.0–2.0 cm long, 3–7 mm diam. Peduncles 3.0–4.5 cm long, slender, rhachis cylindrical. Pedicels 2.0–4.0 cm long, slender. Umbels 10–25-flowered. Sepals narrowly triangular, 2–4 mm long. Corolla campanulate, minutely puberulous within, creamy-white with a pink or red spot at the base of each lobe, 1.0–2.0 cm diam. Corona to 4 mm diam., white; segments ovate, concave above, with two longitudinal, inrolled keels extending the full length below, inner angle apiculate, outer angle rounded. Fruit unknown.

H. oligotricha ssp. *tenuipes* is distinguished within the *H. australis* complex by the glabrous narrow-ovate or narrow-obovate leaves and the long, slender peduncles.

A taxon of rainforests of Cape York, from around the Olive River south through the Iron and McIlwraith Ranges. No collections of *H. oligotricha* are known from between the southern end of the McIlwraith Range and Cooktown, where *H. oligotricha* ssp. *oligotricha* is present. Subspecies *tenuipes* often occurs in deep shade in rainforests, growing as an epiphyte or lithophyte. It is sympatric with *H. australis* ssp. *sana* over much of its range. Scrub-clad rocky hills occur along the coast in areas such as the lower Pascoe River, with *H. oligotricha* ssp. *tenuipes* growing epiphytically within closed forest pockets in sheltered areas, and *H. australis* ssp. *sana* growing lithophytically on exposed rocks often only a few metres away. *H. nicholsoniae* often occurs with *H. oligotricha* ssp. *tenuipes*, and *H. alata* with *H. australis* ssp. *sana* in these situations.

SELECTED SPECIMENS: QUEENSLAND: Hann Creek, *B. Wallace* 83236, 14.9.1983 (NSW)†; Mulingar, McIlwraith Range, *D. Liddle* IML 25 (NSW)†; Lankelly Creek, *D. Liddle* IML 27 (NSW)†; Tozers Gap, *K. Hill* 1871, 29.7.1986 (NSW, BRI).

Excluded names***Hoya carnosa* R. Br.**

Bentham (1869: 346) records *H. carnosa* for Queensland. This record is based on collections by Jardine of Somerset Station at the tip of Cape York which were sent to Mueller and then on loan to Bentham. One specimen (MEL 73617) bears the annotation '*H. carnosa* / Cape York / *Jardine*' in Mueller's handwriting, with no further information. The other (MEL 73618) is labelled '*Hoya jardiniana* / F.v.M. inedit. / Cape York / *Jardine*'. They match perfectly *H. carnosa*, recorded only from Hong Kong and China. This species has long been a popular ornamental plant, and Jardine was known to have cultivated a number of exotic plants at Somerset (e.g. the palm *Borassus flabellifer*, still growing on the site in 1985, *vide* P. Hind, Royal Botanic Gardens, Sydney). It is

most likely that the specimens of *H. carnosa* sent to Mueller were taken from a cultivated plant at Somerset, as there are no other records of this taxon from Australia or nearby South-East Asian countries.

Hoya bicarinata A. Gray, Proc. Amer. Acad. Arts 5: 535 (1862).

Bentham (1869) records this name in synonymy with *H. australis*. The type of *H. bicarinata* was collected in Fiji, and represents a common South Pacific Island member of the *H. australis* complex which is not the same as any of the Australian species. *H. bicarinata* is characterised by large, orbicular leaves with a loose, open indumentum of long, erect hairs on each side.

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New taxa of rainforest Myrtaceae from northern Queensland

Peter G. Wilson and B.P.M. Hyland

Abstract

Wilson, Peter G.¹, & Hyland, B.P.M.² (¹National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000; ²CSIRO Division of Plant Industry, Atherton, Australia 4883) 1988. *New taxa of rainforest Myrtaceae from northern Queensland. Telopea* 3(2): 257–271. — Three new genera, **Barongia**, **Sphaerantia** and **Mitrantia**, are described together with the new species **B. lophandra**, **S. discolor**, **S. chartacea** and **M. bivalvis**. In addition to these, two further species of *Ristantia* Wilson & Waterhouse are described: **R. gouldii** and **R. waterhousei**. All the taxa are illustrated, and their affinities discussed.

Introduction

In the past 15 years, two new genera of rainforest capsular Myrtaceae have been described. The first, *Lindsayomyrtus*, is unusual in that its fruit is not strictly a capsule and its embryo is large, with thick cotyledons (Hyland & van Steenis 1973); it is now thought to be distantly related to the Malesian genera *Whiteodendron* and *Kjellbergiodendron* (Wilson, unpublished observations; Johnson & Briggs 1985). The second, *Ristantia* (Wilson & Waterhouse 1982), is also thought to occupy an isolated, unspecialised position in the family. In the present paper three new genera are added to these, of which two appear to be closely related to *Ristantia* while the third is of uncertain affinity.

All taxa have been observed in the field by one or both authors. Leaf and fruit descriptions are based on herbarium material and floral descriptions on spirit or reconstituted material. Inflorescence terminology is based on Briggs and Johnson (1979) and leaf venation terminology follows Hickey (1973). The Conservation Codings are given in the form adopted by Leigh *et al.* (1981).

Barongia Peter G. Wilson & B. Hyland, gen. nov.

Genus novum proprium ab aliis generibus Myrtacearum australiensibus floribus luteis, staminibus in phalanges lineares connatis, semine persaepe unico trigono, cotyledonibus foliaceis, in embryone reflexis et replicatis facile distinguendum.

TYPE SPECIES: *Barongia lophandra* Peter G. Wilson & B. Hyland

Trees. *Juvenile leaves* spirally arranged. *Adult leaves* opposite. *Inflorescence* a panicle. *Flowers* 5-merous, yellow. *Hypanthium* shallow, margin equal to or slightly lower than the ovary summit. *Stamens* very numerous, yellow, the filaments of varying lengths and united into linear, brush-like fascicles opposite the petals. *Ovary* half-inferior, 3-(rarely 4-) locular, incompletely septate at the apex with a broad compitum connecting the loculi; placentas basal, ovules anatropous. *Style* terminal on the ovary, much shorter than the staminal

fascicles; stigma slightly dilated. *Capsule* not very woody, loculicidal but with a single cavity containing one, very rarely two, relatively large seed(s). *Embryo* with broad cotyledons that do not enclose one another but are sharply reflexed from the top of the hypocotyl then folded back on themselves.

This monotypic genus has no close affinities with any other Australian genus; the flowers and fruits bear a passing resemblance to *Welchiodendron*, but it differs from that genus in phyllotaxis, morphology of the staminal fascicle, placentation, fruit structure, seed and embryo morphology, and in lacking oil ducts in the stem and petiole (see Wilson & Waterhouse 1982).

In the structure of the flower and fruit it is superficially similar to the genus *Whiteodendron* from Sarawak (van Steenis 1952) but it differs from that genus in having the staminal fascicles free from one another rather than joined at the base into a tube, leaves consistently opposite rather than spiral in the adult, lack of an intramarginal vein, lack of a curved apical bud, cotyledons separate rather than one enclosing the other in the embryo, and in lacking oil ducts in the stem and petiole.

The genus shows more similarities with *Ristantia pachysperma* in the general morphology (but not the woodiness) of the fruit of that species and in the leaf venation. The embryo of *Barongia*, although different, could be a less specialised form of the *Ristantia*-type of embryo with the cotyledons broader and reflexed and folded back on themselves, rather than reniform with the lobes rolled. The main differences between *Barongia* and *Ristantia*, and between *Barongia* and the two new genera described below, are the yellow flowers, the long staminal fascicles, the trigonous seed, the spiral-then-opposite phyllotaxis, and the lack of oil glands in the pith. Spiral-then-opposite phyllotaxis does occur in some species of *Xanthostemon s. lat.* but this genus is otherwise quite different from *Barongia*.

The generic name is derived from the only known locality for the species, viz. the Barong Logging Area.

***Barongia lophandra* Peter G. Wilson & B. Hyland, sp. nov.**

Foliis anguste ovatis-ellipticis usque ad 20 cm longis, nervo intramarginali deficienti, inflorescentiis apparenter paniculatis, floribus luteis, phalangibus staminum usque ad 1 cm longis, capsulis exsertis loculicidis et seminibus flavidis, persaepe solitariis trigonis.

HOLOTYPE: QUEENSLAND: State Forest Reserve 755, Barong Logging Area, 17°31'S 145°50'E, Gray 400, 23.3.1977 (QRS). ISOTYPES: NSW, UNSW.

Rainforest tree to over 30 m tall, with flaky bark and prominent buttresses; young twigs finely puberulent. *Leaves* narrowly ovate to elliptical; petiole short, 0.4–0.8 cm long; lamina 10–20 cm long, 4–8.5 cm broad, venation eucamptodromous with 7–9 pairs of secondary veins, definite intramarginal vein not formed, obtuse to cordate at base, shortly acuminate at apex, oil glands numerous. *Inflorescence* axillary, apparently an irregularly-branched panicle. *Flowers* hermaphrodite. *Hypanthium* 0.9–1.0 cm broad. *Sepals* rounded-triangular, 1.5–2.0 mm long, 2.5–4.5 mm wide. *Petals* yellow, gland-dotted, more or less orbicular, 6–9 mm long, 6–7 mm broad. *Stamens* multiseriate, very numerous; staminal fascicles 5, opposite the petals, slender and brush-like due to the spreading free ends of the filaments, base circular in cross-section, c. 1 mm diam., gradually tapering towards apex, 8–10 mm long; anthers all fertile,



Fig. 1. *Barongia lophandra* Peter G. Wilson & B. Hyland. A, flowering branchlet (X 0.5). B, seedling (X 0.5). C-F, fruit (X 1.4). G, flower bud (X 1.8). H, flower (X 1.8). I, longitudinal section of flower (X 2.3). J, staminal bundle (X 5.5). K, L, front and back views of anther (X 14). M, N, seed (X 2). (A, G-L from Gray 400; D-F, M, N from Irvine 1875; B from Irvine 1882; C from Gray 739).

dorsifixed, versatile, the connective gland-tipped. *Ovary* finely pubescent; ovules 9–11 per loculus. *Style* short, c. 2 mm long; stigma slightly dilated, flat-topped. *Fruit* a thin-walled capsule with a rounded or conical summit shortly exerted from the fruiting hypanthium, 10–14 mm across; seed yellowish, c. 6 mm long, 3-angled at distal end. Figure 1.

This species is listed as *Tristania* sp., code 765, in Hyland (1982); it is confined to the area known as Barong Logging Area in the lower part of the North Johnstone River. Its conservation status has been determined as 2R by Thomas and McDonald (1987).

SPECIMENS EXAMINED: QUEENSLAND: **Cook:** S.F.R. 755, Barong L.A., *Briggs* 7409, 30.8.1983 (NSW); *Gray* 347, 2.3.1977 (NSW, QRS, UNSW), 399, 23.3.1977 (QRS, UNSW), 591, 21.6.1977 (NSW, QRS, UNSW), 618, 13.7.1977 (QRS, UNSW), 659, 18.8.1977 (QRS, UNSW), 739, 11.10.1977 (QRS, UNSW); *Hyland* 3470, 3471 *RFK*, 28.10.1976 (QRS, UNSW), 3495 *RFK*, 13.1.1977 (QRS, UNSW), 9288, 13.1.1977 (QRS, UNSW); *Irvine* 1875, 21.10.1977 (NSW, QRS, UNSW), 1882, 21.10.1977 (QRS); *Stocker* 1589, 6.9.1977 (QRS, UNSW).

Sphaerantia Peter G. Wilson & B. Hyland, gen. nov.

Ristantiae affinis foliis oppositis, capsula inclusa in hypanthio truncato-globoso leviter lignoso distinguendum.

TYPE SPECIES: *Sphaerantia discolor* Peter G. Wilson & B. Hyland.

Andromonoecious trees, oil glands present in the pith of young stems and petioles. *Leaves* opposite in both juvenile and adult plants; venation brochidodromous, intramarginal vein poorly developed. *Inflorescence* a terminal or axillary thyrsoid or metabotryoid. *Petals* 4 or 5, white to cream. *Sepals* 4 or 5, persistent on the fruit. *Hypanthium* dish-shaped, exceeding the ovary summit. *Stamens* numerous, the filaments of various lengths, aggregated into five basally connate fascicles opposite the petals. *Ovary* half-inferior, 2- to 3-locular; placentas basal, ovules numerous, anatropous. *Style* inserted in a slight depression on the ovary summit, not exceeding the staminal fascicles; stigma dilated, convex. *Fruit* only lightly lignified, truncate-globose; capsule included within the fruiting hypanthium, loculicidal, containing one or more seeds. *Embryo* with circinate cotyledons.

A genus of two species, clearly related to *Ristantia* by reason of the shared occurrence of the distinctive *Ristantia*-type of embryo and by the oil glands in the pith. The major differences are the regularly opposite leaves, the lack of sterile anthers, the numerous ovules and the included, lightly lignified capsule.

This genus and the next one are further examples of andromonoecy in the Myrtaceae; this condition has not often been reported but may be more common than previously thought. It occurs in *Lysicarpus*, *Eucalyptus calophylla* and related species (Carr *et al.* 1971), *E. petraea* (Carr & Carr 1983), and *Leptospermum* (Thompson, pers. comm.; Primack & Lloyd 1980), while Byrnes (1984, 1985, 1986) cites at least 15 species of *Melaleuca* that have male and hermaphrodite flowers.

The generic name is derived from *sphaera* (globe or sphere), referring to the truncate-globose fruiting hypanthium, and the suffix *-antia* alluding to the relationship with *Ristantia*.

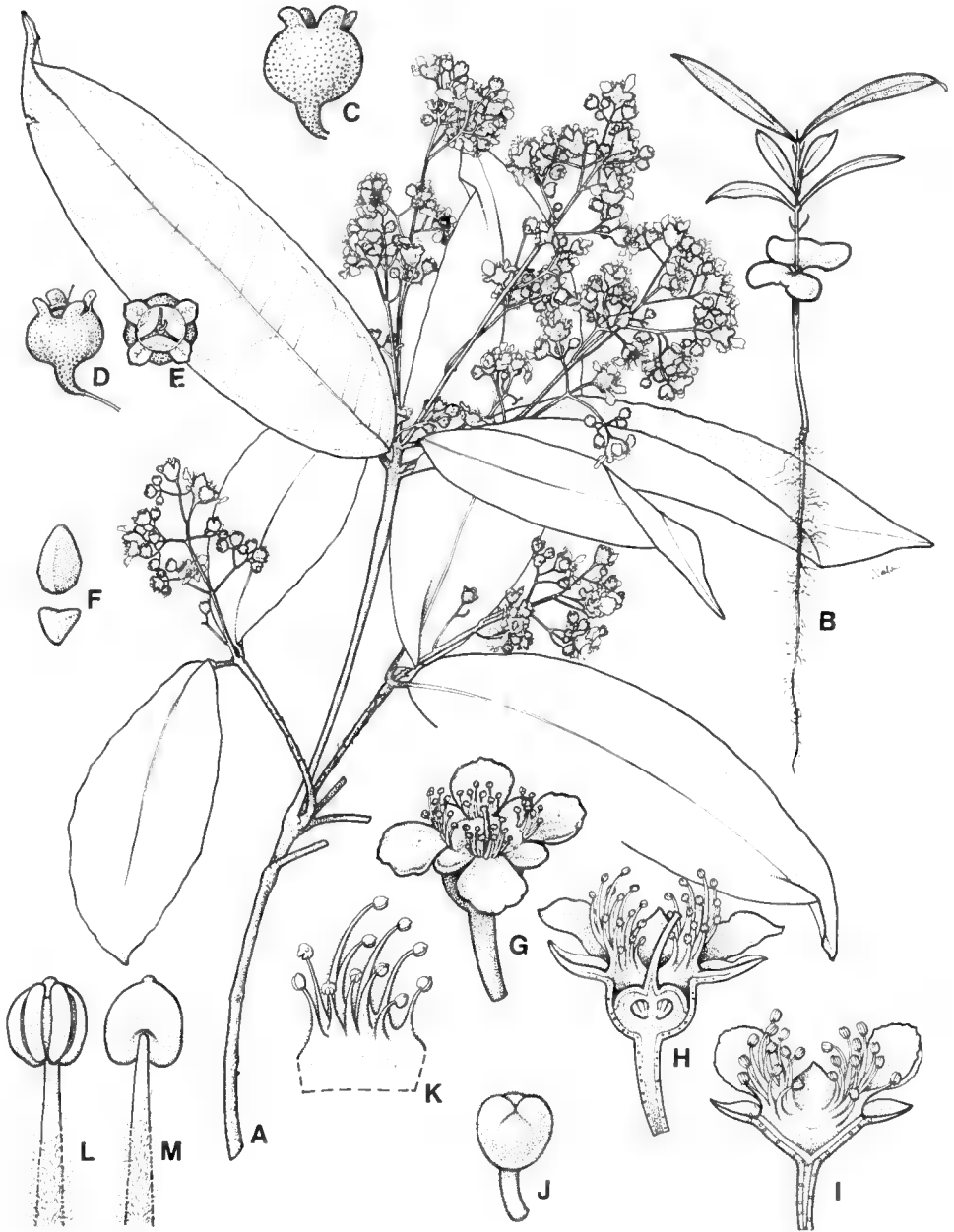


Fig. 2. *Sphaerantia discolor* Peter G. Wilson & B. Hyland. A, flowering branchlet (X 0.5). B, seedling (X 0.5). C, fruit (X 1). D, E, fruit (X 0.8). F, seeds (X 1.8). G, open flower (X 1.8). H, longitudinal section of hermaphrodite flower (X 2.5). I, longitudinal section of male flower (X 2.5). J, flower bud (X 2.2). K, staminal bundle (X 4.5). L, M, front and back views of anther (X 22). (A, G–M from Hyland 3565 RFK; B–F from Gray 848).

Key to species

- Leaves discolorous, usually rather leathery, mostly 9–16 cm long, oil-glands scattered **1. *S. discolor***
- Leaves \pm concolorous, chartaceous, mostly 6–9 cm long, oil-glands dense **2. *S. chartacea***

1. *Sphaerantia discolor* Peter G. Wilson & B. Hyland, *sp. nov.*

Foliis discoloribus plerumque 9–16 cm longis, lamina plus minusve coriacea, sparsim glanduloso-punctatis; inflorescentiis plerumque thyrsoides; filamentis staminum pilos patulos gerentibus.

HOLOTYPE: QUEENSLAND: State Forest Reserve 756, East McNamee Logging Area, 17°40'S 145°30'E, *Hyland 3565 RFK*, 13.9.1977 (QRS). ISOTYPE: NSW.

Tree with buttresses, to at least 20 metres tall and 80 cm d.b.h.; bark flaky. *Leaves* discolorous, narrowly ovate or elliptical, purplish red when young; petiole short, 0.3–0.5 cm long, somewhat thickened; lamina rather coriaceous, 9.5–14(–16) cm long, 3–5(–6.5) cm broad, secondary veins 4–9 mm apart, obtuse to sub-cordate at base, acuminate at apex, oil glands scattered. *Inflorescence* a thyrsoid, less often a metabotryoid, mostly axillary, up to 12 cm long. *Hypanthium* 4–5 mm broad, covered with a fine, short indumentum. *Sepals* 4, semicircular to oblong, 1.5–2.5 mm long, 2–3.5 mm broad, dotted with oil glands, clothed with same indumentum as hypanthium with the margin woolly-ciliate. *Petals* 4, white, orbicular, 3–3.5 mm broad, both surfaces covered with same indumentum as sepals but with the margin glabrous, oil glands absent or obscure. *Stamens* numerous, apparently in three series, 9–15 in each fascicle; filaments 0.5–2.5 mm long, bearing short, spreading hairs for most of their length; anthers all fertile, dorsifixed, versatile, the connective gland-tipped. *Ovary* bearing an indumentum of white hairs; ovules numerous, up to 35 per loculus. *Style* 3–5 mm long; stigma capitate, convex. *Fruit* dark brown, 10–14 mm diam.; seeds pale brown, irregularly ovoid, 5–6 mm long. Figure 2.

This species is listed as *Tristania* sp., code 93, in Hyland (1982); it is restricted to a small area in the region around the Russell and Johnstone Rivers. Its conservation status has been assessed as 2R by Thomas and McDonald (1987).

Gadek and Martin (1981) examined the pollen of this species (as “gen. nov. ‘McNamee’”); they found a similarity with the pollen of the two *Ristantia* species included in their study and noted further that the pollen of the three taxa showed a combination of character-states that had ‘not been found elsewhere in the *Metrosiderinae*’.

SPECIMENS EXAMINED: QUEENSLAND: **Cook:** S.F.R. 755, Tewon L.A., Russell River, 17°27'S 145°47'E, *Irvine 1938*, 11.7.1979 (NSW, QRS); S.F.R. 756, East McNamee L.A., *Gray 794*, 15.11.1977 (QRS, UNSW), *836*, 20.12.1977 (NSW, QRS, UNSW), *848*, 10.1.1978 (QRS, UNSW); *Hyland 3566, 3567 RFK*, 13.9.1977 (QRS, UNSW), *5631*, 3.11.1971 (QRS, UNSW).

2. *Sphaerantia chartacea* Peter G. Wilson & B. Hyland, *sp. nov.*

Foliis plus minusve concoloribus plerumque 6–9 cm longis, lamina chartacea, dense glanduloso-punctatis; inflorescentiis plerumque metabotryoides; filamentis staminum pro parte majore glabris.

HOLOTYPE: QUEENSLAND: Timber Reserve 176, Monkhouse, Shipton Logging Area, 15°48'S 145°16'E, Hyland 12301, 21.10.1982 (QRS). ISOTYPES: NSW, UNSW.

Tree to at least 10 metres tall and 20 cm d.b.h.; bark usually flaky. Leaves \pm concolorous, narrowly elliptical to oblong; petiole 0.4–0.7(–0.9) cm long, slightly thickened at the base; lamina chartaceous, (5.5–)6–9(–13.2) cm long and (1.5–)2–3.5(–4.7) cm broad, secondary veins (2–4(–6) mm apart, acute at base,



Fig. 3. *Sphaerantia chartacea* Peter G. Wilson and B. Hyland. A, flowering branchlet (X 0.75). B, C, fruit (X 0.75). D, staminal bundle (X 5.5). E, longitudinal section of flower (X 3). (A, D, E from Hyland 12301; B, C from Hyland 12516).

acuminate at apex, oil glands dense. *Inflorescence* a metabotryoid, terminal, up to 12 cm long. *Hypanthium* 5–7 mm broad, covered with a fine, short indumentum. *Sepals* 4 or 5, broadly deltoid to semicircular, c. 2 mm long, 2–3.5 mm broad, dotted with oil glands, both surfaces covered with a fine, short indumentum, the margin woolly-ciliate. *Petals* 4 or 5, cream, ovate-orbicular, 2.5–3.5 mm long, 2–3 mm broad, indumentum denser on outer surface, margin glabrous, dotted with oil glands. *Stamens* numerous, apparently in 3 series, 16–22 in each fascicle; filaments 0.9–3.2 mm long, with a few spreading hairs at the base; anthers all fertile, dorsifixed, versatile, the connective gland-tipped. *Ovary* bearing a sparse indumentum of fine, short hairs; ovules numerous, 20–30 per loculus. *Style* up to 3 mm long; stigma dilated, slightly convex. *Fruit* pale to dark brown, 12–16 mm diam.; seeds yellowish, irregularly ovoid, c. 6 mm long, 4–5 mm broad. Figure 3.

This species was the basis of the 'gen. aff. *Tristania* ("Parrot Creek")' discussed by Briggs and Johnson (1979) and was listed as *Allosyncarpia* sp. vel aff., code 755, in Hyland (1982). It is only found in the vicinity of Mount Finnegan, near Cooktown; its conservation status has been classed as 2RC by Thomas and McDonald (1987).

SPECIMENS EXAMINED: QUEENSLAND: **Cook**: T.R. 176, Shipton L.A., *Hyland* 12516, 8.2.1983 (NSW, QRS, UNSW); T.R. 146, Shipton L.A., 15°50'S 145°15'E, *Hyland* 3229, 3230, 3231, 3233 *RFK*, 10.7.1975 (QRS); Parrot Creek, 15°50'S 145°16'E, *Webb & Tracey* 12693 [*H. Dick* 4], 2.1973 (QRS); Mt Finnegan, 15°47'S 145°17'E, *Webb & Tracey* 10860, 25.8.1972 (BRI, NSW, QRS).

***Mitrantia* Peter G. Wilson & B. Hyland, gen. nov.**

Ristantiae affinis sed capsula conica biloculari leviter lignosa differt.

TYPE SPECIES: *Mitrantia bilocularis* Peter G. Wilson & B. Hyland.

Andromonoecious trees, oil glands frequent in the pith of young stems and petioles. *Leaves* alternate; venation weakly brochidodromous, intramarginal vein poorly developed. *Inflorescence* a terminal or axillary thyrsoid. *Flowers* 5-merous, white. *Hypanthium* cup-shaped, exceeding the ovary summit. *Stamens* in a single series, aggregated into five groups opposite the petals; filaments free. *Ovary* half-inferior, 2-locular; placentas basal, ovules few, anatropous, arranged in a semicircle on each placenta. *Style* terminal on the ovary; stigma dilated. *Capsule* exerted, lightly lignified, loculicidal, the base cupped by the fruiting hypanthium; seeds 1 or 2. *Embryo* with circinate cotyledons.

This genus is, on current knowledge, monotypic. It is related to *Ristantia* and *Sphaerantia* in its embryo type and in the occurrence of oil glands in the pith. The major differences are the much-reduced staminal fascicles and the distinctive fruit form. The fruit is somewhat similar to that of the monotypic *Basisperma* in that the capsule is two-valved, much exerted, and contains a single seed. However, a study of specimens and published descriptions of *B. lanceolatum* (White 1942, Foreman 1978) revealed a number of major differences: the leaves are opposite or irregularly ternate and have a definite intramarginal vein; the inflorescence is a dichasium; the ovules are scattered on the placenta; the fruit is small and subglobose, rounded at the summit and looks *Pittosporum*-like when fully opened, and the testa is described as red and subcarnose. In addition, the embryo, judging from the illustration of the seed in Foreman's paper, could be quite different. The exact relationships of

Basisperma are still unclear; it has been suggested by Briggs and Johnson (1979) that its affinities lie with the 'Kania alliance' but this has been disputed (Wilson 1982) and a relationship with *Ristantia* suggested (Wilson & Waterhouse 1982). The question of the relationships of *Basisperma* cannot be completely resolved until the precise arrangement of the cotyledons in its embryo can be determined; Foreman (1978) merely states that they are folded. The generic name is derived from *mitra* (a cap or turban), referring to the shape of the exerted capsule, and the suffix *-antia* alluding to the relationship with *Ristantia*.

***Mitrantia bilocularis* Peter G. Wilson & B. Hyland, sp. nov.**

Foliis obovatis-ellipticis 7–12(–14.3) cm longis et (2.2–)3–5 cm latis, nervo intramarginali inconspicuo; inflorescentiis thyrsoidis, floribus albidis, staminibus paucis ante petala aggregatis; capsulis conicis exertis.

HOLOTYPE: QUEENSLAND: Timber Reserve 55, Whyanbeel, 16°22'S 145°20'E, Hyland 8689, 30.3.1976 (QRS). ISOTYPES: NSW, UNSW.

Tree, slightly buttressed, to at least 25 metres tall and 80 cm d.b.h.; bark flaky, fissured. *Leaves* obovate-elliptical; petiole 0.4–1 cm long, thickened at base; lamina rather coriaceous, 7–12(–14.3) cm long, (2.2–)3–5 cm broad, the base acute, the apex generally obtuse and bluntly acuminate, oil glands dense. *Inflorescence* a thyrsoid, terminal or axillary, up to 12 cm long. *Hypanthium* 2–3 mm broad, covered with a dense indumentum of short to long soft hairs (also present on sepals and petals). *Sepals* 5, irregularly square or rectangular, up to 1.5 cm long, dotted with oil glands. *Petals* 5, cream, ± orbicular, oil glands present. *Stamens* in small groups of 1–3 opposite the petals; one long stamen c. 0.7 mm long always present in front of the petal with up to two shorter stamens c. 0.4 mm long flanking it towards the margins of the adjacent sepals; anthers all fertile, dorsifixed, versatile, the connective gland-tipped. *Ovary* with an indumentum of very short hairs; ovules 3–5 per loculus. *Style* 0.6–1 mm long; stigma capitate, flat-topped. *Fruit* brown, 6.5–10.5 mm diam., valves projecting 4–5 mm from fruiting hypanthium; seeds pale brown, irregularly ovoid, 6–8 mm long. Figure 4.

M. bilocularis was listed as *Tristania* sp., code 455, in Hyland (1982). The species has been collected only from Timber Reserve 55 north-west of Whyanbeel; its conservation status is given as 2R by Thomas and McDonald (1987).

Pollen of this species (as "gen. nov. 'Whyanbeel'") was examined by Gadek and Martin (1981) who found that the combination of its pollen characters was unique among the species examined in their study.

SPECIMENS EXAMINED: QUEENSLAND: **Cook:** T.R. 55, Whyanbeel, Hyland 1115, 1116 RFK, 12.10.1967 (QRS), 3024 RFK, 1.7.1974 (QRS, UNSW), 3025, 3026, 1.7.1974 (QRS), 7974A, 7.1.1975 (QRS, UNSW), 8690, 30.3.1976 (QRS, UNSW), 8784, 13.5.1976 (QRS), 8907, 2.9.1976 (NSW, QRS, UNSW); **Irvine** 1615, 1616, 9.10.1975 (QRS), 1716, 17.12.1975 (QRS).

***Ristantia* Peter G. Wilson & Waterhouse**
Austral. J. Bot. 30: 442 (1982)

TYPE SPECIES: *Ristantia pachysperma* (F. Muell. & F. Bailey) Peter G. Wilson & Waterhouse.



Fig. 4. *Mitrantia bilocularis* Peter G. Wilson & B. Hyland. **A, B**, fruit (X 5). **C**, flowering branchlet (X 0.7). **D**, longitudinal section of male flower (X 10). **E**, longitudinal section of hermaphrodite flower (X 10). (**A, B** from Hyland 8907; **C-E** from Hyland 8689).

Trees, oil glands present in the pith of young stems and petioles. *Leaves* alternate; venation eucamptodromous, intramarginal vein not formed. *Inflorescence* a panicle or metabotryoid, axillary; flowers mostly hermaphrodite. *Petals* 4 or 5, white to cream. *Sepals* 4 or 5, not, or barely, apparent in the fruit. *Hypanthium* dish-shaped, exceeding the ovary summit. *Stamens* numerous, the filaments of various lengths, with at least some of them irregularly grouped in front of the petals; sterile anthers present, lacking an oil gland. *Ovary* half-inferior, 3-locular; placentas basal, ovules 2 per loculus, anatropous. *Style* terminal on the ovary, shorter than or barely exceeding the stamens; stigma capitate. *Fruit* strongly lignified; capsule globose, exserted from the fruiting hypanthium, loculicidal, containing one or more seeds. *Embryo* with circinate cotyledons.

A very distinct genus of three species. In the protologue, it was stated that neither the sterile stamens nor the grouped stamens described for *R. pachysperma* were diagnostic of the genus. This has proved to be untrue; the sterile anthers and the grouped stamens are merely less conspicuous in the two new species described below.

Key to species

- 1 Fruit splitting almost completely to the base; fruiting hypanthium scarcely developing, everted beneath the fruit **1. *R. gouldii***
- 1* Fruit dehiscence limited by the thickened fruiting hypanthium which is well developed beneath the capsule **2**
- 2 Fruiting hypanthium \pm flat with the free rim deflexed **2. *R. waterhousei***
- 2* Fruiting hypanthium flat to very broadly obconical, rim not deflexed ***R. pachysperma***

1. *Ristantia gouldii* Peter G. Wilson & B. Hyland, sp. nov.

A speciebus aliis *Ristantiae* capsula omnino exserta ad basem findenti, hypanthio vix evoluto sub fructu everso differt.

HOLOTYPE: QUEENSLAND: Timber Reserve 1230, Boonjee Logging Area, 17°25'S 145°45'E, Hyland 6764, 18.7.1973 (QRS). ISOTYPES: NSW, UNSW.

Tree to at least 30 metres tall and 100 cm d.b.h.; bark pale brown, slightly flaky. *Leaves* chartaceous to subcoriaceous; petiole (0.5–)1–2(–2.5) cm long, thickened at base; lamina elliptical, (4–)5–9(–11) cm long, (2–)2.5–5 cm broad, attenuate at base and obtuse to bluntly acuminate at apex; oil glands dense. *Inflorescence* a metabotryoid, axillary, up to 4 cm long; flowers all hermaphrodite. *Hypanthium* 3.5–4.5 mm broad, bearing scattered short hairs, glabrescent. *Sepals* 5, \pm triangular, c. 1.5 mm long, 1.5–2 mm broad, dotted with oil glands, both surfaces clothed with hairs (but longer and denser on inner surface), margins very shortly woolly-ciliate. *Petals* 5, white, obovate to orbicular, c. 2 mm long, dotted with oil glands, indumentum as for sepals. *Stamens* numerous, c. 25–35, apparently in 2 series, the outer \pm continuous but irregular so that gaps may occur in front of sepals, the inner aggregated in front of the petals; filaments 1–2.5 mm long; anthers dorsifixed, versatile, gland-tipped, sterile anthers few, 0.5–0.6 mm long, darker and equal to or slightly larger than the fertile anthers. *Ovary* \pm glabrous. *Style* 2.5 mm long; stigma dilated, flat-topped. *Fruit* brown, rugose, 1–1.5 cm diam.; capsule fully exserted,

splitting to base, style base often persistent on the summit as a short apiculum; fruiting hypanthium barely developed, small and everted beneath fruit; seeds pale brown, ovoid. Figure 5 B, F, J.

This species is listed as *Tristania* sp., code 686, in Hyland (1982). It is rather rare, its conservation status being classed as 2V by Thomas and McDonald (1987); it is only known from small populations at three widely separated localities. We have named the species in honour of Mr Keith Gould (formerly Forester in the Atherton district) who first drew this species to our attention.

Gadek and Martin (1981) examined the pollen of this species (as 'sp. aff. *Tristania pachysperma*') and found it to be very similar to *R. pachysperma* except that the grains were not anisopolar.

SPECIMENS EXAMINED: QUEENSLAND: Cook: T.R. 165, Pieter Botte L.A., 16°06'S 145°23'E, Hyland 3506 RFK, 1.6.1977 (QRS); T.R. 1230, Boonjee L.A., Briggs 7414, 1.9.1983 (NSW), Hyland 6926, 11.10.1973 (QRS, UNSW), 7147, 29.11.1973 (QRS), 7193, 15.2.1974 (QRS), 12481, 1.9.1983 (QRS), 2781, 2782 RFK, 7.2.1973 (QRS), Irvine 1093, 5.12.1974 (QRS), Wilson UNSW 3737, 5.12.1974 (NSW, UNSW); S.F.R. 756, Velvin L.A., 17°43'S 145° 36'E, Dansie AFO 3965, 6.10.1966 (QRS).

2. *Ristantia waterhousei* Peter G. Wilson & B. Hyland, sp. nov.

R. gouldii similis sed capsula tantum ad hypanthium findenti, hypanthio sub fructu plano cum parte libro deflexo, staminibus plus numerosis, antheris sterilibus majoribus, stylo longiore differt.

HOLOTYPE: QUEENSLAND: Mount Dryander, 20°15'S, 148°32'E, Wilson & Puttock UNSW 13291, 12.4.1982 (NSW). ISOTYPES: QRS, UNSW.

Tree to over 20 metres tall and 65 cm d.b.h.; bark brownish, the surface tessellated with thin flakes. *Leaves* chartaceous to subcoriaceous; petiole 0.6–1.0(–1.3) cm long, thickened at base; lamina elliptical (4–)5–12(–16) cm long and (1.8–)3–5(–5.8) cm broad, often with a few tooth-like extensions of the margin, attenuate at base, obtuse to acute or acuminate at apex; oil glands dense. *Inflorescence* a metabotryoid or thyrsoid, up to 4 cm long; flowers hermaphrodite or very rarely male. *Hypanthium* 4–5 mm broad, ± glabrous. *Sepals* 4 or 5, semicircular, 1–1.5(–2) mm long, 1.5–3(–4) mm broad, dotted with oil glands, margin minutely ciliate. *Petals* 4 or 5, white, orbicular, 2.5–3 mm long, oil glands absent or obscure, the outer surface covered with short hairs. *Stamens* very numerous, 80–100, apparently in 2–3 series but in distinct groups of 19–26, the outer series ± continuous but with distinct gaps opposite the centre of the sepals, the inner stamens aggregated in front of the petals; filaments 1–3.5 mm long; anthers dorsifixed, versatile, gland-tipped, the fertile ones 0.4–0.5 mm long and 0.3–0.4 mm broad, the sterile ones few, pale orange, 1 mm long and 0.6–0.7 mm broad. *Ovary* ± glabrous. *Style* 5 mm long; stigma dilated, convex. *Fruit* brown, rugose, 1–1.5 cm diam., capsule strongly exserted, splitting as far as the broad, flat fruiting hypanthium which has its free margin deflexed; seeds pale brown, ovoid. Figure 5 A, D, E, G, H.

We have named this species in honour of our late friend and colleague John T. Waterhouse who saw this species in the field and whose interest in the Myrtaceae was a great inspiration to us.

The species is apparently restricted to Mt Dryander, NE of Proserpine. It is the dominant tree on the more sheltered southern side of the mountain and

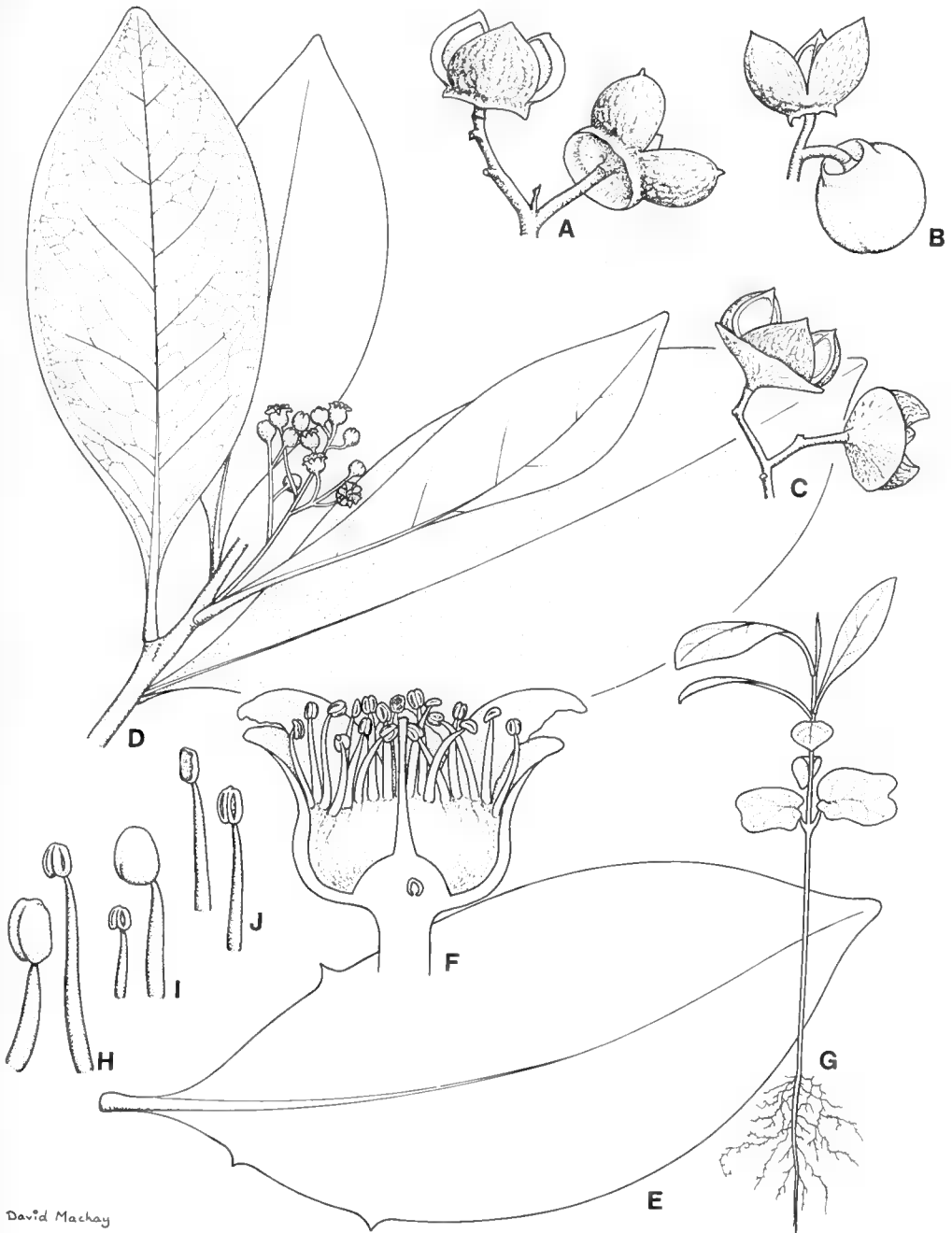


Fig. 5. *Ristantia waterhousei* Peter G. Wilson & B. Hyland. **A**, fruit (X 1). **D**, flowering branchlet [coppice growth] (X 1). **E**, leaf showing teeth (X 1). **G**, seedling (X 0.5). **H**, sterile (left) and fertile (right) stamens (X 10). *R. gouldii* Peter G. Wilson & B. Hyland. **B**, fruit (X 1). **F**, longitudinal section of flower (X 8). **J**, sterile (left) and fertile (right) stamens (X 10). *R. pachysperma* (F. Muell. & F. Bailey) Peter G. Wilson & Waterhouse. **C**, fruit (X 1). **I**, fertile (left) and sterile (right) stamens (X 10). (**A**, **D**, **G**, **H** from Wilson & Puttock UNSW 13291; **B** from Hyland 6926; **C** from Wilson UNSW 3732; **E** from Wilson & Waterhouse UNSW 3802b; **F**, **J** from Hyland 6764; **I** from Hyland 6033).

occurs from the foothills to the summit; Thomas and McDonald (1987) give its conservation status as 2R.

R. waterhousei is unusual in the Myrtaceae in having tooth-like projections from the lamina margin of some leaves (fig. 5E). These are not homologous with the tooth-like marginal projections of the epidermis of some *Baeckea* species (Johnson & Briggs 1985: 714), nor are they true teeth since they lack a central, principal vein (Hickey & Wolfe 1975). These 'teeth' do not occur on all leaves and are variable in number when they do occur. Of the other two *Ristantia* species it is closest to *R. gouldii* but differs from that species in its more numerous stamens, its larger sterile anthers, its longer style and in having a broad fruiting hypanthium.

R. pachysperma differs from both of the above species in having hard, thick, furrowed bark, generally larger more coriaceous leaves, longer, more branched inflorescences, stamens more distinctly grouped, sterile anthers more numerous and on distinctly longer filaments (fig. 5I), style very short, and fruiting hypanthium flat to very broadly obconical (fig. 5C).

SPECIMENS EXAMINED: QUEENSLAND: **North Kennedy:** Mt Dryander, *Guymmer* 1722, 1736, 3.7.1982 (BRI), *Lavarack* 6-7.1972 (QRS, UNSW), *McLain* 3.11.1979 (QRS), *Moriarty* 1901, 1902, 21.7.1974 (QRS), *L.S. Smith* 27.5.1969 (BRI), *Webb & Tracey* 12235 [*P. Stanton* s.n.], 1.12.1973 (QRS), *Wilson & Waterhouse* UNSW 3802a, b, 14.6.1974 (UNSW), *Wilson & Puttock* UNSW 13292, 12.4.1982 (UNSW).

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Valerie May — fifty years of phycology*

Robert J. King and Barbara G. Briggs

Abstract

King, Robert J.¹ & Briggs, Barbara G.² (¹*School of Botany, University of New South Wales, Kensington, Australia 2033*; ²*National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000*) 1988. *Valerie May — fifty years of phycology*. *Telopea* 3(2): 273–279. — The career of Valerie May (Mrs. E.H. Jones) is outlined in a paper to mark her retirement. A list of publications is accompanied by a review of her pioneering studies in the systematics of Australian marine algae, the control of toxic freshwater cyanobacteria (blue-green algae), and changes in algal floras following environmental changes resulting from coastal sewage outfalls or the damming of rivers.

Studies of the history of phycology in Australia have recognized three periods, corresponding with collections from early expeditions, collections by resident Australian naturalists with their description by British and European phycologists, and studies this century by Australian phycologists (Womersley 1959, 1984; Ducker 1981). This last period commenced with studies by gifted amateurs, particularly A.H.S. Lucas, but has been actively pursued since the mid-1930s by university-trained phycologists. Valerie May was in the vanguard of this group.

Valerie May began her undergraduate studies at the University of Sydney expecting to major in Chemistry, but Botany, taken as a 'fill-in' subject, soon became her major interest. Her undergraduate studies led to First Class Honours in 1936 and she won all the Botany prizes along the way. When she graduated everyone said there were no jobs in her chosen field of algal studies but she resolved to work on algae until she starved: fortunately she never found it necessary to return to chemistry for a livelihood.

The general state of phycology in Australia when Valerie May commenced her studies can be judged by a comment of Lucas (1936): "During the present century practically the only additions made to our knowledge of Australian Algae have been made in the papers published by myself in the Proceedings of the Linnean Society of New South Wales." There was no guidance in phycology in the Botany Department at Sydney or indeed elsewhere in Australia at that time but Valerie was permitted to work for her honours and M.Sc. on the life-history of *Ectocarpus* (May 1939b) and on developing keys to the green and brown marine algae (May 1938a, 1939a). These keys were not major taxonomic revisions but rather drew together the vast taxonomic literature into a readily available and coherent form, and perhaps more importantly they were in

*Paper prepared for a seminar to celebrate fifty years of phycological studies by Valerie May, and to mark her retirement from the Royal Botanic Gardens, Sydney; held on 4 June 1987 at the School of Botany and Centre for Marine Science, University of New South Wales.

English. Much later on this approach was extended to cover the red algal genera (May 1953a, 1965a) and finally the red algal species (May 1965b).

After graduation Valerie held Sydney University Scientific Research and Commonwealth Research Scholarships and then a Linnean Macleay Fellowship of the Linnean Society of New South Wales. It was symptomatic of the scant regard for phycology that, with the appointment of a new Professor and changed departmental priorities, she was required to turn from her algal work for two years to do surveys of mistletoes (May 1941) and work on drought resistance in higher plants (Ashby & May 1941). Another sign of the times was in 1940 when she advised the scholarship authorities of her forthcoming marriage to Ern Jones, who later became a senior staff member of the Faculty of Dentistry in the University of Sydney. She was firmly told that, as a married woman, she would not be eligible for renewal of her scholarship, and indeed that such a development made them doubt that they had been wise to appoint her in the first place.

By late 1940, CSIR, the forerunner of CSIRO, under pressure of wartime needs, sought to develop an agar industry for medical and food requirements (Ferguson-Wood & May 1944). A hectic period followed. Although based at CSIR Division of Fisheries, Cronulla, Valerie spent much time in Queensland and New South Wales on fieldwork by day and working long into the night identifying the collections she and others had made. An industry was established that was viable, at least in the short term, but high labour costs and changed needs prevented its continuation after the war; also the then known suitable algal populations were declining. As a result of these applied studies a monograph on the algal genus *Gracilaria* was published (May 1948b), and the series 'Studies on Australian Marine Algae I-VI' commenced (May 1944-1951).

At about this time Valerie arranged to borrow the large and important collection made by A.H.S. Lucas. Lucas, one-time headmaster at Newington College and later the Sydney Grammar School, had undertaken the honorary curatorship of the algae in the herbarium of the Sydney Botanic Gardens in 1899 (Lucas 1937). After his retirement, at the age of 70 in 1923, he devoted his prodigious energy almost entirely to phycology. He collected all over Australia, with major expeditions to W.A. when in his mid-70s, to the Great Barrier Reef at the age of 78, and to Lord Howe when he was 80. He began work on the handbook of the seaweeds of South Australia in 1935 and the first volume was published on the day he died at age 83, in 1936 (Cortis-Jones 1937). His main collection was bequeathed to the Commonwealth of Australia and consisted of about 5000 specimens. At the time that Valerie arranged for its transfer, the collection had not found a permanent home and was sitting, uncurated, in the corridors of CSIR's offices in Canberra. The collection was moved from the Cronulla laboratories to the National Herbarium of New South Wales when phycological work was no longer part of CSIR's priorities. The Lucas algal collection is a major resource and many research workers have been able to refer to his collection in its more accessible location in Sydney.

Valerie had been a frequent visitor to the National Herbarium of New South Wales during her honours year and later during her tenure with CSIR. While her four children were young, Valerie worked at the herbarium on a part-time basis but without any official position or salary. In 1960 she was appointed as Honorary Custodian of Cryptogams. This gave only a meagre fee as remuneration and no security of tenure, but she continued in this position (later retitled Honorary Phycologist) until the end of 1986. The position was set up to

give facilities and some assistance to a botanist in this field, and was additional to the regular staff. In practice, Valerie mostly worked beyond the requirements of a fully paid position, maintained an active program of fieldwork, and dealt with a constant flow of specimens for identification.

The early work was strictly marine with an emphasis on the Rhodophyta: the census and key to the species of the Rhodophyta of Australia (May 1965b) summarized much of her previous 15 years of work. Later Valerie diversified her interests by extending into the freshwater environment. Early in the 1960s she was asked by the then Director of the Gardens, Knowles Mair, and veterinarian Eddie McBarron to respond to a new challenge: stock deaths due to blooms of blue-green algae in farm dams. She identified the organisms, worked with chemists to determine the conditions in which blooms occurred, and adapted and tested methods of control (May 1970b, 1971, 1972, 1974, 1976c, 1978a, 1978b, 1980a, 1981a, 1981c; May & Baker 1978; May & McBarron 1973; McBarron & May 1966). Valerie has been widely recognized for her pioneering work in this field. As a result she has been invited to speak at, or co-convene, international symposia (e.g. in 1980, The Water Environment: Algal Toxins and Health, Dayton, Ohio, USA and The International Symposium on Inland Water and Lake Restoration, Portland, Maine, USA). She has contributed also to many Australian conferences.

In addition, Valerie has undertaken joint work, as shown by her publications, with zoologists, veterinarians, statisticians, fisheries biologists and ecologists in universities and State and Commonwealth organizations. She has been consulted extensively about problems of water quality, especially blooms toxic to humans and stock.

Phycology has led her into unusual places and into studies of the interactions of algae and other organisms. She has cooperated in research on the effects on algal growth of removing animal predators from rocky headland sites (May *et al.* 1970), algal epiphytes, sea-grasses (May *et al.* 1978) and subtidal floras (May & Larkum 1981) and, in the terrestrial sphere, has studied the effects of algal epiphytes on the growth of *Macadamia* trees in plantations. She has investigated problems and identified specimens for the police, for poultry farmers and in relation to questions about safety of both mines and dams.

Concern with deleterious environmental influences affecting marine or freshwater algal populations has been the principal theme in her recent work. Changes in algal floras at coastal sewage outfalls have been monitored (May 1981b, 1985b), as have seasonal and annual changes in floras of rivers and dams (May & Powell 1986). By seeking baseline data before dams and outfalls are built, and by monitoring over extended periods, Valerie has again done pioneering work relevant to present day environmental concerns about water quality and eutrophication.

In addition to her scientific contribution, Valerie has played her part in the important task of making the general public aware of marine plants and their role in the environment: mangroves (May 1967); seaweeds (May 1976b); water resources (May 1982a).

In 1987 Valerie May was appointed as an Honorary Research Associate of the Royal Botanic Gardens, Sydney, and she continues to work towards further publication of her research on floras of inland rivers and dams.

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(Photograph F. Baverstock)

Mrs Valerie Jones

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- A plea for more culturing in taxonomic studies.

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SHORT COMMUNICATION

Chionochloa howensis (Poaceae), a new species from Lord Howe Island

This new species is being published to allow its inclusion in the forthcoming treatment of the floras of Lord Howe and Norfolk Islands as part of the 'Flora of Australia' project.

Chionochloa howensis S.W.L. Jacobs, sp. nov.

C. flavicanti similis, a qua differt lemmate dorsali glabro lemmate infimo segmento rhachillae destituto.

HOLOTYPE: 'Razorback, S. end summit plateau, Mt. Gower, Lord Howe Island, J. Pickard 2634, 21.xi.1975. Rare tussock grass to 0.7 m high on exposed rocky basalt spur on edge of scrub. On edges of 700 m cliff in low appressed scrub. Leaves nibbled by feral goats. 31°35'S 159°04'E Grid ref 790 000' (NSW). ISOTYPES: BRI, CHR, K, US.

Coarse, erect, caespitose perennial to c. 1 metre tall. Culms erect, compressible; nodes 4-5, not exerted. Leaf sheaths keeled at first, finally becoming flat, glabrous except for a few hairs 1-2 mm long on the margin just below the collar, 10-15 mm wide, persistent, outer surface strongly ribbed, initially green, then becoming straw-coloured and finally grey-brown. Ligule a row of hairs 0.5-1 mm long, with a few scattered hairs 1-2 mm long continuing for a short distance along the margin of the blade. Leaf blade to c. 60 cm long on specimens, possibly considerably longer, flat when fresh to c. 12 mm wide, becoming involute when dry, tardily deciduous; upper surface strongly ribbed, scabrous; lower surface slightly ribbed, smooth, glabrous. Panicle 15-25 cm long, 6-8 cm wide, dense, most of the inflorescence exerted; axis terete to angled, pubescent with hairs 0.25-0.5 mm long; branches 2-5 per node, to c. 10 cm long, angled, pubescent with hairs 0.25-0.5 mm long; pedicels 1-3 mm long, pubescent with hairs c. 0.25 mm long. Spikelets 6-8 mm long (excluding awns); florets mostly 3-5 with the lower 2-3 fertile, the remainder male or sterile. Glumes 2, lanceolate, membranous, 1-nerved, tips acute; lower glume 4-5.5 mm long; upper glume 5-6 mm long. Lowest lemma 4.5-5.5 mm long, terminally awned from an entire apex or from the sinus of a bilobed tip, chartaceous, 5-7-nerved, glabrous on the back with a tuft of hairs at the callus and ciliate on the lower margins with hairs c. 0.5 mm long; callus blunt, almost perpendicular to rhachilla, c. 0.25 mm long, with spreading hairs to 1 mm long; apex 2-lobed with lobes 0.25-0.5 mm long or the lobes fused to the base of the awn, especially in young material; awn straight, 8-10 mm long, flattened, loosely once or twice spirally twisted or not twisted. Upper lemmas becoming progressively smaller but differing from the lowest lemma chiefly in the longer callus, to 0.75 mm long, due to the attached rhachilla segment, occasionally the lobes with bristles to 1 mm long. Palea subequal or equal to the lemma, 2-nerved, bilobed, the margins ciliate with stiff hairs \leq 0.1 mm long. Lodicules 2, cuneate, glabrous, c. 0.25 mm long; stamens 2; stigmas 2. Mature caryopsis not seen.

DISTRIBUTION: Only known on or near cliffs on Lord Howe Island.

OTHER SPECIMEN EXAMINED: NEW SOUTH WALES: **Lord Howe Island**: NW. shoulder of Mt. Lidgbird, J. Pickard NSW 178643, 21.9.1970 (NSW, K, CHR).

The specific epithet is derived from the name of the island on which the species occurs.

This species is listed as *Chionochloa* sp. A (aff. *conspicua*) in Jacobs & Pickard (1981: 39); in correspondence and manuscripts concerning the flora of Lord Howe Island it has frequently been listed as *C. conspicua subsp. nov.*, despite its lack of close taxonomic affinity with that species.

The association with *C. conspicua* (Forst. f.) Zotov has resulted from use of the key to species of *Chionochloa* in Zotov (1963). *C. howensis* does key out to *C. conspicua* on lemma hair pattern, leaf sheaths and awn characters, but differs from that species in inflorescence size and compactness, floret size, glume length, lemma size and shape, stamen number and the callus of the lowest lemma.

The affinities of *C. howensis* lie with the New Zealand species *C. flavicans* Zotov, not with the two Australian species (*C. frigida* and *C. pallida*) from which it differs in lemma size, shape and hair pattern, relative glume length, inflorescence size and shape, and several vegetative characters. *C. howensis* and *C. flavicans* are similar in lemma size and shape, absolute glume length and glume length relative to spikelet length, spikelet size, inflorescence size and compactness, and habitat. *C. howensis* differs from *C. flavicans* in being glabrous over the back of the lemma (but there are hairs on the callus and the margins), the lack of a rhachilla segment attached to the base of the lowest lemma, the broader leaves, the tendency for the blades to be tardily deciduous, and in being generally a smaller plant. Vickery (1956) and Jacobs (1982) have previously indicated similar lemma hair pattern differences within species in the closely related genus *Danthonia*.

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SHORT COMMUNICATION

***Myosotis exarrhena* F. Muell., the correct name for *M. suaveolens* (R. Br.) Poir. (Boraginaceae)**

During recent examination of material of *Myosotis*, our attention was drawn to the incorrect use in Australia of the name *Myosotis suaveolens*. There are two homonyms involved; the first, *M. suaveolens* Waldst. & Kit. ex Willd., a European endemic, was published in 1809 while the combination *M. suaveolens* (R. Br.) Poir., applied to an Australian endemic, was not published until 1816. The latter species was originally published as *Exarrhena suaveolens* by Robert Brown in 1810 but Poiret transferred it to *Myosotis*, considering that the exerted stamens which give the taxon its name were not sufficient grounds for the erection of a separate genus. However, for reasons that are not clear, Poiret created the homonym *M. suaveolens* (R. Br.) Poir. and relegated *M. suaveolens* Waldst. & Kit. ex Willd. to the synonymy of a new name, *M. odorata* Poir. The legitimate name *M. suaveolens* Waldst. & Kit. ex Willd. was for a long time considered a synonym of *M. sylvatica* Hoffm., which may have hidden the nomenclatural problem, but the treatment of the genus in *Flora Europaea* (Grau & Merxmüller 1972) upholds the species as distinct. In any case, this name has always had priority over the Australian one.

Mueller, in the Fourth Supplement to his Systematic Census (April 1889), published the new name *Myosotis exarrhena* for the Australian taxon with the following entry:

'*Myosotis suaveolens* (not Waldstein & Kitaibel) = *M. exarrhena*, F.v.M.'

This valid publication has been overlooked and the name seems to have been considered a *nomen nudum* because of the reference in Mueller's Second Systematic Census (late 1889 or early 1890) to '*M. exarrhena*; F.v.M., inedit.' where the replaced name was not explicitly indicated. No later authors that we can find have taken up the name and only a few (Moore & Betche 1893; Rodway 1903) even list it as synonym. Indeed, Muir (1979) has not included *M. exarrhena* in his list of Mueller's new taxa, new combinations and new names.

***Myosotis exarrhena* F. Muell.**, Syst. Census Austral. Pl., Suppl. 4: 7 (1889)

M. suaveolens (R. Br.) Poir., Encycl. Suppl. 4: 44 (1816) *non* Waldst. & Kit. ex Willd., Enum. Pl. Hort. Berol.: 176 (1809).

Exarrhena suaveolens R. Br., Prodr.: 495 (1810). TYPE CITATION: '(D.) v.v.' i.e. Van Diemens Land (Tasmania), R. Brown 1804 (Holotype: BM, not seen).

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SHORT COMMUNICATION

Bertya ingramii* (Euphorbiaceae), a new species from New South Wales**Bertya ingramii* T. James, sp. nov.**

B. oleifoliae affinis sed differt foliis brevioribus marginibus minus recurvatis, bracteis paucioribus (modo 6 vel 7), segmentis perianthii florum femineorum parvioribus subter fructum non accrescentibus atque nonnisi dimidio inferiore connatis.

HOLOTYPE: NEW SOUTH WALES: **Northern Tablelands:** Top of Dangar's [Dangar] Falls, southeast of Armidale, *J.B. Williams K29*, i.1964 (NSW). ISOTYPE: NE.

Slender to rounded shrub to 2.5 m high with a short, grey, stellate tomentum, lower stems glabrescent. Leaves alternate, linear to narrow-ob lanceolate or narrow-elliptic, 10–35 mm long, 1–4 mm wide; upper surface at first with sparse stellate hairs, becoming scabrous; lower surface whitish grey to pale yellowish, densely stellate-tomentose, midrib prominent, apex obtuse to acute, margins recurved; petioles 1–3 mm long. Flowers axillary, solitary on short, thick peduncles to 1 mm long. Bracts 6 or 7; outer bracts 3 or 4, unequal, 1.5–3 mm long, lanceolate, thick, grey-tomentose; inner bracts to 2 mm long, ovate-triangular, thin-textured, sparsely tomentose to glabrous. Male perianth segments to 3 mm long, oblong-elliptic, imbricate, brown, glabrous; staminal column 4–5 mm long. Female perianth segments connate below the middle, lobes 2–3 mm long, oblong-ovate, brown, glabrous, often recurved. Ovary densely stellate-tomentose, far exceeding the perianth segments; styles 3, each deeply 3-fid. Capsule ovoid, 8–10 mm long, tomentose with both long and short stellate hairs becoming sparser with age. Seeds c. 6 mm long, glossy, reddish brown; caruncle broad-conical, apex shortly acuminate, persistent. Flowering period: September to December.

DISTRIBUTION: Known only from the Armidale area, New South Wales.

SPECIMENS EXAMINED: NEW SOUTH WALES: **Northern Tablelands:** Gara River, via Armidale, *K. Ingram NSW 193871*, 10.1936; Dangar's [Dangar] Falls, near Armidale, *J. Williams G60*, 1.1962; Dangar Falls, Armidale, *E. McBarron 20294*, 9.1971. All specimens in NSW.

HABITAT: In scrub or low forest at the edge of the gorge above Dangar Falls with *Leptospermum brevipes* and *Allocasuarina luehmannii*. The collection from Gara River lacks habitat information.

The species is named in honour of Mr C. Keith Ingram of Mt Tomah, New South Wales, who has provided many valuable collections from this State over the years. His 1936 specimen is the earliest collection of this species at NSW.

B. ingramii resembles *B. oleifolia* in leaf shape and overall tomentum but differs from that in its smaller leaves with less markedly recurved margins and in its smaller female perianth segments which do not enlarge under the fruit and which are distinctly connate below the middle.

B. ingramii was treated as *Bertya* sp. C by Jacobs and Pickard in 'Plants of New South Wales' 1981: 115.

I thank Peter Wilson for providing the Latin diagnosis and John Williams for his field observations.

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SHORT COMMUNICATION

***Lindsaea terrae-reginae*, a new fern species from Queensland**

When the account of the genus *Lindsaea* for Australia and New Zealand was published (Kramer & Tindale 1976), a specimen was cited at the end of the treatment of *L. obtusa* with the remark that it differed in a number of respects and might represent an undescribed species. During a visit to the National Herbarium of New South Wales, Sydney, in October 1986, the author examined the specimen again and found a second specimen that obviously represented the same taxon. This seemed to indicate that a truly distinct species was involved, which is here described as new, in anticipation of a treatment of the genus for the 'Flora of Australia'.

***Lindsaea terrae-reginae* Kramer, spec. nova**

Rhizoma brevissime repens; folia aggregata, simpliciter pinnata, sursum et deorsum angustata; pinnulae dimidiatae, superiores et (paucae) inferiores reductae, inferiores remotae; venae reticulatae; pinnulae integrae, soris continuis; indusium c. 0.3–0.4 mm latum, valde intramarginale sicut receptaculum. Sporae triletae.

TYPE: QUEENSLAND: S. slopes of W. ridge of Thornton Range, above 1000 m, 16°10'S 145°23'E, *P. Hind 2447 B*, August 1979 (NSW, holotype; isotype in BM, not seen).

Rhizome very short-creeping, c. $\frac{2}{3}$ –1 mm diam., reddish brown; scales minute, fawn-coloured, lanceolate, c. 0.4 mm long, 2 or 3 cells wide at base, soon shed, a few similar scales present on the petiole base. Petioles clustered, stramineous with the extreme base reddish brown, slender, c. $\frac{1}{2}$ mm diam., adaxially narrowly sulcate, abaxially bi-angular and very shallowly sulcate, c. 5–14 cm long, half as long as to about as long as the lamina. Lamina thinly herbaceous, dark olivaceous when dry, narrowly lanceolate to linear, narrowed to both ends but more strongly so towards the apex, simply pinnate, up to 18 x 2.2 cm, with up to c. 25 pinnules to a side; rachis like the petiole, slender. Middle and upper pinnules spreading or the upper ones slightly ascending, their width apart to (the upper ones) contiguous; lowermost pinnules remote and sometimes slightly deflexed. Major pinnules 4 x 2½–12 x 5 mm, dimidiate-ovate to subrhombic, obtuse to very obtuse, when fully fertile entire except for the subundulate-erose anterior margin, the latter evenly, or outward increasingly, convex; posterior margin straight or, especially in lower pinnules, concave. Upper pinnules gradually and strongly, evenly reduced, the uppermost denticuliform, confluent; basal pinnules remote and reduced, c. 3 x 2½ mm, often sterile and then crenate on the anterior margin. Veins rather lax, reticulate, the basal portion of a pinnule with one or two series of elongate-hexagonal areoles between posterior margin and receptacle, the larger areoles 1 mm wide. Sori in fully fertile pinnules continuous, strongly intramarginal, the receptacle $\frac{1}{2}$ –1 mm from the margin. Indusium pale, subentire, 0.3–0.4 mm wide, its edge falling short of the margin by roughly the width of the indusium. Spores trilete, tetrahedral, medium brown, almost smooth, c. 18 x 26 μ m. Fig. 1.

OTHER SPECIMEN SEEN: Mt. Sturgeon, Cook Distr., *C.T. White 10533*, Sept. 1937 (BRI, GH).

The type collection bears the ecological data, 'occasional in deeply shaded and high humidity locations in rainforest, on tree roots and under rocks, base of granitic boulders, on clayey soils'.



Fig. 1. *Lindsaea terrae-reginae* Kramer. A, lamina (apex missing) (X 1). B, detail of lamina (X 6). (Both from holotype.)

Although clearly a member of section *Synaphlebium* close to *Lindsaea obtusa* J. Smith in Hooker, this species does have some characters of *L. brachypoda* (Baker) Salomon of section *Paralindsaea*: a basally reduced lamina (as in the sterile leaves of *L. brachypoda*) and continuous sori. The possibility of hybrid origin was considered, but the (very few) spores remaining in the available material (some found in the sporangia) are well-developed and not so large in comparison with those of the other two species that it might be considered an allotetraploid hybrid. Both *L. obtusa* and *L. brachypoda* occur in the area where *L. terrae-reginae* was collected.

In Kramer & Tindale (1976) it will key out to *L. obtusa* but is readily distinguished from that species by continuous sori and particularly by the reduced and remote basal pinnules, unique in the Section. The suggestion given there that this may be Domin's 'var. *contigua*' must be rejected, as that was described as having partly bipinnate leaves of firm texture and as no mention was made of basally reduced pinnules.

The author is much indebted to Dr Mary D. Tindale, Sydney, for drawing his attention once more to this evidently undescribed species; to the Directors and Curators of NSW and BRI for hospitality extended to him and for the loan of material; and to Mr A. Zuppiger, Zürich, for preparing the illustrations.

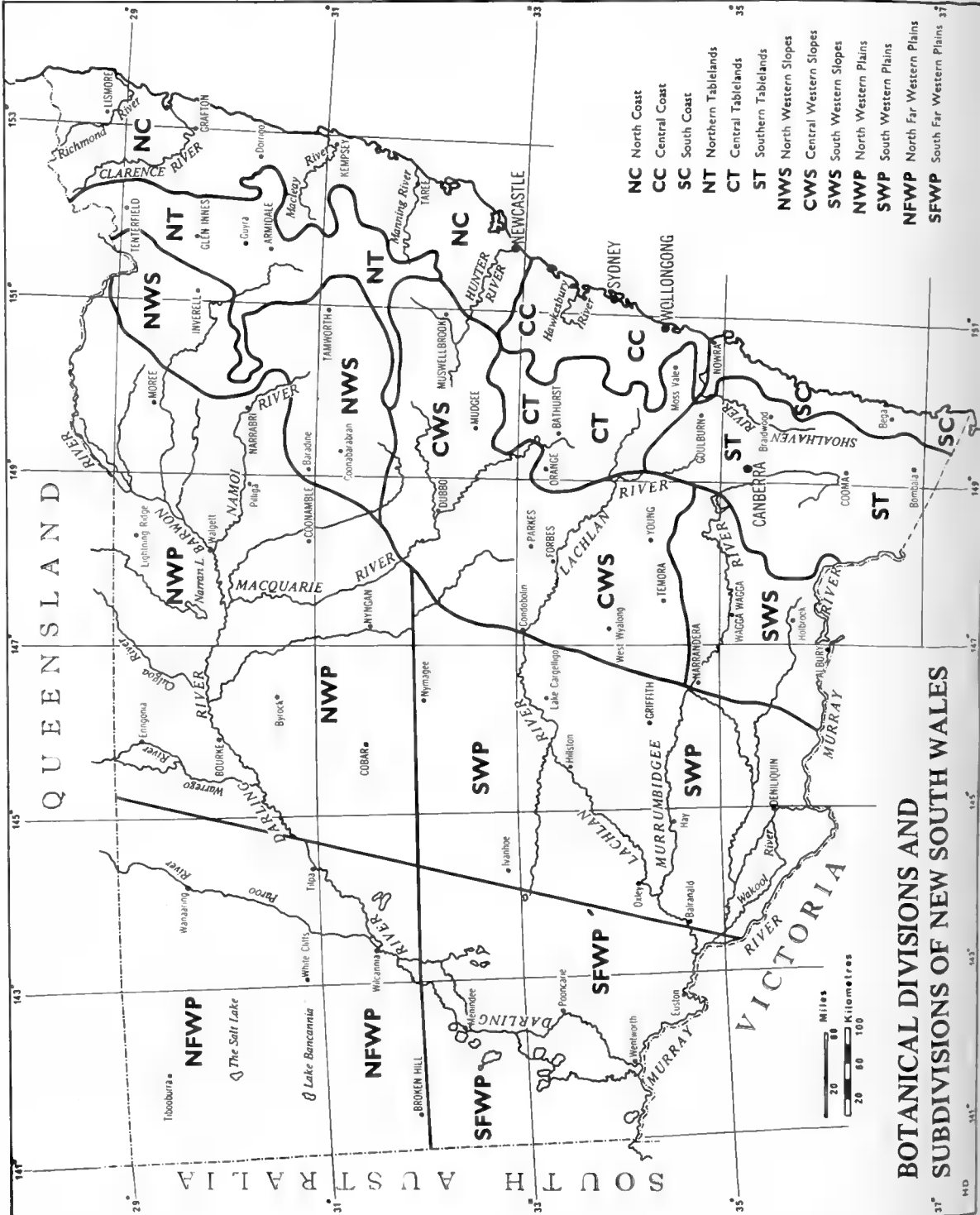
Reference

- Kramer, K.U., & Tindale, M.D. (1976) The Lindsaeoid ferns of the Old World VII. Australia and New Zealand. *Telopea* 1(2): 91-128, 4 pl.

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For explanation and description of the Botanical Divisions and Subdivisions of New South Wales see R.H. Anderson (1961) Introduction. *Contr. New South Wales Natl Herb., Flora New South Wales* Nos. 1-18: 1-15.

A revision of the genus *Neofabricia* (Myrtaceae)

J.R. Clarkson and Joy Thompson

Abstract

Clarkson, J.R. (Botany Branch, Department of Primary Industries, P.O. Box 1054, Mareeba, Queensland, 4880) and Joy Thompson (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1989. A revision of the genus *Neofabricia* (Myrtaceae). *Telopea* 3(3) 291–300. The genus *Neofabricia*, endemic to Cape York Peninsula, is reviewed. Three species, *N. mjoebergii*, *N. myrtifolia* and *N. sericisepala*, are described, *N. sericisepala* as a new species. The distribution of each species is mapped and a key for their identification provided.

Introduction

The genus *Neofabricia* J. Thompson (1983) was erected to accommodate *N. myrtifolia* (Gaertner) J. Thompson and *N. mjoebergii* (Cheel) J. Thompson, two species previously referred to *Leptospermum* Sect. *Fabricia* Benth. (1867), as *L. fabricia* Benth. and *L. mjoebergii* Cheel.

Recently a third species of *Neofabricia* has been found that differs in its morphology and ecological requirements from the known species. We now give a formal treatment of this genus to summarise our knowledge of the group.

Neofabricia J. Thompson, *Telopea* 2(4): 380 (1983)

TYPE: *N. myrtifolia* (Gaertner) J. Thompson.

SYNONYM: *Fabricia* Gaertner, *Fruct. Sem. Pl.* 1:175, t.35, (1788), non Adans. (1763), nec Scopoli (1777), nec Thunb. (1779), nom. illeg.

TYPE: *Fabricia myrtifolia* Gaertner.

Shrubs or small trees with fibrous, longitudinally fissured bark. *Leaves* alternate, spirally arranged, simple, entire, sessile or very shortly petiolate, with numerous oil glands readily visible with a lens; *venation* acrodromous with 3–5(–7) basal nerves, reticulate, the nerve islands elongate. *Inflorescence* an axillary bracteolate monad (rarely a triad), in leaf axils or on condensed shoots where a single flower and the terminal shoot bud are surrounded by imbricate bracts in the bud; *bracteoles* opposite. *Flowers* sessile or very shortly pedicellate, regular, 5-merous, polypetalous, bisexual; *hypanthium* broadly funnel-shaped to hemispherical, pubescent; *sepals* broad, persisting at least on young fruit; *petals* 5, imbricate in bud, yellow, white or cream, glabrous; *stamens* numerous, arranged in several irregular rows, with the outermost usually the longest, on a somewhat undulate disc, their disposition suggesting that there are 5 bundles each centred on a petal; *filaments* filiform, tapering at the apex; *connectives* with a prominent terminal gland; *anthers* dorsifixed, non-versatile, 2-celled, opening by longitudinal slits; *ovary* inferior, 5–12-locular, with narrow axile placentas bearing 2 rows of ovules; *top of the ovary* raised, with lobes above each loculus, pubescent; *style* terete, well inset in the top of the ovary; *stigma* terminal, simple, discoid, sometimes set obliquely on the style. *Fruit* a

multilocular capsule, almost spherical before dehiscence; *valves* exerted, splitting along the upper margins. *Seeds* irregularly ovate, flattened, usually 1 per loculus, developing from one of the lower ovules with the remaining ovules of that loculus aborted and fusing to form a pale scarious wing.

DISTRIBUTION: A genus of 3 species confined to Cape York Peninsula (Cook district), North Queensland (Fig. 1).

NOTES: *Neofabricia* appears to be a member of the *Leptospermum* suballiance of Briggs and Johnson (1979) but its relationship to other genera of that group has not been studied. The features which distinguish *Neofabricia* were discussed by Thompson (1983). They include the ontogeny of the wing on the seed, the anther attachment and the arrangement of the stamens.

Key to the species

- 1 Leaves less than 1.5 cm long. Flowers white or cream. Base of fruit broadly conical, 4 mm or less in diameter 1. *N. mjobergii*
- 1* Leaves more than 1.5 cm long. Flowers yellow. Base of fruit broadly cupular, more than 4 mm in diameter 2
- 2 Sepals densely sericeous. Leaves 2–4(–5) mm wide. Fruit 5–8-locular 2. *N. sericisepala*
- 2* Sepals glabrous except on margins or sparsely pubescent, never densely sericeous. Leaves (4–)6–10(–13) mm wide. Fruit 8–12-locular 3. *N. myrtifolia*

1. *N. mjobergii* (Cheel) J. Thompson, *Telopea* 2(4): 381 (1983).

BASIONYM: *Leptospermum mjobergii* Cheel, J. & Proc. Roy. Soc. New South Wales 53: 120 (1919).

HOLOTYPE: QUEENSLAND: Coleman River, Dr E. Mjöberg NSW 180571, 9.1913 (NSW).

Shrub or small tree to 10 m. *Bark* tight, grey or grey-brown. *Branchlets* villous, glabrescent. *Leaves* sessile, narrowly elliptic to oblanceolate or obovate, 6–10(–14) mm long, 2–4(–6) mm wide, glabrous or puberulent; base attenuate to cuneate; apex acute to acuminate. *Flowers* borne singly or rarely in triads in the upper leaf axils, subtended by a pair of bracteoles; *bracteoles* leaf-like, green, puberulent, persisting on young fruit but at length deciduous; *hypanthium* broadly funnel-shaped, 2–3 mm long, 3–3.5 mm diam. at the apex, puberulent; *sepals* broadly ovate, 2–3 mm long, glabrescent; *petals* almost orbicular, 3.5–4 mm long, white or cream. *Filaments* 1.5–4.5 mm long; *terminal gland* spherical; *anther cells* diverging, separate, on opposing sides of the gland, 0.4–0.5 mm long. *Ovary* 5–7-locular; *top of the ovary* raised, strongly lobed, villous; *style* 3.5–4.5 mm long; *stigma* 0.4–0.5 mm wide, as wide as or slightly wider than the apex of the style. *Fruit* 3–4 mm diam., villous, glabrescent; *base* broadly conical; *valves* much longer than the cupular base. *Seeds* c. 1.5 mm long excluding the wing, c. 1 mm wide, dark reddish brown; *wing* 2–3 mm long, c. 1.5 mm wide. (Fig. 2c & Fig. 4g-l).

FLOWERING AND FRUITING PERIODS: Flowering occurs from August to October. Most fruit fall shortly after the seed has been shed but a few are sometimes retained until flowering the following year.

DISTRIBUTION: Central inland areas of Cape York Peninsula southwest of Princess Charlotte Bay between latitudes 14° 30' and 15° 30' South.

ECOLOGY: Occurs in open forests and woodlands dominated by *Eucalyptus* and *Melaleuca* species, usually associated with white sands. The understorey of these communities is often shrubby.

CONSERVATION STATUS: The rating 2R by Thomas and McDonald (1987) is probably an accurate assessment of the conservation status of this species. The flowers, however, are insignificant and the plant could have been overlooked by collectors. Although no collections have been seen from within a proclaimed conservation reserve, the species almost certainly occurs within the Lakefield National Park.

NOTES: This species is readily distinguished from other *Neofabricia* species by its habit, its small, narrow leaves, white or creamy coloured flowers and its small fruit. In the field it could be confused in general appearance with the more widespread and common *Thryptomene oligandra*. This may account for its poor representation in herbaria. The opposite leaves of the *T. oligandra* serve to distinguish it.

SPECIMENS SEEN: 16.

SELECTED SPECIMENS: 13.7 km N of Wakooka on the track to Cape Melville, *Clarkson* 7313, 31.7.1987 (BRI, NSW, MBA); near Musgrave, *Hyland* 10066, 15.9.1979 (QRS); 54 km E of Edward River on the Musgrave to Edward River Road, *Clarkson* 3503,

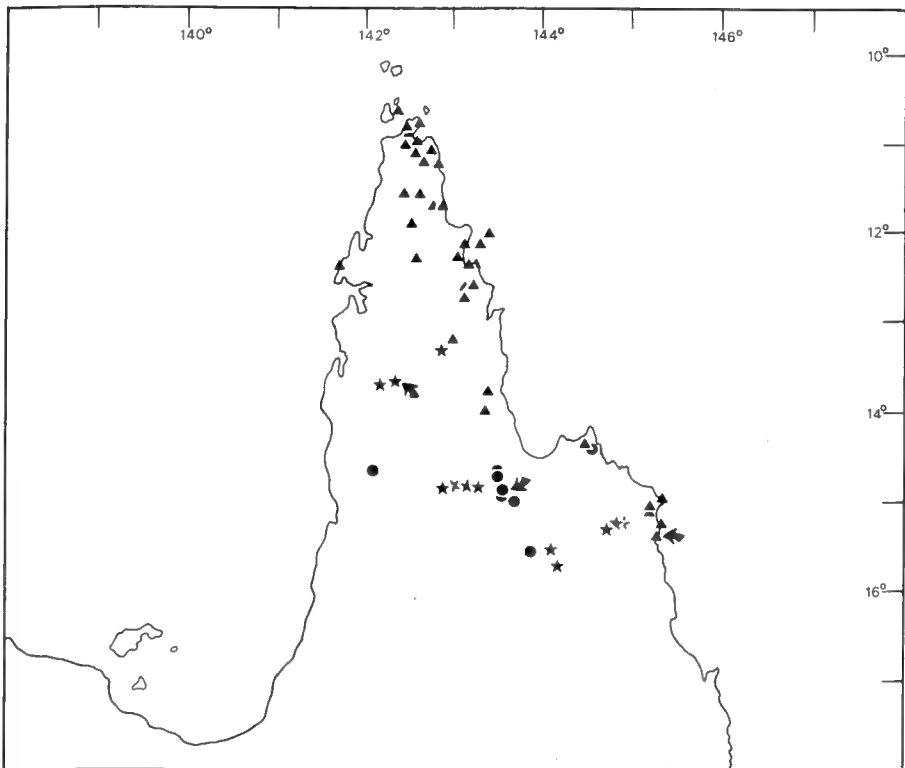


Fig. 1. Distribution of *Neofabricia* species. *N. mjoebergii* ●, *N. sericisepala* ★, *N. myrtifolia* ▲. Arrows indicated type localities.

10.10.1980 (BRI, CANB, K, L, MBA, MEL, MO, NA, NSW, NT, PERTH, QRS); between Morehead and Hann Rivers, *Brass* 19983, 29.8.1948 (BRI); 7.2 km NW of Kennedy River crossing on the Fairview to Kimba road, *Clarkson* 3184, 20.4.1980 (BRI, K, MBA, MO, NSW).

2. *N. sericisepala* J. Clarkson & J. Thompson sp.nov.

A *N. myrtifolia* (Gaertner) J. Thompson foliis angustioribus, floribus et fructibus parvioribus, a *N. mjoebergii* (Cheel) J. Thompson foliis grandioribus et floribus flavis, et ab ambobus sepalis sericeis, differt.

HOLOTYPE: QUEENSLAND: 2 km E of Merapah Station on the track to Rokeby, 13°43'S, 142°25'E, J.R. Clarkson 7142 and B.K. Simon, 10.5.1987 (BRI).

ISOTYPES: AD, CANB, CHR, DNA, K, L, MBA, MEL, MO, NSW, PERTH, QRS.

Shrub or small tree to 6 m. *Bark* tight and hard, grey. *Branchlets* with a dense, short, closely appressed pubescence, glabrescent. *Leaves* sessile, oblanceolate to narrow-elliptic, often somewhat falcate, (15-)20-30(-40) mm long, 2-4(-5) mm wide, sericeous, glabrescent; base attenuate; apex narrowly acuminate, somewhat pungent. *Flowers* borne singly on short, axillary, bracteate shoots; *bracts and bracteoles* scarious, brown, sericeous, caducous; *hypanthium* broadly funnel-shaped, 2.5-3 mm long, 4-4.5 mm diam. at the apex, densely sericeous; *sepals* suborbicular, 3-3.5 mm long, densely sericeous; *petals* orbicular, 5-5.5 mm long, yellow. *Filaments* 1-3 mm long; *terminal gland* spherical; *anther-cells* diverging, separate, on opposing sides of the gland, 0.3-0.4 mm long. *Ovary* 5-8-locular; *top of the ovary* slightly raised and lobed, sericeous; *style* 2.5-3 mm long; *stigma* c. 0.5 mm wide, slightly wider than the apex of the style. *Fruit* 5-6 mm diam., sericeous, glabrescent; *base* broadly cupular; *valves* equal to or slightly longer than the base. *Seeds* c. 2 mm long excluding the wing, 1.5-1.8 mm wide, dark reddish-brown; *wing* c. 3 mm long, c. 2 mm wide. (Fig. 2d & Fig. 4m-r).

FLOWERING AND FRUITING PERIODS: Flowering occurs from May to July or occasionally August. Fruits persist until October or November and are shed before flowering the following year.

DISTRIBUTION: Central and southern inland areas of Cape York Peninsula between latitudes 13° and 16° South.

ECOLOGY: Occurs in *Eucalyptus* woodlands usually on shallow sandy soils derived from sandstone. The soil surface is often strewn with quartzose pebbles.

CONSERVATION STATUS: This species rates as 3R using the criteria of Thomas and McDonald (1987). No populations are known from within a proclaimed conservation reserve but it is highly likely the plant occurs within the Rokeby National Park.

NOTES: Until recently this plant has been infrequently collected and confused with *N. myrtifolia* from which it is distinguished by its narrow leaves, smaller flowers and fruits and 5-8-locular ovary. The hoary appearance of the sepals due to the sericeous indumentum serves to separate the new species from both *N. myrtifolia* and *N. mjoebergii*.

ETYMOLOGY: The specific epithet is based on the latin 'sericus' referring to the silken hairs on the sepals which readily distinguish the species from the other known species of the genus.

SPECIMENS SEEN: 14.

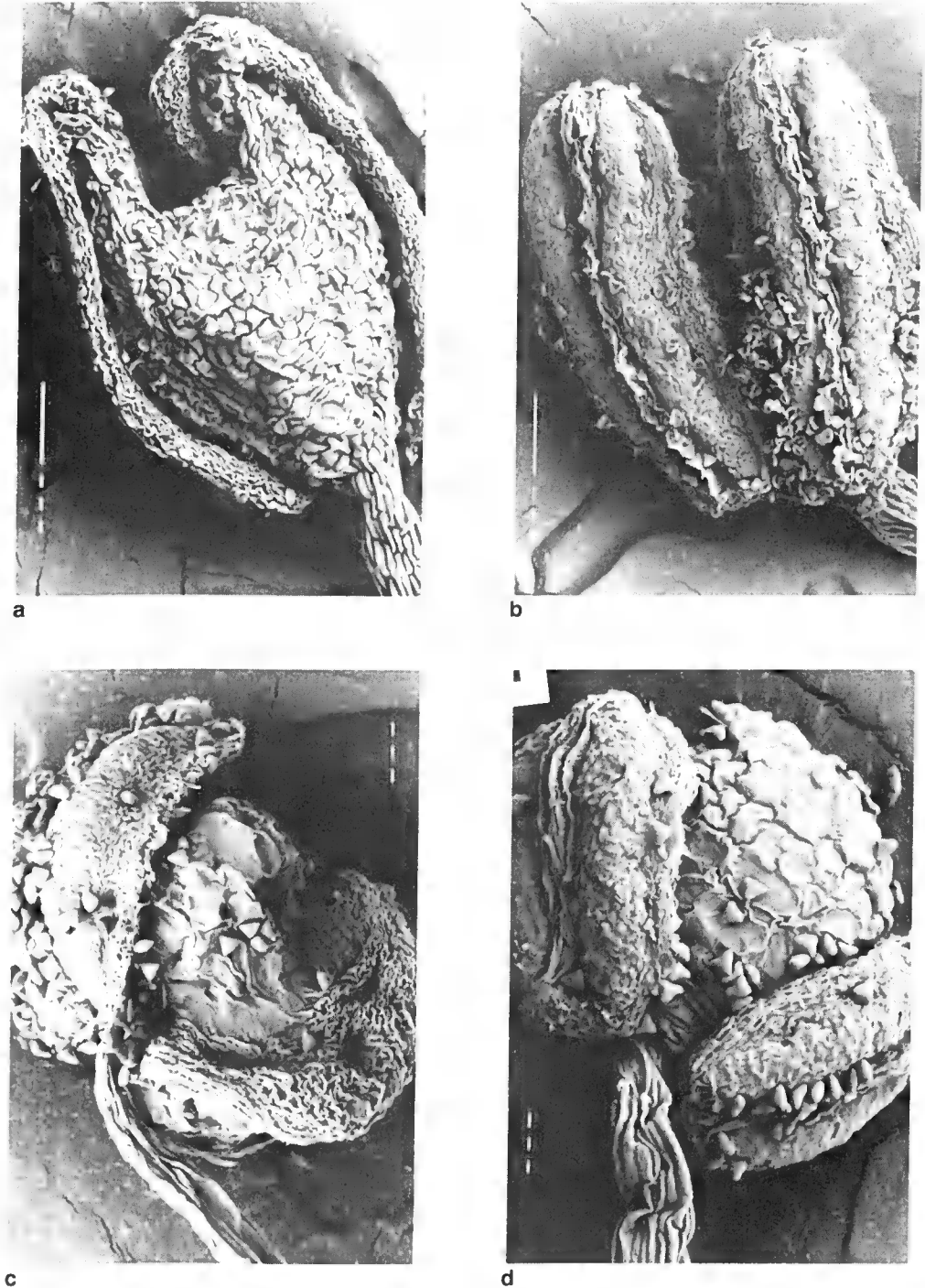


Fig. 2. Scanning electron micrographs of anthers of *Neofabricia* species. **a, b** anther of *N. myrtifolia* (top bar = 100 μm); **c** anther of *N. mjoebergii* (bottom bar = 10 μm); **d** anther of *N. sericisepala* (top bar = 10 μm); (**a, b** from Gittins 1802; **c** from Gittins 1879; **d** from Clarkson 7142 & Simon).

SELECTED SPECIMENS: 7.8 km N of the Archer River on the Peninsula Development Road, *Clarkson 6041*, 25.7.1985 (BRI, K, MBA, MEL, NSW, QRS); 3.6 km E of Lukin River on Edward River to Musgrave road, *Clarkson 3573*, 14.10.1980 (BRI, CANB, K, MBA, MO, NA, NSW, NT, PERTH, QRS); range between Isabella Creek and Normanby River, *Stephens CAIRNS 14953*, 30.5.1968 (QRS); 1.7 km E of the Normanby River on the Laura to Cooktown Road, *Clarkson 5977*, 5.6.1985 (BRI, CANB, DNA, K, L, MBA, MEL, MO, NSW, PERTH, QRS); 41 km S of Laura on the Maytown road, *Searle SDS 998*, 1.10.1984 (MBA).

3. *N. myrtifolia* (Gaertner) J. Thompson, *Telopea* 2(4): 380 (1983).

BASIONYM: *Fabricia myrtifolia* Gaertner, *Fruct. Sem. Pl.* 1: 175, t. 35, (1788).

HOLOTYPE: Endeavour River, *Banks & Solander*, 1770, n.v. ISOTYPE: NSW.

SYNONYM: *Philadelphus myrtifolius* Solander ex Gaertner, loc. cit., nom. nud.

Leptospermum fabricia Benth., *Fl. Austral.* 3: 102 (1867). TYPE: As above.

Shrub or tree to 5 m, occasionally reaching 10 m. *Bark* hard, dark grey-brown to almost black. *Branchlets* glabrous or with a mixed indumentum of both long and short spreading hairs, glabrescent, the shorter hairs persisting longer. *Leaves* sessile or very shortly petiolate, oblanceolate to narrowly obovate, (20-) 35-45 (-55) mm long, (4-) 6-10 (-13) mm wide, glabrous or sericeous when young particularly along the margin; base attenuate; apex obtuse to broadly acute or acuminate. *Flowers* borne singly on condensed bracteate shoots at branch ends; *bracts and bracteoles* scarious, brown, with a fine rather spreading pubescence, caducous; *hypanthium* almost hemispherical above a short stout basal part, 4-5 mm long, 6-8 mm diam. at the apex, with a dense, long, appressed or spreading pubescence; *sepals* almost orbicular or broader than long, 3(-5) mm long, usually glabrous apart from the densely pubescent margins, occasionally shortly pubescent; *petals* almost orbicular, 8-10(-12) mm long, yellow. *Filaments* 3-10 mm long; *terminal gland* elliptic; *anther cells* parallel and usually touching on the same side of the connective, 0.6-0.8 mm long. *Ovary* 8-12-locular; *top of the ovary* raised and lobed, usually with a dense, rather crisped pubescence; *style* c. 2.5 mm long; *stigma* 0.8-0.9 mm wide, much wider than the apex of the style. *Fruit* 7-9 mm diam., with a fine spreading pubescence, glabrescent; *base* broadly cupular; *valves* equal to or slightly longer than the base. *Seeds* 2-2.5 mm long excluding the wing, 1-1.5 mm wide, reddish brown; *wing* 5-6 mm long, 2.5-3 mm wide. (Fig. 2a-b, Fig. 3 & Fig. 4a-f).

FLOWERING AND FRUITING PERIODS: The peak of flowering occurs from May to August with occasional plants flowering somewhat earlier. Fruits appear to be retained longer than those of the other two species and, although usually shed by the start of the next season's flowering, may at times be retained.

DISTRIBUTION: Eastern and northern areas of Cape York Peninsula from Horn Island south to near Cooktown between latitude 10° 30' and 15° 30' South and on some continental islands off the east coast.

ECOLOGY: Occurs on exposed rocky headlands and in heath communities on coastal dunes where it is often one of the dominant species. North of the Wenlock River it is a common understorey element in *Eucalyptus* open forests and woodlands on sandy soils.

CONSERVATION STATUS: Widespread and not considered at risk. The species has been recorded from a number of proclaimed conservation reserves.

NOTES: This is the most widespread of the three species. The habit and general morphology of the plant is quite variable. On exposed headlands plants can be rendered almost prostrate by the shearing effects of strong winds, while in coastal dune communities the habit is generally shrubby. In less exposed, tree-dominated communities further inland plants usually grow as small trees.

The leaves of plants occurring in coastal areas, particularly towards the southern limit of the species' distribution (cf. *Clarkson 5988*), tend to be broader, more obtuse and generally shorter than those from open forest and woodland communities further inland (cf. *Clarkson 6127*) and more closely resemble the form figured by Banks and Solander (1901: t. 105) and Gaertner (1788: t. 35). Flowers from these southern coastal populations also tend to be somewhat larger and deeper yellow in colour. Specimens collected from a number of continental islands off the east coast have extremely small leaves (cf. *Clarkson 7407*) although equally small-leaved specimens have occasionally been collected on the mainland (cf. *Pedley 2751*).

Neofabricia myrtifolia is the species referred to as Black Tea-tree by Brass in his account of the 1948 Archbold expedition to Cape York (Brass 1953). Brass records the Aboriginal name for the species as 'Untarra' or 'Antarra'. Volck (cf. Volck 01511) notes that the Aborigines of the Lockhardt River area used a reddish coloured gum from this species for glueing skins to their drums.

The plant has been introduced into cultivation where it has proved to be an adaptable species which will grow well in districts subject to no more than light frosts.

SPECIMENS SEEN: 85.



Fig. 3. Light micrograph of seed of *N. myrtifolia* (approx. $\times 15.5$). From *Clarkson 3642*.



Fig. 4. Flowers, fruit and leaves of *Neofabricia* species (x2.5). a-f *N. myrtifolia*; g-l *N. mjoebergii*; m-r *N. sericisepala*; (a from Clarkson 7312 & Jacobs; b, e from Clarkson 7294 & Jacobs; c, d from Clarkson 6141; f from Clarkson 7407; g, l from Clarkson 3503; h, k from Gasteen 719; i from Clarkson 7313 & Jacobs; j from Clarkson 3184; m, o, p from Clarkson 7142 & Simon; n from Clarkson 3573; q from Clarkson 5977; r from Clarkson 7179 & Simon).

SELECTED SPECIMENS: Horn Island, *Tyack Bake* [AQ 041532 (BRI)], 11.7.1943 (BRI); 1.5 km S of the Dulhunty River crossing on the Peninsula Development Road, *Clarkson 6127*, 27.8.1985 (BRI, MBA, NSW, PERTH, QRS); Forbes Island, *Clarkson 7407*, 28.11.1987 (BRI, MBA, NSW, QRS); between Pine River basin and Gulf coast N of Duyfken Point, *Morton AM1117*, 17.2.1981 (BRI); Iron Range, *Brass 19099*, 8.6.1948 (BRI); c. 30 miles WSW of Portland Roads, *Pedley 2751*, 1.7.1968 (BRI, NSW, QRS); 7 km N of upper crossing of Massey Creek on Silver Plains Station, *Clarkson 3642*, 12.11.1980 (BRI, K, MBA, MO, NSW, NT, PERTH, QRS); 6 km E of the Hopevale to Starke road on the track to the mouth of the McIvor River, *Clarkson 5988*, 7.7.1985 (BRI, K, L, MBA, MEL, NSW, PERTH, QRS).

Acknowledgements

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List of specimens examined

Neofabricia myrtifolia

Anon 214 BRI; *Banks & Solander sn; Benson D.H. 604; Blake S.T. 20261; Brass L.J. sn [AQ 325821 (BRI)], 18516, 18754, 18876, 18941, 19099, 19395, 19649; Briggs B.G. 7301, 7360; Cameron E. 2106; Clarkson J.R. 2182, 3642, 3936, 5157, 5334, 5654, 5988, 6049, 6127, 6141, 6148, 6254, 6507, 6508, 6509, 7391, 7407, 7415; Clarkson J.R. 7294 & S. Jacobs; Clarkson J.R. 7312 & S. Jacobs; Clarkson J.R. 7327 & S. Jacobs; Clarkson J.R. 7336 & S. Jacobs; Dockrill A. 563, 612, 905; Dodson J. sn [AQ 0003587 (BRI)];

Flecker H. sn CAIRNS 13182; Gittens C.H. 1011, 1058, 1802; Hill K. 1098, L. Johnson & D. Blaxell; Hyland B. 5509, 6225, 6455, 7466, 9006; Isbell R. 10; Johnson L.A.S. 7766; Kanis A. 1927, 2071; Maconochie J.R. 2707; McDonald T.J. & G.N. Batianoff 1614, 1620 A; Morton A. 583, AM 1117; Musgrave A. sn NSW 183715; Paijmans K. 2781, 3025; Pedley L. 2725, 2751; Poland W. sn [AQ 41475 (BRI)]; Poland W. sn NSW 183714; Scarth-Johnson V. 868 A, 966 A, 1011 A, 1325 A; Sharpe P. 1512; Smith L.S. 12341, 12450; Stephens S.E. sn CAIRNS 11890; Stocker G. 880; Thomson D.F. 4; Tyack Bake H.T. sn [AQ 041532 (BRI)]; BRI 363346; Volck E. 01511, QF 62/58; Webb L.J. 3284; Webb L.J. & J.G. Tracey 5988; Whitehouse F.W. sn [AQ 041531 (BRI)], AQ041044, sn [AQ 348742 (BRI)]; Young J.E. sn [AQ 041531 (BRI)].

Neofabricia mjoebergii

Brass L.J. 19983; Calderwood J.C. sn NSW 28560; Clarkson J.R. 3117, 3184, 3503, 7313; Garnett S. G2; Gasteen J. 719; Gittens C.H. 1807, 1879; Hyland B. 5230, 10066; Lavarack P.S. 1002, 1642; *Mjöberg E. sn NSW 180571; Smith L.S. 12027.

Neofabricia sericisepala

Byrnes N. 3321; Clarkson J.R. 3466, 3573, 4581, 5467, 5701, 5977, 5982, 6041; *Clarkson J.R. 7142 & B.K. Simon; Clarkson J.R. 7179 & B.K. Simon; Pedley L. 2664; Searle S. SDS 998; Stephens S.E. sn CAIRNS 14953.

* Indicates type.

The material examined is located at BRI, NSW, QRS or MBA. Some material, particularly that collected by J.R. Clarkson, has been widely distributed.

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A revision of the genus *Leptospermum* (Myrtaceae)

Joy Thompson

Abstract

Thompson, Joy (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1988. A revision of the genus *Leptospermum* (Myrtaceae). *Telopea* 3(3): 301–449. The genus *Leptospermum* is revised and a new generic description provided. Generic attributes are discussed in relation to new observations and previous, often incorrect, descriptions in published work. A key to the 79 species accompanies a formal treatment of these taxa of which 27 are new, and 15 renamed or very much altered as to circumscription. Eight new subspecies are recognised. Seven putative natural groups are discussed; each in relation to its species-members, anomalies, the possibility of reticulation and its likely history. The evidence suggests that *Leptospermum* originated before the onset of Miocene aridity, and was dispersed relatively recently from eastern Australia to New Zealand, New Guinea, the Kimberley region of Western Australia and South East Asia.

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Introduction

The genus *Leptospermum* is a natural, but somewhat bipartite, taxon that has never been represented accurately as a whole in literature. Bentham (1867) included other genera in his concept. He also did not appreciate infrageneric relationships. As a result of this, and his failure to sustain genera and species distinguished by his predecessors, taxonomy in this area of the Myrtaceae has continued since Bentham's day in a state of chaos. The generic limits of *Leptospermum* have now been defined (Thompson 1983), and species of *Kunzea*, *Homalospermum*, *Pericalymma* and *Neofabricia*, formerly included, shown to be misplaced there. This redefinition has removed many of the anomalies that had brought confusion to the treatments of *Leptospermum* in most published work.




Distribution

Leptospermum is widely distributed across southern Australia. In eastern Australia *Leptospermum* is found from southern Tasmania to Cape York, while one species extends westward in the tropics to the Northern Territory and northwestern Australia and also across Torres Strait to New Guinea. One species common in Tasmania is widespread in New Zealand. Two species are found in South East Asia, one endemic on Mt Kinabalu in Borneo and the other, predominantly on mountains, from southern Burma, Thailand and the Philippines, to Flores and the Moluccas (see Map 1). The genus is not in the Caroline Islands, that record being based on *L. benningsenianum*, a species of *Myrtella* (Scott 1978), and is not in New Caledonia, though recorded by Curtis and Morris (1975) for that island. It has been recorded also for the mountains of New Guinea by Mueller (1890) and Diels (1922), but the descriptions given are obviously based on misidentified specimens.

Habitat

Though found in a variety of habitats, members of this genus are usually where the substrate is wet or periodically damp, and is acid with a low nutrient content. Mycorrhizae, both ectotrophic and endotrophic, have been found associated with the roots of a number of species (Lamont 1979). Habitats include damp sandy heath, areas of high water-table in dry sclerophyll forest, the base of granite boulders in arid Western Australia, crevices of granite boulders, coastal and inland dunes and sandstone escarpments, while soils range from the skeletal of rock outcrops to deep river sands. Some species occupy particular habitats; such as *L. laevigatum*, usually found on beach sand (Burrell 1981), *L. riparium* on river margins in Tasmanian rainforest (Jarman & Brown 1983), and some local endemics (such as *L. grandiflorum* and *L.*



-  *more than one species*
-  *one species (of Group 1)*
-  *one species (of Group 2)*

Map 1. Distribution of *Leptospermum*

petraeum) on rocky sites. However, most species grow near and often intermingled with other species, making estimation of their particular habitat-requirements difficult. Morrison and Myerscough (1982) have distinguished the habitats of *L. polygalifolium* and *L. morrisonii* on the basis of soil-nutrients, but more work of this nature is needed to explain the distributions associated with soil-type that separate other closely related species such as *L. trinervium* and *L. subglabratum*, and members of the *L. roei* group in Western Australia. A number of species inhabit apparently similar environments, as with *L. liversidgei*, *L. polygalifolium*, *L. speciosum*, *L. trinervium*, *L. whitei* and *L. semibaccatum* on the coastal sands of northern New South Wales and southern Queensland, and *L. polygalifolium*, *L. trinervium*, *L. myrtifolium*, *L. continentale* and *L. obovatum* on infertile tableland soils of central eastern New South Wales. None of these species is a relict occupying a species-rich environment as suggested by Smith (1981); on the contrary, they are all wide-ranging and rather vigorous species. Many of the species show great altitudinal range. *L. obovatum* reaches almost to the treeline of subalpine Kosciusko but also occurs near the coast in East Gippsland and western Victoria. The two Tasmanian endemic species *L. nitidum* and *L. glaucescens* are similarly found in both high-mountain and coastal regions. The variation associated with broad altitudinal range has been studied by Lee and Lowry (1980) for *L. javanicum* and *L. recurvum* in Borneo, Burrell (1965) for *L. scoparium* in New Zealand and Morrison (1984) for *L. polygalifolium* and *L. morrisonii* in central eastern New South Wales. Morrison found that the two taxa differed in their degree of response to increasing altitude.

Diagnostic characters

Habit

Although some species, notably *L. javanicum*, can become tall forest trees and others are usually found as low-growing shrubs, most *Leptospermum* species vary greatly in size according to the opportunity presented to the individual by the habitat. The relatively large-boled tree, *L. purpurascens*, has been observed to flower (in the nursery of the Royal Botanic Gardens Sydney) at the height of 15 cm. Most species readily reach a height of 1–2 metres but many of these have been reported as being found as trees in sheltered positions. Apart from size, most species have a characteristic habit, with the timing and vigour of the buds from the flowering region having great effect on the general aspect of the plant. Some species, such as *L. brevipes*, have a number of slender graceful young stems during or after flowering, while others, like *L. juniperinum*, are graceful in the upper part but leafless below. Others, like *L. lanigerum* and *L. grandifolium*, have their dense bushy nature assured by a moderate and uniform extension of growth from the terminal bud of many flowering shoots, each of which is at the end of a leafy axillary branchlet. The angle at which the majority of young stems branch from stems of a higher order is characteristic. The broad angle of branching found in species such as *L. erubescens*, *L. exsertum*, *L. arachnoides* and *L. glabrescens*, perhaps associated with the optimal display of flowers, is a useful diagnostic feature. Lignotubers have not been observed for many species but the "whipstick" nature of many is probably associated with an ability to shoot from a stout stock after trauma to the aboveground parts. *L. myrsinoides* is said (Burrell 1981) to regenerate from underground parts. The disproportionately stout trunks of *L. trinervium* are obviously associated with its possession of epicormic buds (protected by corky layered bark) ready to shoot after fire in its dry forest habitat.

Bark

Several different bark-types are found among species of *Leptospermum*. In most species the bark is fibrous and remains close to the stem, though on older plants it may loosen at the base of the plant. This bark-type can be seen in *L. polygalifolium* and *L. lanigerum* (fig. 1a). *L. petersonii* has a loosely fibrous (stringy) bark (fig. 1c), as do *L. javanicum*, *L. recurvum* and *L. wooroonooran*. *L. brachyandrum*, *L. luehmannii* (fig. 1e), *L. parviflorum* and *L. purpurascens* have bark that exfoliates seasonally to reveal a very smooth and often brightly coloured surface. *L. grandifolium* (fig. 1b) also sheds its bark in layers but these remain untidily about the stems. *L. trinervium* (fig. 1d) has bark in many fine layers with the outer layers being shed irregularly, whereas in *L. macrocarpum*, *L. spectabile* and *L. sphaerocarpum* a fibrous bark remains in place but becomes thick, dark and corrugated. Bamber (1962) examined the microscopic anatomy of the bark of several species of *Leptospermum* but there is no correlation between his anatomical results and the striking differences in external morphology, and this study did not distinguish taxa now assigned to *Kunzea* and *Homalospermum*. Aerenchymatous layers have been found in bark of *L. scoparium* under conditions of water-logging in New Zealand by Cook et al. (1980). It is possible that this feature could occur in other species, many of which flourish in flood-prone habitats and tend to have lifting bark at the base of their trunks.

Wood Anatomy

Wood structure of members of this family has been extensively studied, and wood characteristics have proved useful especially in the delimitation of genera. For instance, Van Wyk et al. (1983) found the wood of the southern African species of *Eugenia* quite distinct from that of *Syzygium*. But wood anatomists have suffered from the prevailing confusion as to the limits of *Leptospermum*. Ingle and Dadswell (1950) included *Kunzea ericoides* in the genus. Baas's (1977) *Leptospermum* was *Pericalymma*. Carlquist (1977) included the genera *Homalospermum* and *Pericalymma* in his concept of *Leptospermum*, while Johnson (1984) confused all these genera, and also *Neofabricia*. Only Johnson's work deals with individual *Leptospermum* species and it does not support apparently natural relationships, apart from the separation of *Pericalymma*.

Young Stems

It is the younger stems that are to be found in herbarium specimens, and characters from these can be useful for distinguishing species. On new growth, most species have long fine silky hairs that soon become sparse or are lost. Pubescence other than this is of taxonomic significance in some species although in most it is variable, especially as to the amount present and the proportions of different types, and cannot be used confidently for classification. These young stems often have a membranous flange extending each side of the leaf-base and sometimes continuing for some distance down the stem. In some species, such as *L. javanicum* (fig. 2a) this is very conspicuous and wing-like, while it is absent from others, like *L. grandifolium* (fig. 2b). In *L. laevigatum* (fig. 2c) a groove runs down the stem from beyond the leaf-base as if extra tissue has become fused (this needs confirmation by anatomical study), while, especially in Western Australian species (fig. 2d), there is an extension that remains on the stem as a conspicuous projection after leaf-fall.

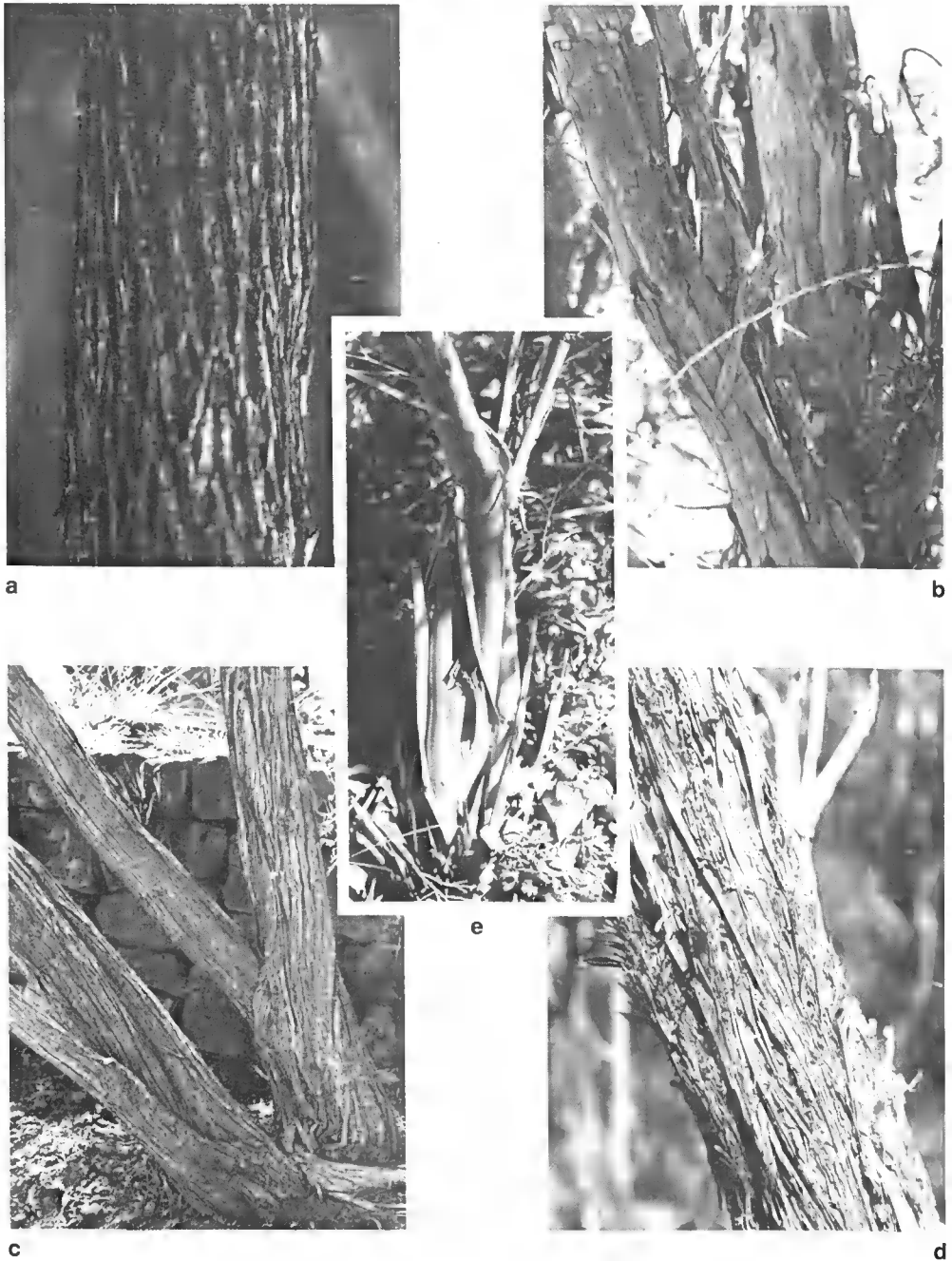


Fig. 1. Bark types. **a.** Close, fibrous bark, *L. lanigerum* (Tidbinbilla Nature Reserve, ACT). **b.** Smooth and exfoliating bark, persisting on the stems, *L. grandifolium* (Kosciusko National Park, NSW). **c.** Flaky and fibrous bark, *L. petersonii* (Mosman, NSW, cult.). **d.** Bark in many papery layers, *L. trinervium* (Mittagong, NSW). **e.** Smooth bark, seasonally exfoliating and shed, *L. huehmannii* (Mosman, NSW, cult.).

Leaves

All species observed produce several pairs of opposite leaves before development of the spiral condition. All mature *Leptospermum* plants have spiral leaves and bracts, only the bracteoles being subopposite or opposite.

Mature leaves are usually narrow and are rarely more than a few centimetres long (in most species no more than one cm in length). Leaf-size is consistent within a narrow range in some species and covers a wide range in others. However, in a number of species, individuals with ■ leaf-size beyond the normal range are not uncommon. Variation of leaf-shape in *L. scoparium*, including change of shape after transplanting to a different locality, is discussed by Burrell (1965). Some species have a distinct short petiole, as in *L. parvifolium*, and some lack one, but in most the petiole varies according to the position of its leaf on the plant. In spite of the difficulty in quantifying them, there are useful diagnostic characters carried by this region. Often the base of the midrib is very stout as seen on the lower leaf-surface. Many species are variable in the nature of the leaf-apex but the apex does provide some useful diagnostic characters. It is often unthickened, somewhat grooved on the upper surface and with a tendency to recurve. It may bear ■ short blunt point which, owing to the curvature, is behind the tip. Although occasionally retuse, it may, when not so, appear retuse when the tip is strongly recurved as in *L. wooroonoran*. When the tip is thickened it may vary within the species in the degree of pungency, but in species such as *L. squarrosum* the area below the point is stiff and triquetrous and the point long and pungent. Leaf-texture is generally scleromorphic but, in detail, is usually characteristic for the species. Leaf-margins are always entire but may vary from rounded and smooth to minutely tuberculate, a character that has been used diagnostically (Willis 1973). The minute tubercles are seen best in dried leaves, where, in many species, their presence can vary with the turgor of the individual leaf. The leaf-venation is derivative from brochidodromy, varying within as well as between species, and is often difficult to observe. Usually three, but sometimes more, main veins, separated by reticulation, are conspicuous near the base of the lower leaf surface. The curvature of the outer vein to form an intramarginal vein seems to be associated with leaf-shape. Extra veins are often present in juvenile plants. The leaves of most species are pubescent at least in part and when young, and this pubescence tends to persist longer on the lower surface, the margins and the base. Though useful in general, pubescence is far from reliable in defining species. The cuticle was studied by Johnson (1980) who observed cuticular papillae in the related *L. laevigatum*, *L. coriaceum* and *L. glaucescens*. Johnson also studied the stomates but this study did not associate species considered related morphologically or to distinguish between *Leptospermum* and related genera. Leaf chemistry has been studied, but, with the exception of the work of Flynn et al. (1979), has not been associated with accurately named specimens. However, it has been possible to locate material in the herbarium that would have been part of that used by Penfold (1922) and to reinterpret his results. This has shown that he considered the essential oils of three subspecies of *L. polygalifolium* to differ. Two species, *L. liversidgei* and *L. petersonii*, are lemon-scented, the latter not invariably. There is another aromatic scent, very strong in *L. morrisonii* but associated with a number of other species, that has now been chemically identified as the β -triketone grandiflorone (J. Brophy, pers. comm., see Hellyer & Pinhey, 1966).

The disposition of the leaves in relation to the stem is often characteristic for a species and helpful for identification. Although somewhat variable in each species the angle of divergence affects the appearance of the plant, as does the



a



b



c



d

Fig. 2. Leaf-stem junction. a. *L. javanicum*. b. *L. grandifolium*. c. *L. laevigatum*. d. *L. inelegans*. Scale (longest or shortest marker bar) = 200 μ m.

degree of curvature of the leaf itself. *Leptospermum* is characterised by a rather sharp transition from leaves to bracts in the flowering region (Thompson 1983) that distinguishes it from *Pericalymma*, but some species show modification of leaves in this region. In many species all leaves on the upper (flowering) part of the plant are smaller than the earlier leaves of a more vegetative phase, while in a few, such as *L. lanigerum*, some of the leaves close to the flower may have reduced blades and wider petioles. The pattern of oil-glands as seen in the dried leaves is often similar in apparently related species.

Inflorescence

The inflorescence of *Leptospermum* was generally misunderstood until Briggs and Johnson (1979) showed that the flowering shoot consists of a growth unit (fig. 3a) terminated by a vegetative bud and bearing one to several axillary bracteolate monads (with occasional triads in *L. purpurascens*) in bract-axils. The presence of several flowers on the flowering shoot had been observed by various authors and used not only to associate several species of the *L. brachyandrum* subgroup of Group 1 but to show (erroneously) that these were species of *Agonis*. Several flowers also develop on the shoot of other species, including *L. emarginatum* of Group 2, but most workers have failed to observe the extra flowers and have assumed the flowering shoot (the "inflorescence"), even of the numerous two-flowered species, to be one-flowered.

In *L. glaucescens* (fig. 3c) the usual condition is for the flowers to be monads in the axils of normal leaves, though occasionally this species can be found with *L. laevigatum*-type flowering shoots. Flowering as monads in leaf-axils can also be seen in regrowth ("reversion shoots") of *L. trinervium*. Most species have extra bracts below those subtending flowers (fig. 3b) but a few, e.g. *L. oligandrum*, lack these. The number of bracts on the flowering shoots varies according to the species. It is associated with the patterns of development of seasonal growth units so that shortly branched species usually have fewer bracts. When the bracts remain small it is easy to note the constant presence of the terminal vegetative bud, but in most species the bracts are somewhat too much enlarged and enclose the bud (fig. 3d); and often the flower (or the larger when two flowers develop) appears terminal. This bud and its development are most important as they control the form of the plants, as does the timing of this development. If precocious the bud can leave flowers as monads at the base of a leafy shoot (fig. 3e), if of very restricted development it can result in a plant with very short flowering side-branches along older stems, and if aborted it can result in apparent cauliflory; but as the terminal bud and the flowering shoot developing from it have the plasticity of vegetative parts they are unreliable for use in classification.

The paired bracteoles (prophylls) subtend the hypanthium and are usually similar in texture to the bracts, this texture often being scariosus but in some species firmer. Many species have bracts and bracteoles so readily deciduous as to be rarely observed, while others hold them about the opened flower. Bracteoles are often difficult to distinguish in the mass of imbricate tissues, especially where two flowers are involved, but are sometimes, as in *L. polygalifolium* (fig. 3g), large enough to overlap and envelop the mature bud, while in *L. trinervium* (fig. 3f) they remain lateral though large and it is the inner bracts that become broad and protective. In some species, such as *L. lanigerum*, the long sepals soon protrude through the rather rigid imbricate bracts surrounding the bud.

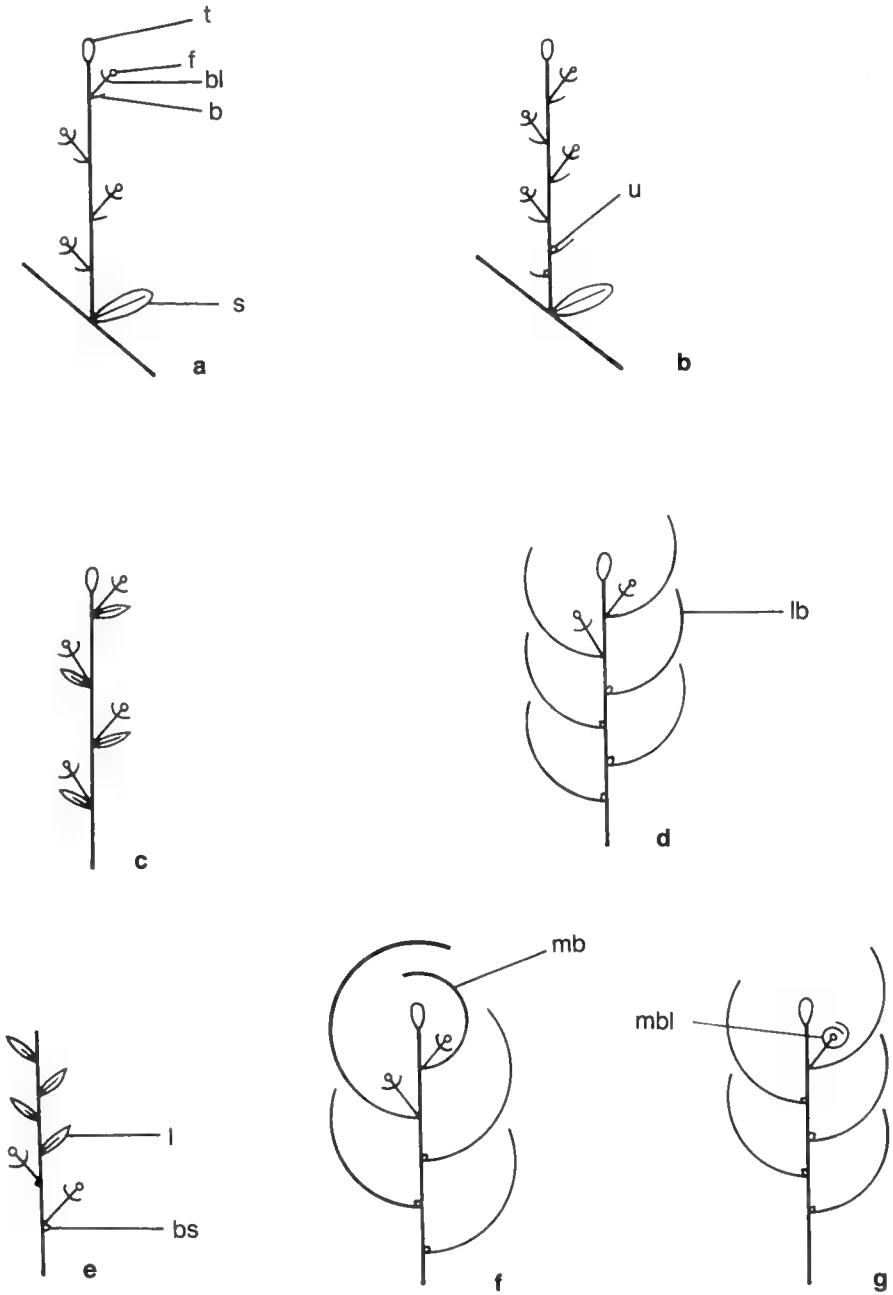


Fig. 3. Flowering roots — showing different forms found in *Leptospermum* (diagrammatic). (See text for discussion.) b = bract; bl = bracteole; bs = bract scar; f = flower; l = leaf of former terminal bud; lb = large bract; mb = much enlarged bract; mbl = much enlarged bracteole; s = subtending leaf; t = terminal vegetative bud; u = undeveloped floral bud.

The flowering shoot is sometimes axillary, and this can be seen clearly in *L. brachyandrum* and *L. oligandrum*, but for the vast majority of species a second unit of modified vegetative growth intervenes and there are two stages to flower-development. The apparently axillary flowering shoots of some species, when carefully examined, are seen to be at the end of a short stem topped by scars. This feature is hard to see in the truncated side-branches of some of the Western Australian species, but is readily seen in the more expansive leafiness of some of the eastern species. Whether at the ends of slender leafy growth or on a succession of short branches extending from adjacent stout stems below the leafy branches, these flowering shoots are usually massed.

Flowering time

Estimations of flowering time given here are based on herbarium material and are not necessarily exact. Most species flower very prolifically over a few weeks in spring and early summer and sporadically (in a few individuals) at other times. *L. squarrosum* has a major flowering in autumn. Western Australian species are spring-flowering as is to be expected in the Mediterranean climate of the southwest of the continent. Owing to the tendency for out-of-season flowers to be over-represented in collections, there is little record in the herbarium of the time of maximum flowering and of the difference in the peak with change of altitude and latitude. In the field the time of maximum flowering differs in the sympatric *L. speciosum* and *L. whitei* but other sympatric species such as *L. myrtifolium* and *L. continentale* flower together.

Flowers

The individual flower of *Leptospermum* is relatively simple and rather uniform (fig. 5c). The hypanthium often grades into a pedicel bearing two evanescent bracteoles that sometimes leave prominent scars. The ovary is enclosed by the hypanthium which is fused to its wall. The top of the hypanthium extends beyond the top of the ovary and bears persistent or deciduous sepals, petals that are readily deciduous and stamens that are usually readily deciduous. The loculi usually extend above the base of the style. The floral parts, the sepals, petals and staminal groups, are in fives and are attached to the hypanthium rim. The outer parts are imbricate, forming a cover to the bud while the stamens lying below them are incurved towards the short stigma. Flower size varies between species, from a few millimetres diameter to two or more centimetres, but there can also be some variation within species, especially a tendency to form abnormally small flowers under conditions of stress. Flowers are usually very conspicuous, being produced in large numbers on many plants at the peak of the flowering season, but they are inconspicuous and usually few on the scattered individual plants often seen flowering out of season.

In many, perhaps all, species a number of flowers lacking female parts are to be seen. From herbarium material this is difficult to detect and the proportion of these flowers in the individual species impossible to assess.

Hypanthium

The hypanthium exhibits valuable diagnostic features. It may be sessile, as in *L. squarrosum* (fig. 4c) and *L. macgillivrayi* (fig. 4g), or pedicellate as in *L. brevipes* (fig. 4a, b) and *L. maxwellii* (fig. 4d). The term "pedicel" is used here for the structure below the ovary, i.e. the anthopodium of Briggs & Johnson

(1979). The length of the pedicel in relation to that of the hypanthium is usually rather constant within a species but occasionally shows much infraspecific variation. *L. brevipes* (fig. 4a, b) and *L. trinervium* each have both a short) and a long-pedicellate form. These are usually separated geographically but are often observed to be sympatric. *L. fastigiatum* (fig. 4f) is pedicellate only in fruit. Also of significance is the area of transition from pedicel to hypanthium which is sometimes well-defined but often obscure. The shape of the base of the hypanthium, though variable, is often diagnostic, as in *L. brevipes* (fig. 4a) and *L. squarrosus* (fig. 4c) where it is broad and rounded and *L. maxwellii* (fig. 4d), *L. scoparium* (fig. 4e) and *L. macgillivrayi* (fig. 4g) where it tapers, in the case of *L. maxwellii* to a tapered pedicel. The shape is often associated with the shape of the enclosed loculi. The size of the hypanthium is most readily measured as a diameter and is not always in proportion to other floral parts.

The texture of the hypanthium may vary in turgor, being especially turgid in those few species, such as *L. glaucescens*, where, in the fruit, it may become coloured and succulent.

The upper (free) part of the hypanthium above the level of the ovary-top, though always proportionate in length to the lower part helps to distinguish some species. In some, e.g. *L. spinescens*, *L. macgillivrayi* (fig. 4g) and *L. subglabratum*, it is incurved to lie over the outer part of the ovary-top, in others, as in *L. erubescens* and *L. brevipes* (fig. 4a,b), it is a little widened and erect so as to appear as a rim, while in species such as *L. incanum* and *L. maxwellii* (fig. 4d), it is expanded and erect so that the hypanthium is infundibuliform. The pubescence of the hypanthium often characterises species but as it can vary in, or be lost from, individual plants it cannot be relied on as diagnostic in every case. Most of the many species with a densely pubescent hypanthium and pedicel have fewer hairs on the upper (free) part. Many of those numerous species that have an almost glabrous hypanthium may bear hairs on the pedicel. *L. myrsinoides* has been distinguished in the past by a hypanthium silky in the lower part and glabrous above, but *L. myrsinoides* is neither consistent in this feature nor the only species to show it. Species such as *L. laevigatum* that usually have a glabrous hypanthium are occasionally pubescent, and the usually pubescent *L. trinervium* can have a glabrous hypanthium.

Sepals

The five sepals are always imbricate but the amount of overlap varies. The almost cymbiform tips of the sepals in some species are associated with their packing in the bud. All species of Group 1 have persistent sepals, mostly ovate-deltoid, pubescent, at least in part, or glabrous, and becoming scarious toward the margins. *L. macgillivrayi* is unique in having wafer-thin obtuse sepals, while *L. confertum* has turgid sepals with pale scarious margins. In Group 2, while many species, such as *L. lanigerum*, have persistent sepals (some such as in *L. nitidum* long-deltoid and conspicuous), most have sepals that develop a basal abscission layer that allows them to be shed as the fruit develops. The formation of this layer is rather erratic in a few species, as in *L. liversidgei*, but the layer is usually well developed, often with the sepal pale and thin above it. The sepals are not conspicuously coloured but may, according to the species, be green, light brown or even pinkish red. In *L. macgillivrayi* they are cream-coloured.

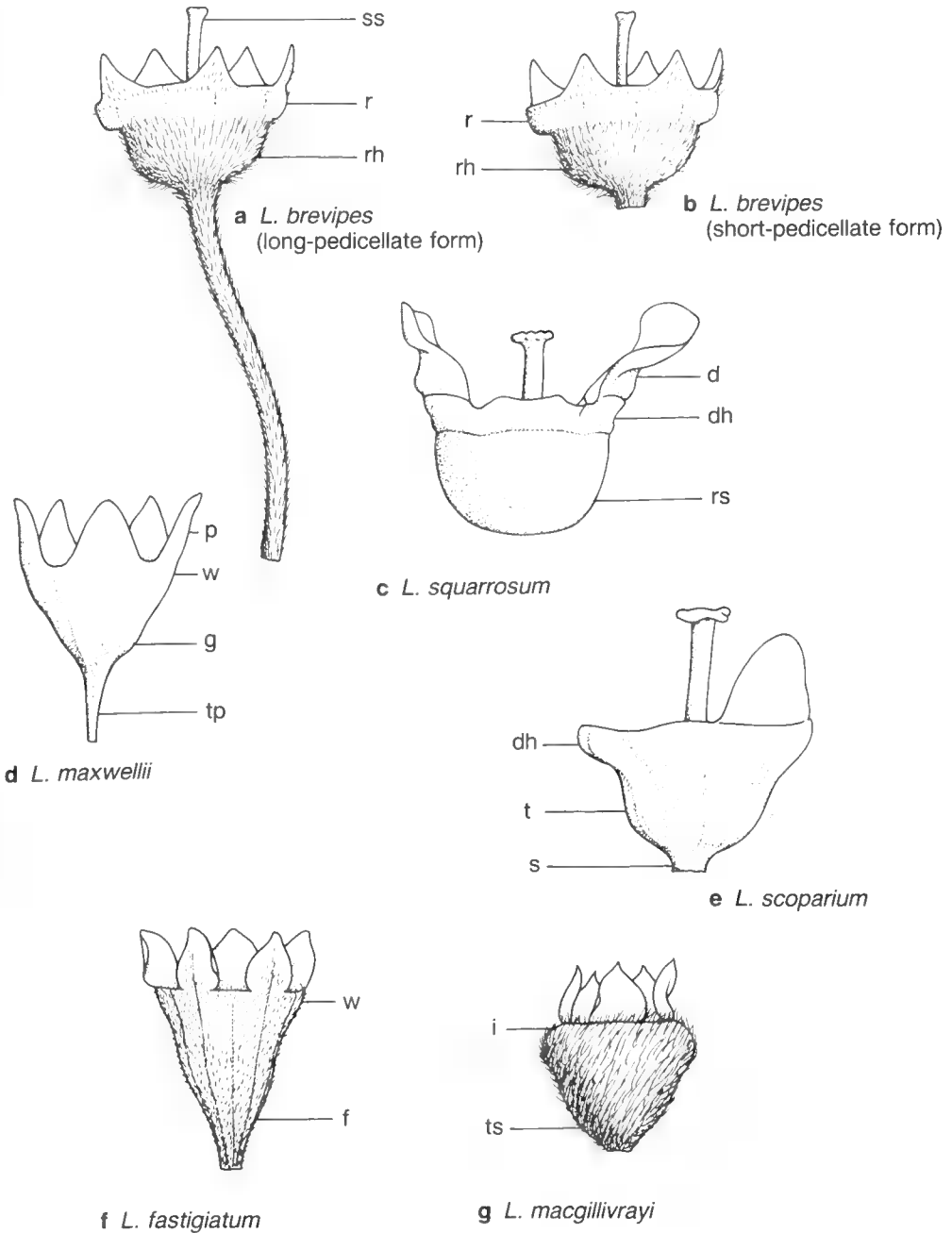


Fig. 4. Lateral view of young fruits. (See text for discussion.) a = dehiscent sepal; dh = somewhat widened and differentiated upper part of hypanthium; f = tapered fluted hypanthium developing a pedicel; g = gradually tapered hypanthium; i = incurved upper part of hypanthium; p = persistent sepal; r = upper part of hypanthium forming a rim; rh = rounded hypanthium-base with sudden taper to a scarcely tapered pedicel; rs = rounded sessile hypanthium; s = tapered hypanthium with short broad pedicel; ss = stigma and style; t = tapered hypanthium; tp = tapered pedicel; ts = tapered sessile hypanthium; w = widened upper part of hypanthium.

Petals

The five petals are obovate, often with an attenuation of the base that appears to vary within the flower as well as the species, and which is impractical to assess from herbarium specimens. Length was measured from herbarium specimens in order to relate all species but this reduces considerably the measurements that would be found in fresh specimens. In all species except *L. minutifolium* (which has small petals disproportionate to other floral parts) petals are longer, often much longer, than the stamens. The majority of species have white petals but in some these may be flushed with pink at the base. Some species may have some pink-flowered individuals while in others the petals are always pink. *L. macrocarpum* may have white, pink or red flowers, the last as a regional variant, and *L. spectabile* is uniformly dark red. Pink and red variants of *L. scoparium* occur in New Zealand but in Australia the petals are always white.

Stamens

Leptospermum stamens are arranged in groups (staminal bundles), each of which is centred opposite a petal (fig. 5c, Johnson & Briggs (1984), fig. 8). In dried specimens this arrangement is not obvious but in fresh flowers the curvature of the filaments shows their grouping within the continuous ring of stamens on the hypanthium edge. In some species the stamens are of almost equal length while in others the length within the bundle varies; always, however, the central stamen is shorter than the two on each side of it (the longest of the group) (fig. 5b) and the outer stamens of the group (if present) are shorter, later to unfold and variable in number within the flower as well as within and between species. As a result of this variability the number of stamens per bundle must usually be expressed as a range. In the bud the longer stamens are incurved or extend almost horizontally from the hypanthium to the stigma that is at approximately the same level (fig. 5a). The anthers face downward and the gland behind them lies near the stigma. The longer stamens lift first, before their anthers dehisce. That plants are self-compatible has been shown for *L. scoparium* in New Zealand (Burrell 1965).

The anthers of Group 1 species have two shallow and closely parallel cells, each with a layer of tissue at the base (fig. 6a). After dehiscence this layer is exposed as the pollen is shed. Two eastern Australian species, *L. trinervium* and *L. subglabratum* are exceptional in this group in having deep anthers, i.e. anthers where the dehiscent surface is well above the base. Deep anthers are universal in Group 2 species, but in other anther features this group is much less uniform than Group 1. The size of the anther-opening is restricted in some species and in these species the cells are often seen as diverging or separated (fig. 6c). This feature has never been remarked in literature but was illustrated (rather crudely) by J.C. Wendland & Schrader (1797) in their publication of *Melaleuca thea* (*L. polygalifolium*). This condition is constant in *L. polygalifolium* (fig. 6c) and *L. morrisonii*. In *L. lanigerum* and a number of other species of Group 2 there is considerable development of the tissue at the base of the cell. This is very obvious in the huge anthers of *L. macrocarpum* (fig. 6d). Some species show a tendency for the cells to either fold back (towards the filament, fig. 6a) or to curve in the other dimension, i.e. across the top of the filament (fig. 6d). The size of the anther-cell is usually \pm constant for the species but varies between species.

The filament is extremely narrow at the apex where it attaches to the back of the anther beside a conspicuous gland (fig. 6b). In some western species this

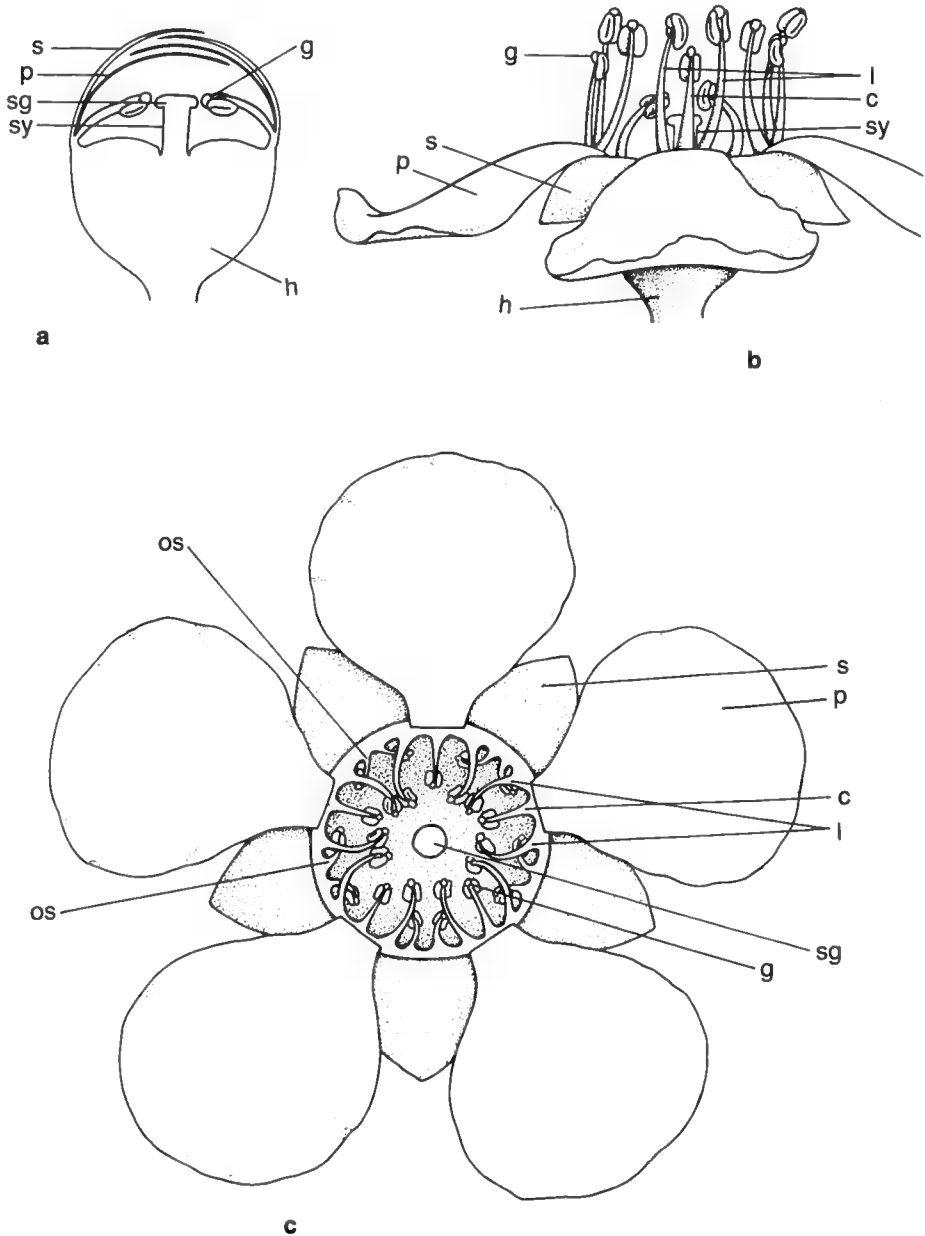


Fig. 5. Disposition of stamens in buds and flowers. **a.** Cross-section of bud. **b.** Side view of flower. **c.** Plan view of flower. (See text for discussion.) **c** = central stamen of the bundle; **g** = gland; **h** = hypanthium; **l** = longest stamen of the bundle; **p** = petal; **s** = sepal; **sg** = stigma; **sy** = style.

narrowing is abrupt but in most species the filament tapers gradually to its apex. A number of species show filaments dilated laterally at the base (splayed) and in some, such as *L. sejunctum*, the lower parts of stamens in the same group tend to fuse. Most species of Group 1 have short filaments less than 2 mm long, whereas in most species of Group 2 they are 3 mm or more. Hairs are found on the filaments, consistently in *L. deanei* (fig. 6b), inconsistently in *L. polyanthum* and very rarely in other species.

Top of the ovary

The surface of the ovary-top varies from glabrous to densely pubescent. All species of Group 2 have the surface glabrous and often shining with nectar. Most species of Group 1 have the surface variously and often densely pubescent, sometimes with short, erect hairs, and sometimes silky, but the species *L. brachyandrum*, *L. spinescens*, *L. macgillivrayi* and *L. exsertum* are exceptional in being consistently glabrous. The shape of this area may vary (fig. 7) from flat to slightly or conspicuously domed, and in *L. exsertum* it is almost conical. Some species, such as *L. luehmannii*, have the surface raised above each loculus of the ovary below. The shape of the domed surface is accentuated with the maturing of the flower and fruit and is best observed in association with fruit characters. In the flower the ovary-top is at first rather flat, with the style-base (in most species) inset, but often the surface later becomes raised either over the whole top or that part of it surrounding the style.

Stigma and style

The style is simple, as in all Myrtaceae, usually with its base inset in the top of the ovary (fig. 7a), the proportion inset being associated with the position of the placenta in the ovary. In a few species the surface of the ovary does not descend around the base of the style but is horizontal or raised to extend upward over a style-base (fig. 7b) which often adheres irregularly to the dehiscing fruit-valves. The style may be stout or slender and is often stout-based and tapering (fig. 7d). Though constant within species this feature is rarely diagnostic for a group. An exception is the style in *L. scoparium*, *L. juniperinum*, *L. continentale*, *L. rupicola* and *L. squarrosus* (fig. 8c), which is characteristically straight-sided with a disproportionately large flat stigma, but the style of the apparently unrelated species, *L. liversidgei*, is somewhat similar. Many species regularly or occasionally produce flowers in which the style is reduced or aborted (fig. 7c). In these flowers the style may be either unnaturally short, absent so that the stigma is sessile on the ovary-top, or absent with the stigma also absent so that the ovules abort. In a number of those species with a pubescence on the ovary-top, a few hairs can be found on the style-base. The size of the stigma, i.e. large or small, is best expressed in relation to the length of the style and is constant in many species (fig. 7). The stigma is sometimes noticeably lobed, the number of lobes corresponding to the number of ovary-loculi (fig. 7a), but this feature is rarely uniform within a species and its retention on herbarium specimens may depend on the drying process. Observation of living flowers may show it to be of some diagnostic value, as may be features of the stigmatic surface not studied here. Primack & Lloyd (1980) found the stigma of *L. scoparium* to be receptive throughout the life of the flower.

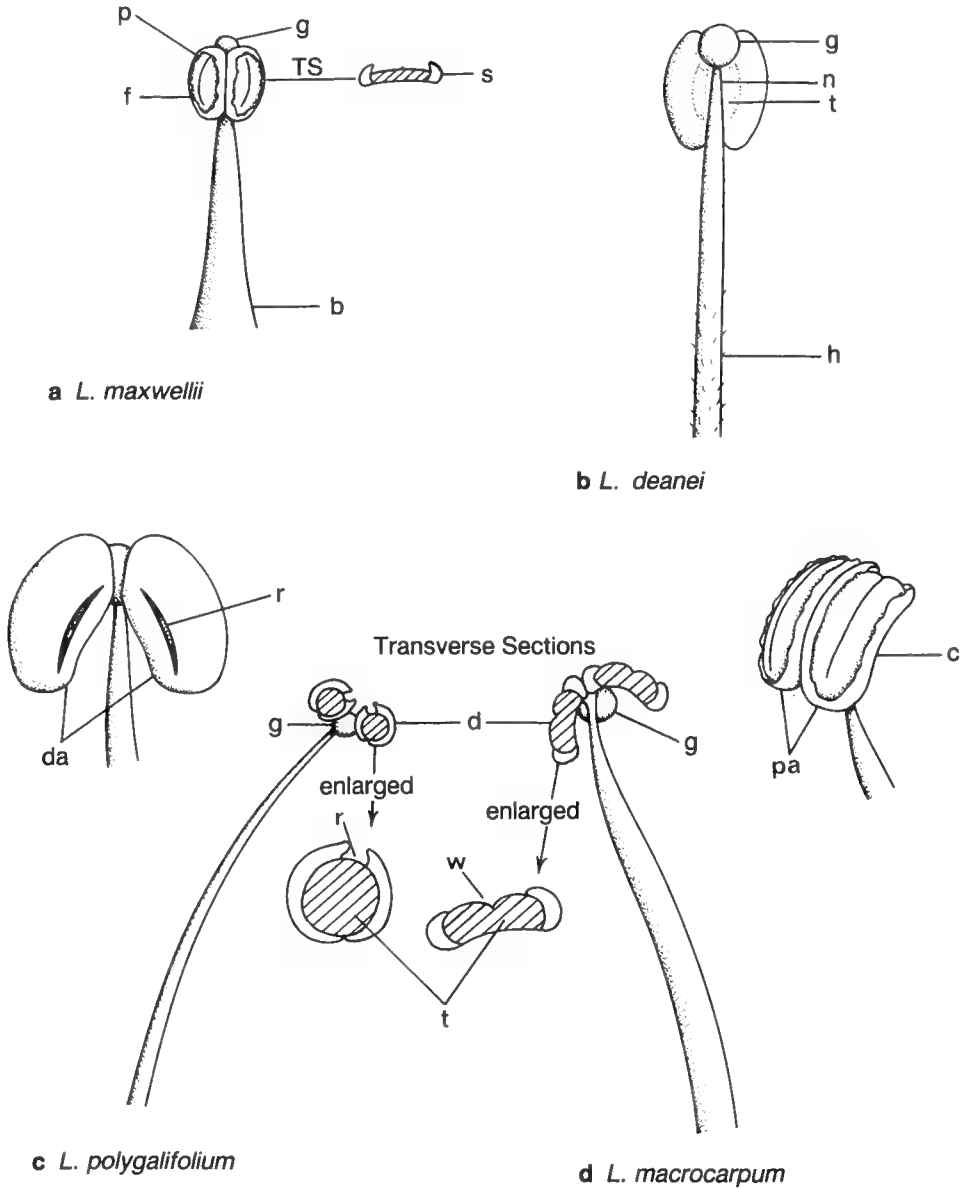


Fig. 6. Stamens after dehiscence. (See text for discussion.) b = broad (splayed) filament base; c = curved anther cell; d = deep anther cells; da = divergent anther cells; f = cell folded back; g = gland; h = hairs on filament; n = narrowed apex of filament; p = primitive (group 1 type) shallow anther cell opening wide; pa = parallel anther cells; r = restricted opening; s = shallow cell; t = thickened area; w = wide opening.

Ovary

The ovary has (2-)3-10 or more loculi, each with a placenta on the adaxial wall and numerous ovules. The number of loculi has long been used as a diagnostic character. However, this feature, while valuable in defining some species, is variable in many more species than has been supposed. This lack of careful observation has rendered misleading most published keys to species. A number of species regularly have 3 loculi, others 5 loculi, but many show variation with fruit of 3, 4 and 5 loculi on the same branch. *L. laevigatum* usually has more than 5 loculi (up to 10 or even more), and several other species show occasional fruit with more than 5 loculi. The placenta is peltate and usually attached somewhat above the middle of the axis (fig. 8a-d). In some species the placenta is attached so high in the loculus that all ovules are descending (pendulous) with the uppermost aborted. This is seen in *L. maxwellii* (fig. 8b). *L. parvifolium* is the only species of *Leptospermum* having the placenta attached low and most of its ovules ascending (fig. 8d). In most species the placenta has, on the distal surface, about 60 ovules spreading or descending according to their position, and distributed in unequal numbers in about six rows (fig. 8a, e). The distal surface of the placenta is narrow and the ovules in only two rows in several species, e.g. *L. glaucescens* and *L. laevigatum* (fig. 8f). It is broad with ten or more rows in others, such as *L. morrisonii*. In some species the upper part extends so far into the loculus that all or most ovules are descending. This is especially conspicuous in the high placentas of *L. petersonii* and *L. javanicum* (fig. 8c), and has been illustrated by Tison (1876), but obviously from an exceptionally modified individual of *L. javanicum*. Tison also illustrated the narrow, as in *L. coriaceum*, broad, as in *L. lanigerum*, and average-sized, as in *L. myrsinoides* (fig. 8a), placentas found in the genus. Viewed laterally the placenta may be seen to be shallow or deep (extending into the loculus), and its distal surface to be flat or rounded. Placentas that do not extend far from the axis or that are short (small) allow space for more ovule-development in the loculus.

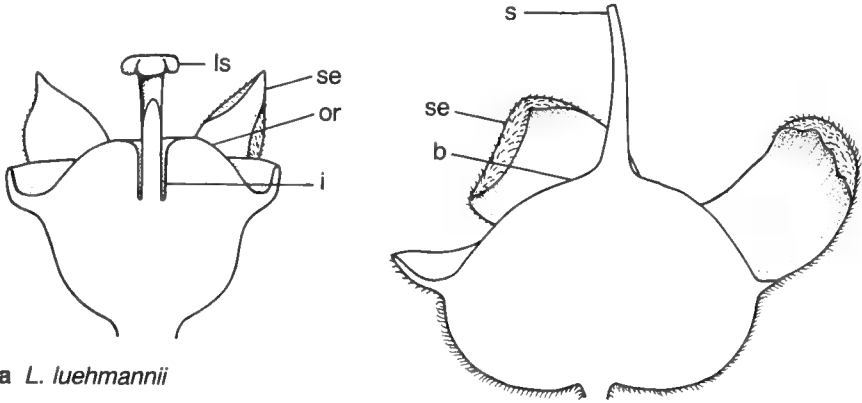
Some characteristics of the placenta can often be observed in opened fruit, see fig. 9b.

Ovules

The ovules are anatropous and are arranged in vertical rows on the placenta (fig. 8e, f). The structure of those of *L. laevigatum* is well illustrated and described by Johnson (1984), and, apart from the wing on its seed, this species is likely to represent the genus well. Usually a number of ovules fail to develop to maturity; occasionally these are vestigial but most develop at least part of the way towards maturity. The position of these unsuccessful ovules is not fixed though they tend to occupy the more cramped part of the loculus. The proportion developing varies between species but also varies considerably within species probably depending on environmental conditions.

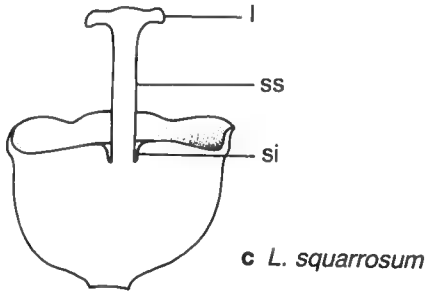
Fruit

The fruit is a loculicidal capsule, in general of a depressed-globular shape (fig. 9a) but occasionally hemispherical or spherical. It opens by the splitting of the top of each loculus (fig. 9b). The fruit of Group 1 species show little tendency to remain on the plant after they have matured, with the exception of those of the highly modified *L. spinescens* and *L. confertum*. The myth that all species of *Leptospermum* have woody fruit that remain in position on the plant until the

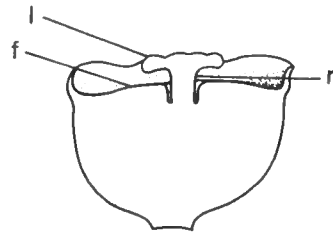


a *L. luehmannii*

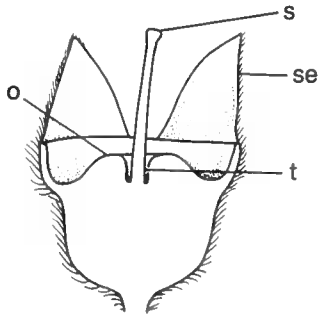
b *L. macrocarpum*



c *L. squarrosum*



e *L. multicaule*



d *L. trinervium*

Fig. 7. Style and ovary-top. (As seen in young fruit. Not to scale. See text for discussion.)
 b = surface of ovary raised at the base of the style which is not inset; d = surface of ovary forming a high dome; f = surface of ovary almost flat; i = style base well inset; l = large stigma; ls = lobed stigma; o = surface of ovary raised near the style; or = surface of ovary raised above each loculus; r = reduced style; s = small stigma; se = sepal; si = style shallowly inset; ss = almost straight-sided style; t = tapering and stout-based style.

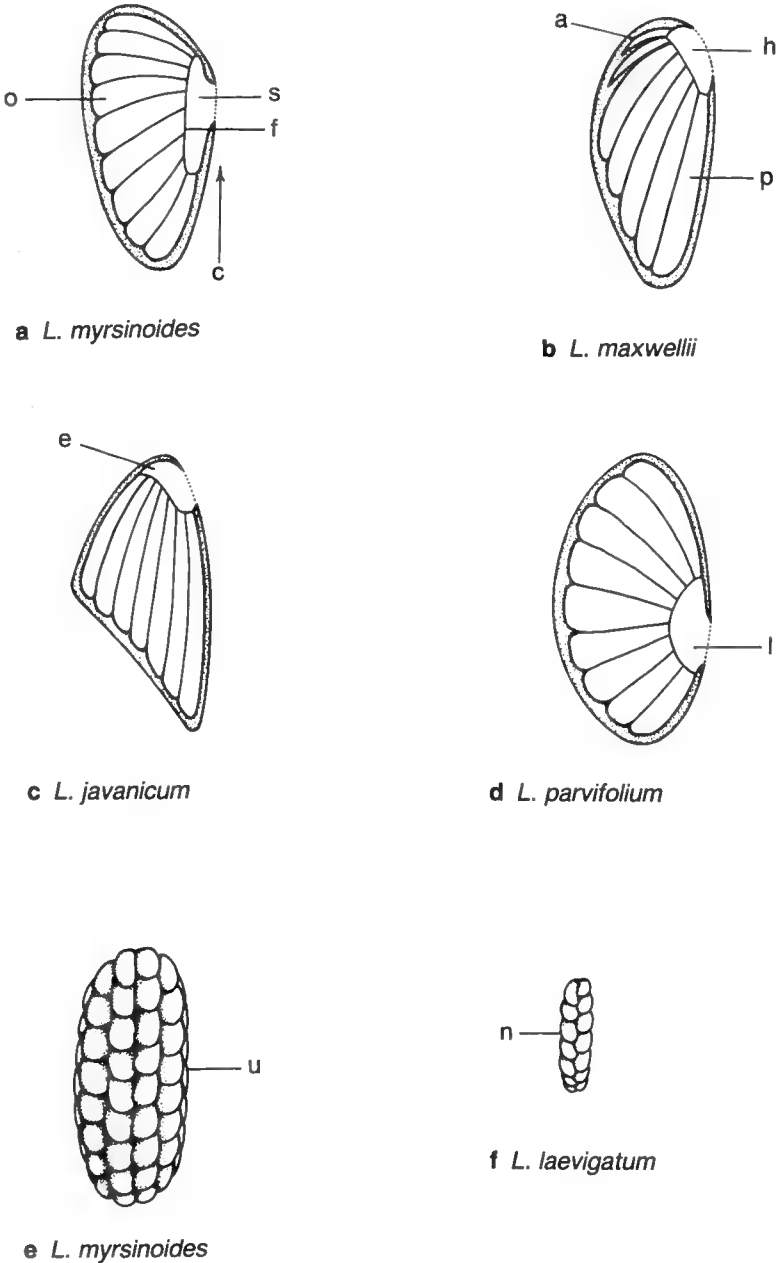


Fig. 8. Disposition of ovules in ovary (diagrammatic), shown in lateral view (a-d) and distal view (e, f). (See text for discussion.) a = aborted ovules; c = central axis of the loculus; e = placenta extended in upper part; f = flat distal surface of placenta; h = short placenta attached high in the loculus; l = placenta low in the loculus; n = narrow placenta showing ovules in 2 rows; o = ovules in rows on distal surface; p = pendulous ovules; s = shallow peltate placenta; u = placenta of usual proportions showing c. 30 ovules in 4-6 rows.

seed is released by fire is thoroughly entrenched in ecological literature (Burrell 1981; Specht 1981). In fact the species most often mentioned in the context of fire in heathland, *L. myrsinoides*, is a typical fruit-shedding member of Group 1.

The texture of the part of the fruit surrounded by the hypanthium changes with maturity, changing greatly in species that retain their fruit for a number of seasons. Unfortunately for the usefulness of this character in herbarium material, it may vary within a species according to conditions affecting the individual plant or population, so that fruit on a plant that has matured early and shed its seed from young fruit has quite a different aspect from fruit of the same species held in situ and becoming scaly or gnarled over several years. In some species, such as *L. myrtifolium* and *L. lanigerum*, a thin surface layer can often be seen to lift almost as a piece from the fruit, while in others the surface remains, smooth or cracking or, in the case of a turgid or succulent surface, wrinkling. In most species the pedicel, when present at flowering, is retained at the fruiting stage as a stalk, but in species whose fruit continues to enlarge while persisting on the plant this feature can be obscured or even lost, the base of the fruit becoming broad where it is in contact with the stem or in extreme cases submerged in expanding stem tissue. In the normally persistent-fruited Group 2, long-persistence is often associated with the position of the fruit in relation to a stout stem. If the fruit is carried on a very slender branchlet, as in *L. petersonii*, it often fails to persist for many years. In Group 2 only *L. emarginatum* has fruit that is readily shed; this apparently premature fruit-fall may be due to the fragility of the long-attenuate pedicel of this species. The proportion of the height (side view) of the fruit occupied by the valves may vary within the individual species but is still a useful diagnostic character. In some species, especially *L. nitidum*, the valves often may not extend at all above the rim and in others, e.g. *L. coriaceum* (fig. 9c), the valve region is very short. In most species the valve region is deeper so that the valves are shortly to strongly exerted. The shape of this region (side view) is a useful diagnostic feature, the upper surface varying from evenly rounded to having the part around the style disproportionately raised. The opened valves rarely extend much beyond the edge of the hypanthium-top but occasionally, as in forms of *L. polygalifolium*, they are spread so widely that the fruit base below them is flat. The texture of the valves varies and is difficult to define. In Group 1 species it is stiff but thin, except in *L. macgillivrayi* where it is translucent and firm, and in *L. spinescens* where it is extremely woody. In Group 2 it is woody; very thick in *L. grandiflorum* and *L. liversidgei*, delicate in *L. petersonii* (fig. 9b), and scarcely woody in *L. emarginatum*.

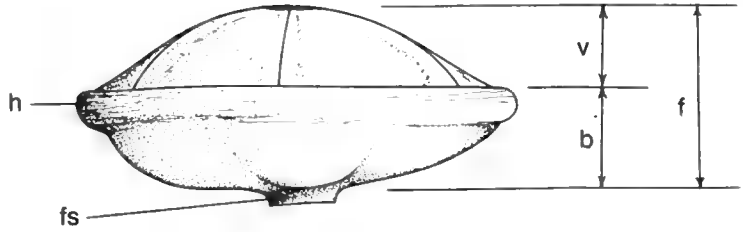
There is variation, hard to define, in the tissue surrounding the seeds. This tissue is thin in most species of Group 1. However, in some species of this group, the rigidity of the fruit may be explained by the thickening of this region inside a softer and more turgid exterior. Johnson (1983) illustrates prominent sclerification of cells lining the loculus in *L. laevigatum*. Perhaps this is the mechanism by which this species, whose fruits are soon shed, survives fire.

Fruit-size varies from a few millimetres in diameter, as in the majority of Group 1 species, to two centimetres in *L. macrocarpum*. It is not constant in species with persistent fruit, being particularly variable in *L. micromyrtus*.

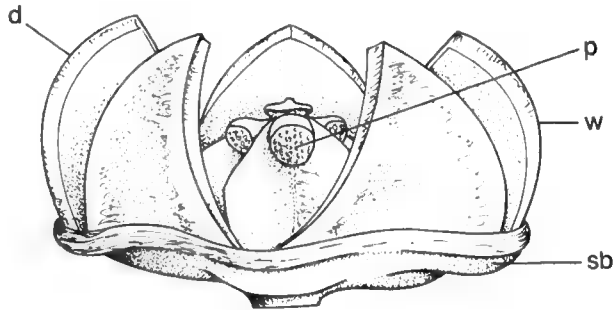
Seeds

The seeds in this genus are of simple structure with two seed coats variously adhering to each other. Observation of seed of normal number, shape, size and

■ *L. petersonii*
(before opening)



b *L. petersonii*
(after opening)



c *L. coriaceum*
(after opening)

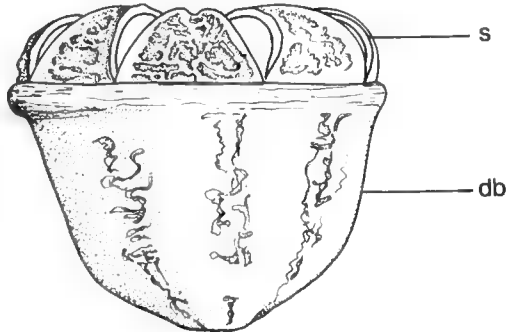


Fig. 9. Capsules, showing variation in valve-base proportions with maturity (a, b) and between species (b, c). (See text for discussion.) b = depth of base; d = delicately woody valve; db = deep base; f = depth of fruit; fs = fruit stalk; h = hypanthium (fruit) rim; p = persistent placenta (with extended top); s = scarcely exserted valves not opening wide; sb = shallow base; v = depth of valve region; w = well-exserted valves opening wide but not extending beyond the hypanthium-top.

surface-pattern in this genus is difficult. In herbaria there are few fruiting specimens of those Group 1 species that shed their fruit early. Also outside the short period of maximum flowering most collectors notice and collect only Group 2 species. In specimens of Group 2 species, even with careful collecting it is difficult to assess all seed characters because mature seed is readily shed in the field while immature fruit on herbarium specimens will open on drying and shed immature seed. As the features of the seed vary with maturity, its position in the loculus and the degree of development attained by the fruit from which it is shed, it has not been easy to be sure that any seed observed is both fully developed and normal. The colour of the seed is, in most species, a rather reddish brown, with the shade varying between species and with maturity. Seeds of *L. divaricatum* can be almost black. The seed-coat of all members of Group 1 has a reticulate pattern although this reticulation is not conspicuous in *L. brachyandrum* (fig. 10a) and its allies. In many species there is a ridge of expanded cells with its position dependent on the packing of the ovules (fig. 10b). This ridge is extended to form a wing in *L. coriaceum* and *L. laevigatum* (fig. 10c). Two western species, *L. spinescens* (fig. 11a) and *L. confertum* have the seed surface with a deep reticulation, so narrow as to be apparently striate, that splits into fibres and tends to lift, while in *L. multicaule* (fig. 11b) and *L. divaricatum* the seeds have a foveate-reticulate surface. The seeds of Group 2 species are all linear-striate (fig. 12.), and in *L. liversidgei*, *L. polygalifolium* (fig. 12a) and *L. morrisonii* the shallow fibres of the striations break and lift near the centre of the seed.

Seed-shape also differentiates the two groups. The first has a seed usually obovoid to broadly cuneiform or oblong, figs. 10 & 11, the second has a narrowly cuneiform to irregularly linear and often almost sigmoid seed, fig. 11. Size is \pm uniform within species and groups of related species. In Group 1, seeds are very small, often c. 1 mm long, the exceptions being a few of the large-fruited species, i.e. *L. spinescens*, *L. confertum* and *L. laevigatum*, and also the small fruited *L. incanum*, and *L. multicaule* and *L. divaricatum* where only a few ovules (perhaps one) develop at the expense of the other ovules in the loculus. In Group 2, larger seeds are the rule. They are commonly about 2 mm long but are smaller in *L. emarginatum* and in the small loculi of *L. liversidgei* and *L. arachnoides*. Very large seeds are found in a number of species (about 5 mm long in *L. macrocarpum*), often (but not always) associated with a small placenta.

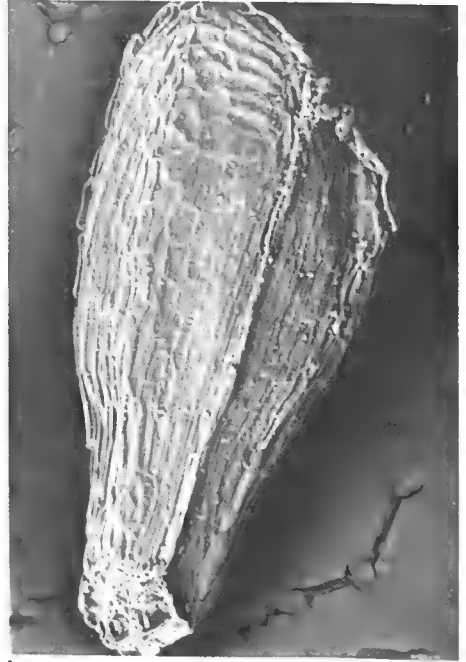
In all species seeds are produced in great abundance. Samples from a number of species have been germinated to reveal a very low percentage viability, from \pm 3.5% in *L. glabrescens* to 43% in *L. myrsinoides*, with an average of 20% for the species sampled. Burrell (1965) found seed of *L. scoparium* to be viable when the fruit has developed for about six months and to germinate normally after several years' retention on the plant.

Chromosomes

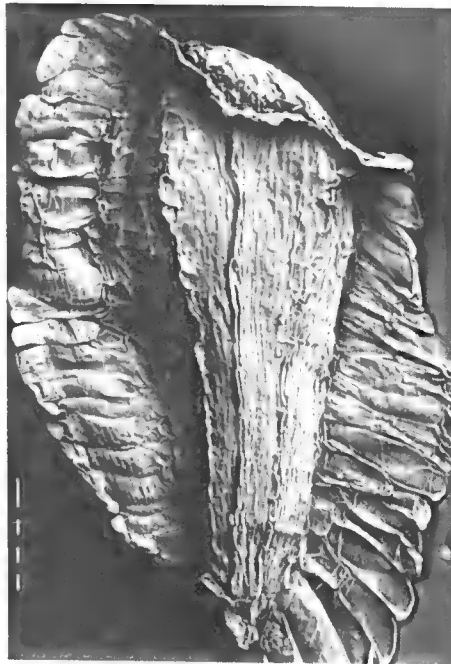
The chromosome numbers known for this genus are $2n = 22$ and $2n = 44$. Unfortunately, few counts have been made. The most quoted numbers are those given by Smith-White (1948) but these counts have no vouchers and the names used are unreliable. Rye (1979) has shown that two Western Australian species, *L. roei* and *L. incanum*, have $n = 22$. These counts are supported by voucher specimens in Perth. She also found a specimen from Kumarl (unvouchered but probably *L. incanum* or *L. erubescens*) to have $n = 11$.



a

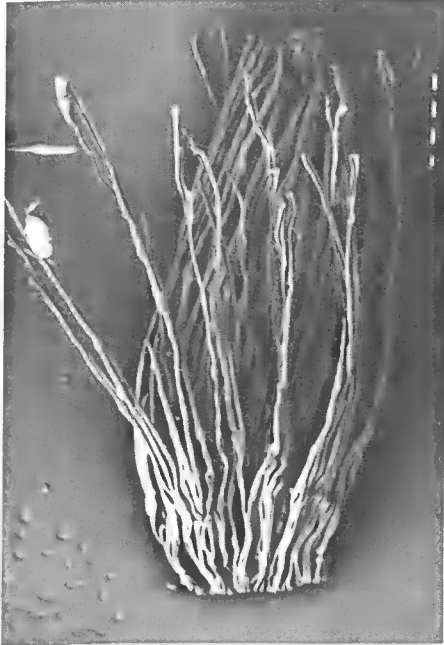


b

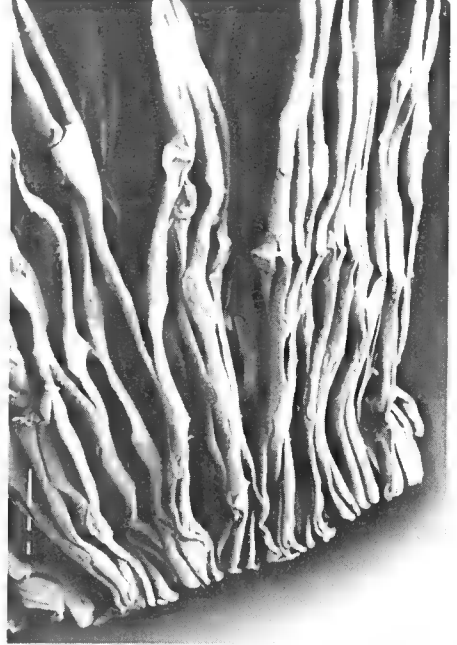


c

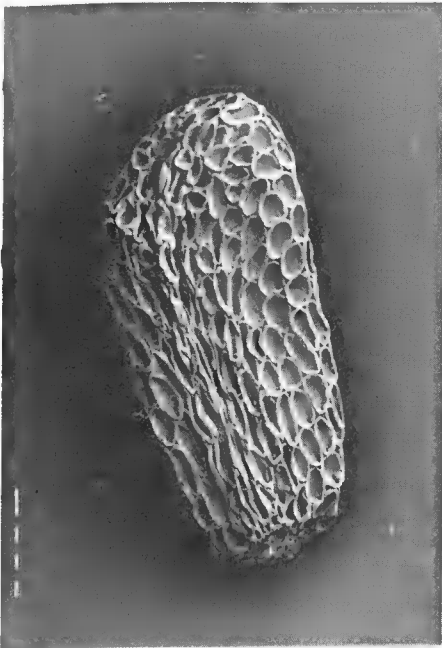
Fig. 10. Seeds. **a.** Irregularly cuneiform seed with inconspicuous long-reticulate pattern, *L. brachyandrum*. **b.** Ovoid-cuneiform but flattened seed with conspicuous shallow reticulation and with marginal cells extended (but not forming a distinct wing), *L. myrsinoides*. **c.** Ovoid-cuneiform but flattened seed with conspicuous shallow reticulation and with marginal cells forming a wing, *L. laevigatum*. a-c: longest bar = 100 μ m.



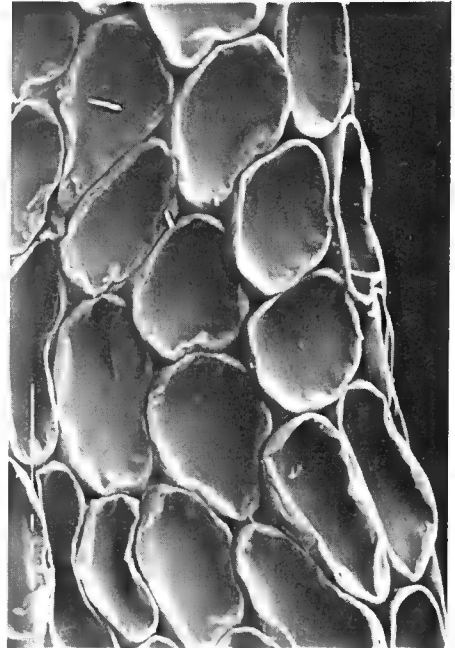
a₁



a₂



b₁



b₂

Fig. 11. Seeds. a₁, a₂. Irregularly oblong seed with long-reticulate pattern and with surface splitting longitudinally and lifting, *L. spinescens*. b₁, b₂. Irregularly obovoid seed with foveate-reticulate surface, *L. multicaule*. a₁; shortest bar = 200 μ m; a₂; shortest bar = 100 μ m; b₁, b₂; longest bar = 100 μ m.

Dawson (1987) has shown that eleven eastern Australian species (each with a voucher at CHR) have $2n = 22$, while *L. myrtifolium* and *L. minutifolium* have $2n = 44$. Smith-White found that, of fourteen eastern Australian species counted, only one, *L. parvifolium*, differed from $2n = 22$ in having $2n = 44$. The three collections of New Zealand *L. scoparium* (Dawson 1987) have the same count as that species in Australia, $2n = 22$.

Putative natural groups

Published infrageneric taxa do not represent any natural grouping in *Leptospermum* in the restricted sense accepted here (Thompson 1983; Morley & Toelken 1983) and have not been used in this work. For practical reasons, the genus has been divided here into two informal and apparently natural groups. These groups have been further divided into subgroups, each of which assembles species that share features considered to be of diagnostic significance. The genus has not been given a formal infrageneric nomenclature here because there is still uncertainty about the placing of some taxa within this framework.

Observations and intuitive estimations of relationship are assembled in the following pages. Intuition, in this case, rests on a store of observation of characters not readily quantified, or not observed for enough species to be used for classification. The many rather anomalous species include *L. fastigiatum*, *L. deanei*, *L. parvifolium*, *L. blakelyi*, *L. emarginatum*, *L. sejunctum*, *L. grandiflorum*, *L. rotundifolium*, *L. deuense* and *L. petraeum*, and most of these are rare, isolated and/or little known taxa.

Although Johnson & Briggs (1984) have developed a suggested phylogeny for the Myrtaceae, they do not distinguish between the numerous genera that are members of the *Leptospermum* group. The genera most closely related to *Leptospermum* are *Kunzea*, *Agonis*, *Neofabricia*, *Sinoga*, *Pericalymma*, *Homalospermum* and *Angasomyrtus* (the *Leptospermum* suballiance of Thompson (1983) and Johnson & Briggs in Morley and Toelken (1983)). *Leptospermum* shares many features with the related genera and examination of these has influenced judgements made here, but these genera have highly modified states for many attributes that are diverse in *Leptospermum*.

Conspectus of infrageneric relationships

The species have been assembled in this work as follows, although not all species possess those characteristics that define their group.

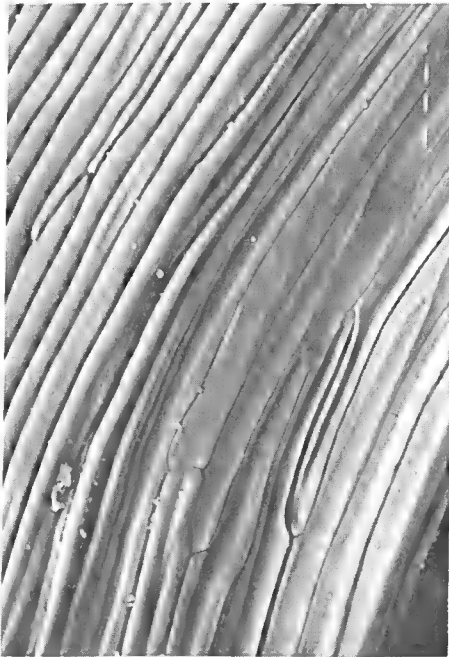
1. Sepals persistent, woody fruit-valves lacking and seeds ovate with a reticulate surface **Group 1.**
2. Development of the terminal bud unrestricted.
3. Flowering shoots in leaf-axils **L. brachyandrum** subgroup.
 1. *L. macgillivrayi*
 2. *L. spinescens*
 3. *L. oligandrum*
 4. *L. maxwellii*
 5. *L. exsertum*
 6. *L. subtenuis*
 7. *L. brachyandrum*
 8. *L. parviflorum*
 9. *L. purpurascens*



a



b₁



b₂



c

Fig. 12. Seeds. a. Narrowly irregularly linear seed with surface splitting longitudinally and lifting, *L. polygalifolium*. b₁, b₂. Linear-cuneiform seed with linear-striate surface remaining on the seed, *L. grandifolium*. c. Narrowly linear-cuneiform seed with linear-striate surface remaining on the seed, *L. rotundifolium*. a, b₁, b₂: longest bar = 100 μ m; c: shortest bar = 200 μ m.

- 10. *L. whitei*
- 11. *L. speciosum*
- 12. *L. luehmannii*
- 3* Flowering shoots on shoots of a higher order **L. erubescens** subgroup.
 - 13. *L. erubescens*
 - 14. *L. sericeum*
 - 15. *L. confertum*
 - 16. *L. parvifolium*
 - 17. *L. deanei*
 - 18. *L. semibaccatum*
 - 19. *L. trinervium*
 - 20. *L. subglabratum*
 - 21. *L. myrsinoides*
 - 22. *L. glaucescens*
 - 23. *L. coriaceum*
 - 24. *L. laevigatum*
- 2* Development of the terminal bud restricted (and flowering shoots on shoots of a higher order) **L. brevipes** subgroup.
 - 25. *L. nitens*
 - 26. *L. roei*
 - 27. *L. inelegans*
 - 28. *L. incanum*
 - 29. *L. fastigiatum*
 - 30. *L. blakelyi*
 - 31. *L. microcarpum*
 - 32. *L. polyanthum*
 - 33. *L. brevipes*
 - 34. *L. sericatum*
 - 35. *L. neglectum*
 - 36. *L. lamellatum*
 - 37. *L. multicaule*
 - 38. *L. divaricatum*
- 1* Sepals deciduous or persistent, fruit-valves woody and seeds linear, striate **Group 2.**
- 4. Sepals deciduous and fruit-valves delicately woody.
- 5. Sepals pubescent near the tip **L. petersonii** subgroup.
 - 39. *L. emarginatum*
 - 40. *L. javanicum*
 - 41. *L. recurvum*
 - 42. *L. wooroonooran*
 - 43. *L. petersonii*
 - 44. *L. liversidgei*
- 5* Sepals glabrous **L. polygalifolium** subgroup.
 - 45. *L. polygalifolium*
 - 46. *L. morrisonii*
 - 47. *L. variabile*
 - 48. *L. oreophilum*
 - 49. *L. novae-angliae*
 - 50. *L. minutifolium*
 - 51. *L. sejunctum*
- 4* Sepals deciduous or persistent and fruit-valves strongly woody.

6. Sepals deciduous **L. myrtifolium** subgroup.
- 52. *L. rupestre*
 - 53. *L. myrtifolium*
 - 54. *L. gregarium*
 - 55. *L. obovatum*
 - 56. *L. argenteum*
 - 57. *L. micromyrtus*
 - 58. *L. scoparium*
 - 59. *L. continentale*
 - 60. *L. juniperinum*
 - 61. *L. rupicola*
 - 62. *L. squarrosium*
 - 63. *L. rotundifolium*
 - 64. *L. grandiflorum*
- 6* Sepals persistent **L. lanigerum** subgroup.
- 65. *L. deuense*
 - 66. *L. grandifolium*
 - 67. *L. lanigerum*
 - 68. *L. arachnoides*
 - 69. *L. thompsonii*
 - 70. *L. glabrescens*
 - 71. *L. spectabile*
 - 72. *L. macrocarpum*
 - 73. *L. sphaerocarpum*
 - 74. *L. riparium*
 - 75. *L. nitidum*
 - 76. *L. petraeum*
 - 77. *L. turbinatum*
 - 78. *L. crassifolium*
 - 79. *L. epacridoideum*

Some limited cladistic analyses (Thompson 1986) have been made but these groupings are not based on cladograms.

There is no assumption here that all species have been correctly assigned, but there is confidence that the scheme presented gives a framework for further observation and testing of hypotheses.

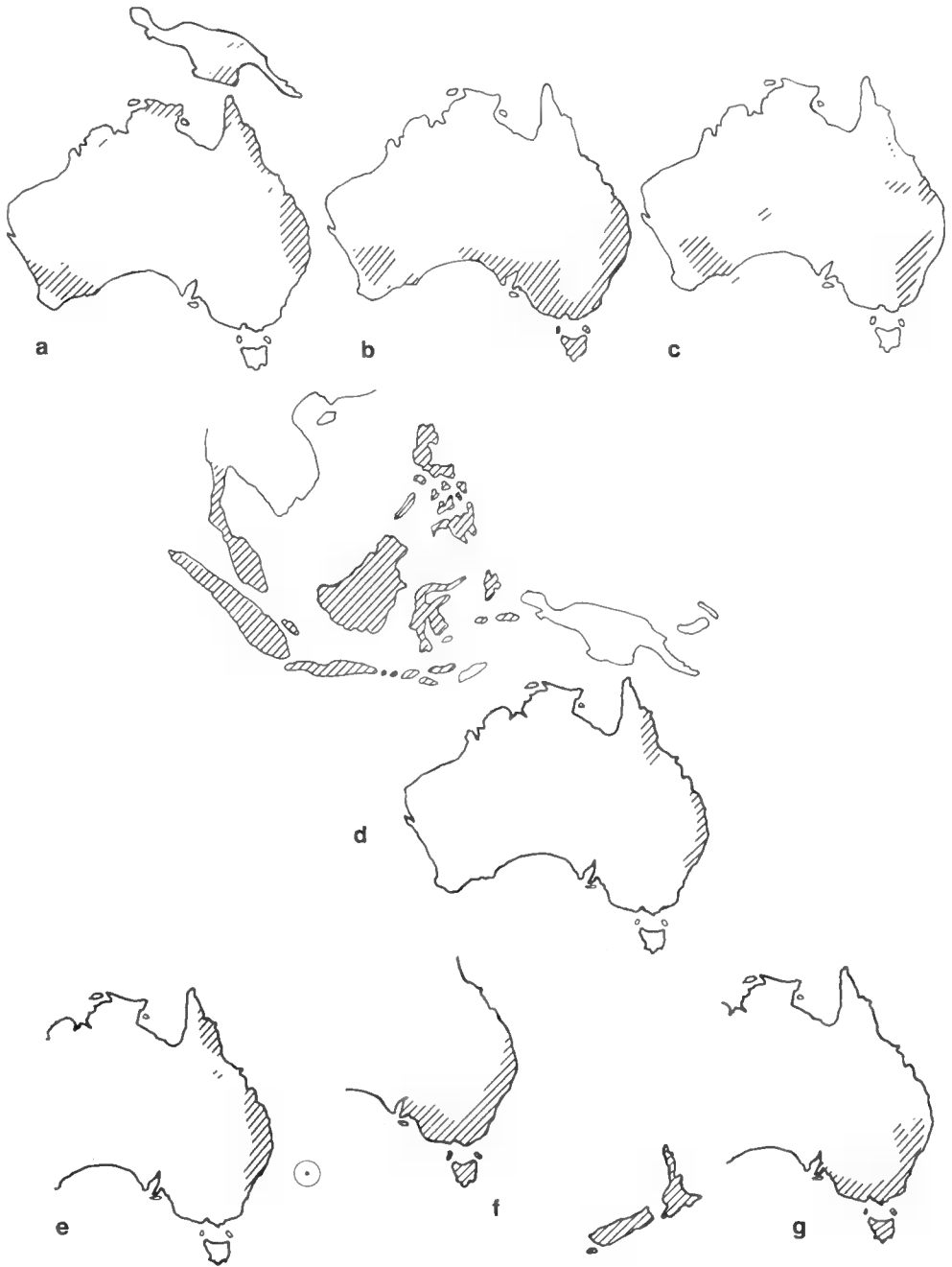
Group 1

This group contains thirty eight of the seventy nine species of *Leptospermum*. It, for the most part, has small fruit that lack woody valves; these rarely remain on the plant beyond the first season, and most have seeds that are, in general, ovate with a reticulate pattern on the surface.

1.1 The *L. brachyandrum* subgroup

The twelve species of this subgroup (Map 2) show a large number of presumably primitive characters, i.e. characters, that are unspecialised and shared with related genera. These characters, although not occurring in every species, include several-flowered shoots and axillary flowering shoots.

In northeastern Australia there is a relatively close-knit assemblage of six species all of which have smooth, seasonally exfoliating bark. *L. parviflorum*, a



Map 2. Distribution of Group 1: a. subgroup 1 *L. brachyandrum* and allies. b. subgroup 2 *L. erubescens* and allies. c. subgroup 3 *L. brevipes* and allies. **Distribution of Group 2:** d. subgroup 1 *L. petersonii* and allies. e. subgroup 2 *L. polygalifolium* and allies. f. subgroup 3 *L. myrtifolium* and allies. g. subgroup 4 *L. lanigerum* and allies.

rheophyte (*sensu* Steenis, 1981) is spread across tropical Australia and from the flat lands of southern Irian Jaya to northern Papua New Guinea. This species and *L. purpurascens*, occasionally showing the very primitive inflorescence condition of triads, have more apparently primitive features than the more scleromorphic *L. brachyandrum* (which extends southward to Port Macquarie), the allied *L. luehmannii* (illustrated by Beadle, 1981, as "*L. brachyandrum*") and the two "wallum" species, *L. speciosum* and *L. whitei*, which are sympatric with one another but differ in flowering time. The only *Leptospermum* in New Guinea, *L. parviflorum*, shows little differentiation and perhaps spread as a lowland rheophyte in the time of "ice-age aridity", at c. 17000–14000 years BP that joined these areas (Axelrod & Raven, 1982). The fact that this species has the most primitive characters of the group possibly reflects its association with the ancestral habitat, rather than an early dispersal, and the frequent opening of Torres Strait (Kemp 1981) was probably of no significance in the timing of the dispersal.

Three species-pairs in Western Australia may have originated from rainforest (margin) ancestors formerly in Western Australia (Beadle 1966). The most specialised pair would then be *L. macgillivrayi* and *L. spinescens* (linked by a characteristic hypanthium), the former little-known, the latter highly modified. *L. spinescens* has a scattered but rather wide distribution in the southwest. Many of its features, such as woody and long-persistent fruit, parallel those of eastern groups. Similarly *L. exsertum* and *L. subtenuis*, rare species of inhospitable habitat, are much modified, with reduced placenta-size and seed-number as are the widespread *L. oligandrum* with its much-reduced stamen-number and its satellite species *L. maxwellii* with a high placenta.

A fossil fruit found near Woomera, South Australia, in a deposit of at least Tertiary age (Lange 1978) bears a striking resemblance to the northern members of this subgroup. It is unlikely that contact between east and west was maintained after the mid-Miocene separation (Kemp 1981) by a northern route. Siliceous dunes may have supplied stepping stones at some time, but according to Kemp (1981) most of the quartz sand is Holocene.

1.2 The *L. erubescens* subgroup

This subgroup, of twelve species (Map 2), seems to be a later development with a two-stage growth unit in the flowering shoot and closer relationship between its eastern and western members than is shown in the *L. brachyandrum* subgroup. It includes a pair of species in the west, the widespread *L. erubescens* and the large-flowered local endemic *L. sericeum*, together with the less closely related *L. confertum* on East Mount Barren, Western Australia, and a group of nine species in the east that fails to reach the Tropic. The similarity of the seeds of *L. confertum* to *L. spinescens* of the *L. brachyandrum* subgroup may be convergence associated with distribution by ants.

L. glaucescens is endemic in Tasmania, whereas the modified and successful pioneer, *L. laevigatum*, occurs on coastal dunes from South Australia and northern Tasmania to northern New South Wales. The latter probably owes its success to an ability to tolerate calcium in the substrate, a suggestion supported by studies on Victorian dunes (Burrell 1981). Several members of this group have a rather succulent hypanthium in the fruit (*L. glaucescens* and *L. myrsinoides* of southeastern heaths, *L. semibaccatum* of eastern "wallum", and *L. confertum*), while *L. laevigatum* and *L. coriaceum* show a texture that could be a precursor to this state. *L. trinervium* and its close relative *L. subglabratum* have a "paper" bark with many layers that obviously protect the epicormic

shoots from which these species can regenerate after fire, allowing a successful entry into dry sclerophyll forests of the eastern mainland. The widespread *L. parvifolium* is anomalous with its low placenta, very small petiolate leaves and ability to hybridise with *L. trinervium* in spite of a recorded chromosome-number difference (Smith-White 1948), while the recently discovered *L. deanei* with its delicate fruit, though bearing some resemblance to *L. myrsinoides* and *L. semibaccatum*, cannot be linked to them by any strong feature and, being a slender tree-like shrub of creek-valley slopes, occupies a different habitat.

The two Group 1 species in Tasmania, *L. laevigatum*, confined there to the northern coast and islands, and *L. glaucescens* of both coastal and mountain heaths are far from primitive. *L. glaucescens* has most of its flowers in axillary monads, a state observed elsewhere in this genus only in reversion shoots of *L. trinervium*. The fact that *L. glaucescens* occasionally shows the flower-shoot of *L. laevigatum* and *L. coriaceum* and that it has only two rows of ovules and traces of a chemical otherwise limited to those species (P. Baas, pers. comm.) suggests that its axillary-flowered condition is an apomorphy, and that *L. glaucescens* is either of hybrid origin, or neotenous as to loculus-number. There is no evidence that the genus entered Tasmania before the Miocene formation of Bass Strait. That *L. coriaceum* has been able to move into areas inundated by both Eocene seas and the later sea incursions into the western Victorian region indicates that this species, like its close relative *L. laevigatum*, has a tolerance of calcareous traces. The apparently less closely related *L. myrsinoides* (Burrell 1981, and Parsons & Specht 1967) lacks such tolerance and is confined to siliceous sands.

1.3 The *L. brevipes* subgroup

This subgroup is found on both sides of the continent (Map 2). All of its species except the anomalous *L. blakelyi* share a synapomorphy: restriction of the terminal bud of the flowering shoot. The characteristic appearance of this subgroup is probably associated with the relative uniformity of its inconspicuous fruit and high placenta. Many species are associated with rocky, especially granite, outcrops and escarpments. The western and eastern members have morphological similarities that are remarkable in view of their geographical separation. *L. fastigiatum* is the only member of the genus in very arid regions and it is somewhat anomalous, having some characteristics of the *L. erubescens* subgroup, and a pedicel in the fruit but not in the flower. Postulation of a hybrid origin is tempting. The four other western species form a subset. The eastern group is more diverse but *L. brevipes* adopts different forms in different regions and becomes similar to or (more likely) hybridises with the related *L. microcarpum* near the Queensland/New South Wales border. *L. divaricatum*, with its pungent-pointed and recurved leaves, is found in drier inland parts of the tablelands and western slopes of New South Wales, and both this species and the similar *L. multicaule* from further south have few and large seeds associated with the reduction of viable ovules in the loculus. *L. polyanthum* of central eastern New South Wales has a characteristic dark turgid hypanthium, *L. lamellatum* of inland Queensland has "paper" bark, and *L. blakelyi* of the Lithgow (New South Wales) district has several features (a small 2-rowed placenta, an extremely long pedicel and strangely broad divaricate branching) that obscure its origin. The mainly coastal Queensland species *L. neglectum*, may be less specialised than the pungent-leaved *L. microcarpum*; and *L. sericatum* on inland Queensland rock ridges may have developed in isolation from the widespread and variable *L. brevipes*.

Group 2

Group 2 is distinguished by a woody-valved fruit that tends to remain on the plant for some years, and irregularly linear seeds with a striate surface. *L. emarginatum* could be regarded as its least specialised member, and shares with members of Group 1 the long pedicel, the readily deciduous fruit, the scarcely woody fruit-valves, the many-flowered flowering shoots, the small flowers and the small fruit. It is not known whether these are plesiomorphic, unchanged from the ancestral condition in the genus, or are cases of reversion. Such a suite of features shared with Group 1 suggests the former view. But if the latter view is taken, the connection between the two major *Leptospermum* groups is seen as tenuous, i.e. they could be considered to be separate genera. *L. emarginatum* is found southward of the main region of occurrence of the subgroup of Group 2, regarded as most primitive, and lacks the characteristic loose fibrous bark. Being a riparian shrub it may represent a southward migration, rather than a relict of a group that has largely moved northward. Group 2 is not represented in Western Australia at all, a fact that might indicate an origin after the mid-Miocene separation within the range of the genus.

2.1 The *L. petersonii* subgroup

This subgroup of six, or possibly only five, species (Map 2) is found in warmer regions, and has spread to South East Asia where it has become established on siliceous or otherwise low-nutrient sites, especially on mountain-tops. The Asian species, *L. javanicum*, with its Mt. Kinabalu satellite *L. recurvum*, does not represent a large divergence from the presumed Australian prototype. However, it does show a pattern of variation indicative of selection on a small gene-pool, analysis of which may show the progress of its dispersal into Asia. The time of the exodus of this subgroup from Australia is unknown. Contact with the Asian plate would have allowed this in the mid-Miocene 15 million years ago but it may have been very much later. *L. recurvum* (illustrated by Wong, 1982, and recognised here) is little more than a vegetative variant of *L. javanicum*, although these Asian taxa are considered to occupy areas with strong evolutionary pressure (Lee & Lowry 1980, and Axelrod 1972). The Australian species, *L. petersonii* of tropical Queensland and scattered occurrence to northern New South Wales, and *L. wooroonooran* of granite peaks in the region west of Cairns, share with the Asian species a tuft of hairs on each sepal as well as "stringy" bark. They also have a distinctly, though not strongly, woody fruit-valve. It is assumed that the woodiness is associated with the poor nutrient-status of the habitat, especially as frequent fire is not a factor. The related *L. liversidgei* of the "wallum" has, however, very woody fruit with reduced seed-set and an extended woody rim that does appear to have become modified for survival in its very fire-prone habitat. The style found in this latter species resembles that found in the *L. scoparium* subset of the *L. myrtifolium* subgroup and this, together with the close bark, small leaves and different habit suggests the possibility of a hybrid origin. All members of this *L. petersonii* subgroup have a character-state not seen in Group 1: deciduous, sometimes tardily so, sepals, a feature found also in other Group 2 lines. Neither the *L. petersonii* subgroup nor any other species of Group 2 are represented in New Guinea. Records for that island (Mueller 1890) have never been confirmed and obviously represent a misidentification.

2.2 The *L. polygalifolium* subgroup

This subgroup contains seven species (Map 2). It is not strongly modified compared with the first subgroup, but shows an increase in flower size, increasing woodiness of the fruit-valves and a thinning of the texture of the sepals, at least in some species. It seems to be a group adapted more to a dry sclerophyll habitat than the generally more wet sclerophyll *L. petersonii* subgroup, so that in this and other advanced groups larger leaves could be considered an adaptation to a riparian habitat. No extant species of the subgroup could be considered more primitive than another, most having autapomorphic specialisations, especially modified anthers, with the little-known *L. sejunctum* anomalous as to anthers, a non-inset style and a high placenta. Further collections of *L. sejunctum* may reveal features enabling it to be placed elsewhere or showing it to be of hybrid origin. The other species of this subgroup are linked by their modified anther-cells that are deep, fail to open widely, and also tend to diverge so that the ends or even the whole cells move apart. Least modified are *L. variabile* and *L. oreophilum*, species of misty coastal mountains. More modified, with obvious cell-divergence and with the seed-surface splitting so that the seed-ends are capped with parasols of fibres, are the widespread and successful species *L. polygalifolium*, which has diverged into six subspecies (one on Lord Howe Island and one in the tropics), and *L. morrisonii*, almost sympatric with *L. polygalifolium* in central eastern New South Wales but on a substrate with more available nutrient. A third pair of species is found on low-nutrient soils of the northern tablelands of New South Wales: *L. minutifolium* with very small leaves and disproportionately small petals, and *L. novae-angliae*, very variable and little-known but often with thick and pungent-pointed leaves, apparently an adaptation to the stresses of climate and poor soils of the region. It is tempting to think of this subgroup as having arisen in the southern part of its range and migrated northward, with the success of *L. polygalifolium* being associated with the more open savannah developing in the Pleistocene.

2.3 The *L. myrtifolium* subgroup

The subgroup of thirteen species around *L. myrtifolium* (Map 2) is much more diverse in general appearance than the two previous subgroups, and has much woodier fruits, a character that perhaps allows recovery from fire, though most species occupy habitats in cool climates that are not particularly fire-prone. Their habitats require an ability to survive periods of low water-availability and most of these species have rather thick leaves, often relatively broad, and some have pungent-pointed leaves. Perhaps the ancestral taxon resembled *L. obovatum*. This species is certainly similar to the two previous subgroups in many ways. It is generalised in its appearance and has the development of its terminal vegetative bud restricted, as in some of the *L. petersonii* subgroup, and it lacks the specialised anthers of the *L. polygalifolium* subgroup. It has spread widely (with some leaf-shape variation) in riparian habitats and reached subalpine altitudes (1620 m) in the Kosciusko area. Apart from this species there appear to be three main lines of development. One has a mostly high-altitude distribution, with *L. rupestre* on Tasmanian mountains, *L. micromyrtus* on granite mountains of the southeastern mainland, and *L. myrtifolium*, *L. argenteum* and *L. gregarium* in swamps and on creekbanks of the southeastern mainland, Barrington Tops region and northern tablelands of New South Wales respectively. It is likely that the small-celled anthers of *L. rupestre* and *L. myrtifolium* represent a reduction from the large-celled state usually found in Group 2 species. The second line in this subgroup is unified by its pungent-pointed leaves. One species, *L. juniperinum*, has been successful

along the eastern mainland coast in sandy swampy soils and has reached southern Queensland. Two others, *L. rupicola* of cliff-faces and *L. squarrosium* of skeletal sandstone soils, are found in central eastern New South Wales, while another, *L. continentale*, is widespread from South Australia to central New South Wales, often in open swampy habitats but able to survive a lowering of the water-table. *L. scoparium*, very variable in Tasmania and the only representative of the complex there, may have differentiated there and subsequently re-invaded the mainland forming scattered populations showing different facies. It appears the least specialised of the pungent-leaved species. Some collections from southern Victoria seem to represent a breakdown of *L. scoparium* and *L. continentale*, perhaps as a result of recent trans-Bass Strait migration of propagules of *L. scoparium*. *L. scoparium* has been very successful in Tasmania and has migrated across the Tasman Sea to New Zealand. In New Zealand it is the only species of *Leptospermum* (the species previously known as *L. ericoides* is now considered a *Kunzea* (Thompson 1983)), and, being a far from primitive *Leptospermum*, cannot be an ancient Myrtaceous plant of the New Zealand Palaeocene as has been assumed in that country (Fleming 1975). It must be a relatively recent arrival by long-distance dispersal. It is likely that on arrival in New Zealand *L. scoparium* became established in limited edaphically suitable areas until the arrival of Polynesian man whose fire and forest-clearing brought about those low-nutrient-status conditions for which it had been pre-adapted in its homeland. Burrell (1965) reports fruit of *L. scoparium* opening within an hour of passage of a fire. The continued deterioration in the fertility of its habitat in New Zealand has been much to its advantage (Ronghua et al. 1984) allowing it to become a significant part of that country's flora. The occurrence of variants, of much interest to horticulture, in New Zealand suggests a small gene pool and expansion into new areas, and there is already indication of regional divergence. Whether this is a significant genecological differentiation will need to be confirmed by further study and transplantation, given the plasticity of vegetative features in the species (Burrell 1965, Ronghua et al. 1984).

A further pair of species may fall within this group, the local endemic *L. grandiflorum* on the granite of the Tasmanian east coast and *L. rotundifolium* of sandstone escarpments of southeastern New South Wales. Both species have very large and beautiful flowers and large seeds in very woody fruit. They seem to have much in common but whether they form a natural group is unclear. It is possible that *L. rotundifolium*, resembling in its style-base and chemistry (Flynn et al. 1979) *L. macrocarpum* of the *L. lanigerum* subgroup, is of hybrid origin.

The time of the entry of the Tasmanian members of the *L. myrtifolium* subgroup, or their precursors, to that region is a matter for speculation. The habitat of *L. rupestre* requires it to have moved into its present sites after the last glacial retreat, while the spread of *L. scoparium* was probably the result of aboriginal firing of the region.

2.4 The *L. lanigerum* subgroup

This is a further subgroup of woody-fruited *Leptospermum* species (Map 2) that is quite distinct from those dealt with so far. It is characterised by lack of any sign of abscission in the sepals, which remain in place on the fruit until time wears them away (a condition general in Group 1 and hence possibly primitive) and by the complete lack of any stem-flanges, a feature rarely absent from other

woody-fruited species. With features awkwardly between this subgroup and the troublesome last pair, *L. rotundifolium* and *L. grandiflorum* of the *L. myrtifolium* subgroup, is *L. deuense*. This is a species recently discovered on a rhyolite cliff in the wilderness of the upper reaches of the Deua (Moruya) River of south coastal New South Wales. It resembles the former group in having a stem-flange, but seems to have persistent sepals. All other species have persistent and deltoid sepals, reduced flanges, and 1-flowered flowering shoots.

Within the subgroup are several obvious lines. In one of these, *L. lanigerum*, a southern species common in Tasmania and extending to South Australia and central New South Wales, is similar to *L. grandifolium* of Victoria and New South Wales but has a different pattern of leaf-variation and a very different bark type. A trio of species, *L. thompsonii*, *L. glabrescens* and *L. arachnoides*, seem to be linked (with short sepals and similar branching). *L. arachnoides* is pungent-leaved, has reduced flower- and fruit-size and extends from southern New South Wales to the Queensland border, the more generalised *L. thompsonii* is limited to the Monga area of the New South Wales tableland escarpment, and *L. glabrescens* is found only on the Recent sands of East Gippsland, Victoria. The latter's hemispherical sepal links it to *L. thompsonii* and its characteristic divaricate branching to *L. arachnoides*. Also sharing a rather striking set of characters are *L. spectabile*, with red flowers and very large fruit, *L. macrocarpum* with even larger fruit and its flowers sometimes red, and *L. sphaerocarpum* whose fruit is atypical for the genus (in being deeper than broad) and often has fewer loculi. These species share a style-character: the ovary surface adheres to a style base which is not inset. Flynn et al. (1979) associate the essential oils of *L. macrocarpum* and *L. sphaerocarpum* and dissociate them from those of "*L. lanigerum*" (probably *L. grandifolium*).

There is a further subset of six species linked by the character-state of long-deltoid sepals. This is a group of highly modified species geographically isolated from one another. One pair, *L. crassifolium* and *L. epacridoideum* have adjacent ranges in south coastal New South Wales and their leaves are similarly thick and glossy. *L. nitidum* is widespread in Tasmania (especially the west) and extends to Bass Strait islands; characterised by a flat-topped fruit, it has been most successful in the fire-ravaged mountains. *L. riparium* of Tasmania lines the rivers of the cool rainforest region (Jarman & Brown 1983). *L. turbinatum* with its obconical fruit base is confined to ranges in western Victoria, while *L. petraeum* is known only from a small granite tor, "Rocky Top", near Kanangra, New South Wales, and a specimen labelled "Blackheath" in the New South Wales herbarium.

Evolution and dispersal

The pattern of relationship between the extant species of *Leptospermum* is consistent with an origin in warm, moist, south-central regions just before the continent experienced increasing aridity. The three subgroups of Group 1 would then represent successive waves of expansion from that area of origin. Group 2 probably arose in the eastern part of the original range and was prevented from moving westward by changed environmental conditions. The pattern also suggests that a decrease in available nutrient in the habitat and an increase in the frequency of fire encouraged the development of species able to use the dwindling resources of a harsh environment (Stebbins 1952). The most "xeromorphic" leaves of the genus are not those of inland species but of species that have moved into the nutrient-poor uplands of southeastern Australia. In

spite of the long-published opinions of Beadle (1966) that scleromorphy is associated with lack of nutrient rather than lack of water, one still finds authors such as Johnson (1980) trying to explain the morphology of these largely swamp species as being due to xeric conditions.

The Quaternary (Axelrod 1979) change to a mediterranean climatic regime in the west of Australia has not been associated with any morphological states not seen in the east, where members of the genus were not subjected to this change. The spiny branches of *L. spinescens* may be an exception. As Beard (1982) indicates, the distribution of scleromorphic species must have been very greatly influenced by man's use of fire. The original speciation, however, must have been associated with the fragmentation of ancestral ranges by natural phenomena (James & Hopper 1981).

From the few chromosome counts available there is little enlightenment as to the basic condition. One could assume an ancestor with $n = 11$, the general base-number in Myrtales, allowing an increase to $n = 22$ when taxon species-numbers are reduced by environmental influences as suggested for species in general by Löve and Löve (1971), or as an adaptation to extreme climate. Such counts as are available do not show $n = 11$ to be associated with species considered to have most ancestral features.

In many, perhaps all, species of *Leptospermum* many flowers lacking female parts are to be seen. From herbarium material this is difficult to detect and the proportion of these flowers on individual plants, or in particular species, impossible to assess. The phenomenon has been documented as occurring in a number of other genera of the family, as by Carr et al. (1971), and the "adaptive significance" of this facultative andromonoecy has been studied in New Zealand populations of *L. scoparium* by Primack & Lloyd (1980, 1980a). It is general in the genus, and widespread in the plant community generally. The influence of environmental factors and nutrition on sex determination in plants is reviewed by Chailakhyan & Khrianin (1987). Monitor (1981) cites work showing that sex-change can be observed in many plants, including *Asparagus officinalis* and *Spinacea oleracea*, that environmental stress causes maleness, and that shortage of water increases cytokinins which increase maleness. He concludes that it is the ability to change that gives the advantage, and this facility may have enhanced the ability of many *Leptospermum* species to invade areas unsuited to more demanding plant species.

There is little to cast doubt on the hypothesis that the genus achieved an early broad range in Australia, followed by differentiation, a central extinction and a northern and southern extension in the east, as a theoretical outline of how evolution produced the genus *Leptospermum* that we see today. There is no definite fossil evidence other than the Woomera fruit to confirm or deny such speculation. There is, however, an alternative explanation of the variation and disjunction observed. Perhaps in *Leptospermum* we have a group evolving so rapidly that many of these apomorphies are quite recent.

Many species of *Leptospermum* are extremely variable, but not all the variation is of the same nature. Some seems to be caused by a large phenotypic response (in stature, the degree of andromonoecy, flower- and fruit-size, and initiation of fruit-valve opening) to relatively minor variation in the environment. Other variation is obviously of genetic origin, with a rapid response to selection that is apparently readily reversible. This is seen in species like *L. grandifolium* where the facies is different depending on habitat, especially as to the shady river margins and sunny river beds of montane regions of its range. Some

species, however, carry variation, at present unexplained, that allows polymorphy within populations. This is the pattern found in *L. trinervium*, where a number of features vary, either associated or dissociated, between and also within populations. These three variation-phenomena are probably similar to those that have allowed the genus to take advantage of the many, though rather slight, oscillations of climate in the eastern Australia of the Quaternary, allowing fixation of species after their isolation.

The success of this genus is probably tied to its ability to colonise rapidly an area left untenanted for any reason, provided that area has low available nutrient. Certainly *L. glabrescens* has occupied the recent new accretions of coastal Gippsland. *L. scoparium* has spread rapidly in New Zealand where man has cleared forests and altered the environment (Mohan et al. 1984; Ronghua et al. 1984). *L. laevigatum* has been planted by sand-miners and local councils and is extending along coastal sand beyond its natural, but no doubt pioneering, limits.

Sterility barriers do not seem to have had much time to develop. Herbarium records (especially those of NSW where workers for a century or more have collected puzzling specimens of *Leptospermum*) show many hybrids. This phenomenon is probably for the most part associated with the recolonising of cleared land, and therefore not a reflection of natural conditions, but there is a real possibility of gene-flow between rather remotely related species under some conditions, demonstrating a lack of development of barriers. A number of species that remain distinct though sympatric through much of their range, break down in certain areas, and may have done so in the past. Although all these species are not distant in relationship, many wide crosses have been observed. Species-breakdown has been noted in the field and recognised in herbarium collections between *L. gregarium* and *L. polygalifolium* subsp. *transmontanum* (on the Northern Tablelands of New South Wales), *L. myrtifolium* and *L. obovatum* (on the Central Tablelands of New South Wales) and *L. myrtifolium* and *L. continentale* (in several regions). As well, natural hybrids have been found between *L. laevigatum* and *L. myrsinoides*, *L. parvifolium* and *L. squarrosum*, *L. arachnoides* and *L. squarrosum*, *L. juniperinum* and *L. polygalifolium*, *L. grandifolium* and *L. sphaerocarpum*, and *L. nitidum* and *L. lanigerum*. *L. emarginatum* and *L. petersonii* have been found to hybridise in cultivation. Unusual specimens from the New England district of New South Wales are thought to be *L. novae-angliae* x *L. gregarium* and *L. minutifolium* x *L. polygalifolium*, and it is likely that other unidentified specimens are of hybrid origin. This could indicate close relationship in the recent past, recent spread of one of the taxa concerned, or that man's alteration of previously distinct habitats has affected species that lack barriers to interbreeding. In South Australia and western Victoria, especially southward of the Grampians, there are populations of *L. lanigerum* that have excited comment and earned the name "Green Teatree". Genes from another species seem to have invaded, but failed to dominate, the local species. It is possible that these genes are from the endemic Tasmanian *L. nitidum* and that occasional invasions across Bass Strait have modified some of the local *L. lanigerum*. These species are known to hybridise in Tasmania though they belong to distinct subsets within their group.

Generic Description

Leptospermum Forst. et Forst. f. Char. Gen. Pl. 71, t. 36 (1776)

LECTOTYPE: *L. scoparium*, fide McVaugh, Taxon 5: 142 (1956).

Glaphyria Jack, Trans. Linn. Soc. London 14: 128 (1823). LECTOTYPE here chosen): *G. nitida* Jack (following Merrill, J. Arnold Arbor. 33: 226 (1952) who equated *Glaphyria* and *Leptospermum*).

Macklottia Korth., Ned. Kruidk. Arch. 1: 196 (1847). LECTOTYPE (here chosen): *M. javanica* (Blume) Korth.

Leptospermopsis S. Moore, J. Linn. Soc., Bot. 45: 202 (1920). TYPE: *L. myrtifolia* S. Moore.

Shrubs or trees with smooth and flaking, fibrous or papery bark. Leaves alternate, usually no more than 1 cm long, often variable in shape (within the species) but mostly almost elliptic with the broadest part above or below the middle, the apex various, the base sessile or shortly petiolate and often varying within the species, the margins entire and the surface variously curved, often recurved and incurved in different parts of the same leaf; texture often thick or firm; often aromatic, occasionally lemon-scented. Stipules minute and usually seen only about the flowers. Flowers 2-bracteolate, often pedicellate, axillary in bract-axils on condensed shoots or, rarely, as monads in leaf axils, actinomorphic. Hypanthium obtuse or variously tapered at the base and, in the upper part, erect or spreading at anthesis. Sepals 5, imbricate, persistent or deciduous. Petals 5, spreading, conspicuous, deciduous, white, pink or red. Stamens usually shorter than the petals, in 5 antepetalous groups but appearing free, and spread evenly along the rim of the hypanthium; anthers opening by slits, versatile, with a conspicuous gland near the connective and a thickened area at the base of each cell. Style simple, usually with the base inset in a depression in the ovary summit; stigma entire or occasionally somewhat lobed. Ovary (2-)3-5 or more -locular with the placenta axile and usually just above the middle of the central axis. Ovules few to numerous, anatropous. Fruit a rigid or woody capsule with valves opening at the top. Seeds somewhat ovoid, with the testa reticulate, occasionally ridged or winged; or irregularly linear and striate. $n = 11, 22$.

In most references to individual species of *Leptospermum* in standard works, and in the many papers dealing with attributes of members of this genus, the identity of the taxon has been confused or is unknown. Reinterpretation is difficult when the author's concept of species was as generalised as in S. Schauer (1841), Domin (1928) and Cheel (1943), or when the specimen citations were edited as in Bentham (1867). Geographic limitations will in many cases draw attention to these incorrectly used names. Unfortunately, we must accept the fact that past generalisations about members of this genus have been based on specimens whose correct identity, even as to genus, is often in doubt, and that all past vouchers must be reidentified in the light of our new, though still imperfect, knowledge.

I have traced the original descriptions of almost all published names and included these names in the relevant synonymy, but the subsequent usage of these names has mostly been other than as represented by their Types (often with usage differing with the institution or standard work). It has proved quite impossible to allot to the correct species the disparate elements in most other

references. In many cases an "intelligent guess" would place the published names in the synonymy of the correct species but it was "intelligent guesses" by writers such as Bentham, Smith, J. D. Hooker, Domin and Cheel that brought about the nomenclatural chaos that has characterised this genus and its close relatives.

Key to species

- 1 Fruit not woody, or if so then the valves not woody, *or* the outer part of the fruit smooth and rather fleshy, *or* the plant spinescent. The seed surface usually with a rugose-reticulate pattern [1*: p. 343] 2.
- 2 Branches spinescent. Fruit woody, often more than 1.5 cm diameter, and long-persistent 2. **L. spinescens**
- 2* Branches not spinescent. Fruit not large, woody *and* long-persistent . . . 3.
- 3 Sepals cream-coloured and thin. Filaments very narrow and thread-like 1. **L. macgillivrayi**
- 3* Sepals never uniformly thin and cream-coloured. Filaments broad in the lower part or almost linear; stout or slender, but never fine and thread-like 4.
- 4 Fruit-base firm or chartaceous. Valves with margins variously pubescent or glabrous, but if (rarely) the loculi more than 5, the open edges pubescent [4*. p. 343] 5.
- 5 Leaves c. 1 cm long with the margins strongly recurved when dry 9. **L. purpurascens**
- 5* Leaves various but never as above; if the margins somewhat recurved, the leaves at least 1.5 cm in length 6.
- 6 Most flowering shoots condensed and with more than 2 flowers. Fruit consistently 3-locular. Leaves much longer than broad 7.
- 7 Leaves tapering to a slender apex; the leaf-surface not glossy 8.
- 8 Leaves tapering to a narrow base, or if somewhat broad-based then the anthers c. 0.25 mm long 9.
- 9 Leaves thin in texture with the margins more or less recurved 8. **L. parviflorum**
- 9* Leaves firm in texture, and flat 10.
- 10 Hypanthium glabrous or almost so. Leaves linear-lanceolate 7. **L. brachyandrum**
- 10* Hypanthium pubescent. Leaves elliptical 10. **L. whitei**
- 8* Leaves broad-based. Anthers c. 0.5 mm long 11. **L. speciosum**
- 7* Leaves with a broad, rounded apex; the leaf-surface glossy 12. **L. luehmannii**
- 6* Flowers on most flowering shoots 1-2; if occasionally more then the loculus-number of the fruit varying from 3 to 5. Leaves various . . . 11.
- 11 Fruit with glabrous long-exserted valves extending to the top of the long, erect sepals and a pubescent base much shorter than the valves 5. **L. exsertum**

- 11* Fruit not as above 12.
- 12 Leaf-apex blunt or with a short blunt point, or, if with a very short pungent point, the leaves subtending the flowering shoots not both infolded or incurved *and* reflexed [12*: p. 342] 13.
- 13 Flowers borne at the ends of branches bearing very small, obtuse, petiolate leaves. Hypanthium usually with spreading hairs 14.
- 14 Placenta high in the top of the flat-topped loculus. Petiole broad **6. L. subtenu**
- 14* Placenta low, with the loculus extending far above it. Petiole slender **16. L. parvifolium**
- 13* Flowers usually on side-shoots shorter than the subtending leaf, but if on longer shoots then the leaves not very small, obtuse and petiolate. Hypanthium variously pubescent 15.
- 15 Filaments with hairs at least in the lower part. Hypanthium mostly glabrous but with dense silky hairs on the pedicel **17. L. deanei**
- 15* Filaments glabrous, or if with hairs on the lower part then the hypanthium and pedicel completely glabrous 16.
- 16 Hypanthium pubescent or glabrous, but if glabrous then tapering to the base or with sepals of different texture or 1 mm or more in length [16*: p. 342] 17.
- 17 Leaf-bud of the flowering shoot expanding with or just after the associated flower or flowers. Hypanthium with or without a pedicel [17*: p. 342] 18.
- 18 Fruit 5-locular, 3-5-locular or, if consistently 3-locular, the valves not much exerted and the style-base not inset in the apex of the fruit-valve [18*: p. 342] 19.
- 19 Fruit-valves extending above the hypanthium as the fruit opens [19*: p. 342] 20.
- 20 Upper surface of the fruit disproportionately raised near the style-base 21.
- 21 Fruit (including the stalk) usually as broad as long, with a conspicuous rim formed by the erect hypanthium-top **13. L. erubescens**
- 21* Fruit (including the stalk) usually longer than broad, with the hypanthium-top not forming a conspicuous rim 22.
- 22 Hypanthium tapering rather abruptly to a narrow pedicel. Placenta not high in the loculus, the ovules c. 20 in 4 rows **3. L. oligandrum**
- 22* Hypanthium tapering gradually to a narrow pedicel. Placenta high in the loculus with the ovules usually 4-12 in 2 rows **4. L. maxwellii**
- 20* Upper surface of the fruit evenly rounded 23.
- 23 Leaves usually 1 cm or less in length. Flowers on the flowering shoot usually 1. Upper bracts retained on large buds and usually persisting about the flowers **34. L. sericatum**
- 23* Leaves usually more than 1 cm long. Flowers on the flowering shoot 1 or 2. Upper bracts shed from young buds and not seen about the flowers . 24.

- 24 Leaves obtuse or shortly acuminate. Bark close 33. **L. brevipes**
- 24* Leaves tapering to the apex. Bark on older branches and trunk in many flaky layers 36. **L. lamellatum**
- 19* Fruit-valves not or scarcely extending above the hypanthium as the fruit opens 25.
- 25 Most fruit at least 4 mm in diameter. Anther-cells usually more than 0.5 mm long 26.
- 26 Hypanthium pubescent all over, rarely all glabrous; the top not incurved 27.
- 27 Stems with the bark firm and rather corrugated 14. **L. sericeum**
- 27* Stems with many layers of flaky bark 19. **L. trinervium**
- 26* Hypanthium glabrous or with a dense silky pubescence at the base, the top curved over the edge of the fruit 20. **L. subglabratum**
- 25* Fruit less than 4 mm in diameter. Anther-cells 0.5 mm or less in length 20.
- 28 Fruit (including the stalk) as long as or longer than broad 29.
- 29 The upper part of the hypanthium folded over the top of the fruit 27. **L. inelegans**
- 29* The upper part of the hypanthium not folded over the top of the fruit 30.
- 30 Hypanthium with dense spreading long hairs 26. **L. roei**
- 30* Hypanthium with an appressed pubescence 31.
- 31 Hypanthium very broadly expanded in the upper part and tapering gradually to a tapering and long (to 3 mm or more) pedicel 28. **L. incanum**
- 31* Hypanthium expanded broadly but not further expanded in the upper part; the base tapering gradually, or more suddenly, to a pedicel of usually less than 3 mm 32.
- 32 Young stems not tuberculate. Hypanthium in the flower tapering suddenly below the ovary to a pedicel 25. **L. nitens**
- 32* Young stems usually covered with tubercles. Hypanthium in the flower gradually tapering to the base 29. **L. fastigiatum**
- 28* Fruit very broad and shallow above a very short stalk 35. **L. neglectum**
- 18* Fruit consistently 3-locular, the valves much exerted and each notched slightly at the apex by the scarcely inset style 37. **L. multicaule**
- 17* Leaf-bud of the flowering shoot precocious so that flowers are found at the base of shoots and even of branched shoots. Hypanthium tapering to a very long slender pedicel 30. **L. blakelyi**
- 16* Hypanthium glabrous, or only very slightly pubescent, with short sepals, c. 0.7 mm long, of the same texture; the base broadly and abruptly rounded above a short pedicel 32. **L. polyanthum**
- 12* Leaf-apex with a stiff pungent point c. 1 mm long, the leaves subtending the flowering shoots infolded or incurved, and reflexed 33.

- 33 Sepals obtuse, short-oblong to hemispherical. Ovary 3–5-locular, each locus with more than 20 ovules 31. *L. microcarpum*
- 33* Sepals acute, deltoid. Ovary 3-locular and each locus with 20 or fewer ovules 38. *L. divaricatum*
- 4* Fruit-base succulent or, when dry, coarsely wrinkled as if previously succulent. Valves densely pubescent on the open edges or, if sparsely so, then the loculi more than 5 34.
- 34 Ovules in each locus c. 20, in 4 or more rows. Loculi 3–5 35.
- 35 Sepals long-deltoid, about twice as long as broad. The central stamen less than $\frac{1}{2}$ the petal-length 18. *L. semibaccatum*
- 35* Sepals very shortly deltoid, 0.5 mm long, and usually broader than long. The central stamen c. $\frac{2}{3}$ the petal-length 21. *L. myrsinoides*
- 34* Ovules in each locus c. 10, in 2 rows on a narrow placenta. Loculi rarely less than 5, often more 36.
- 36 Sepals deltoid and rather scarious, usually pubescent at least in part. Leaves flat, broad-elliptic to narrow-obovate 37.
- 37 Many flowers axillary and solitary (not subtended by bracts). Fruit usually 4–5 mm in diameter 22. *L. glaucescens*
- 37* Flowers on a condensed leafless axillary shoot enclosed by imbricate bracts in the bud. Shoot with 2 flowers developing. Fruit usually more than 5 mm in diameter 38.
- 38 Leaves usually light yellowish green and narrowly obtuse, acute or acuminate. Fruit usually 4–7 locular 23. *L. coriaceum*
- 38* Leaves usually grey-green and broadly obtuse. Fruit usually 6–11-locular 24. *L. laevigatum*
- 36* Sepals almost hemispherical, thick, obtuse and incurved, glabrous. Leaves very narrowly clavate (c. 1 mm broad) and somewhat triquetrous 15. *L. confertum*
- 1* Fruit woody and never succulent; with woody valves that often remain unopened for some time. Plants never spinescent. The seed surface with fine longitudinal striations 39.
- 39 Sepals readily deciduous or if tardily deciduous the leaves lemon-scented and/or the stem-flange conspicuous [39*: p. 345] 40.
- 40 Anther-cells broader than deep (when open) and opening wide; or, if deep and not opening wide then the anther-cells not divergent or the leaves glossy [40*: p. 345] 41.
- 41 Leaves not both incurved (in cross-section) and pungent-pointed or if occasionally so then the style tapering and the stigma not proportionately large [41*: p. 345] 42.
- 42 Leaf-base narrow but not petiolate 43.
- 43 Leaves obtuse, retuse or acute without a stout blunt point 44.
- 44 Fruit-rim and valves not very thick. Sepals with hairs at least at the apex. 45.

- 45 Flowering shoots more than 1-, usually more than 2-, flowered. Fruit scarcely woody and with a long, narrow stalk 39. *L. emarginatum*
- 45* Flowers on the flowering shoot 1(-2). Fruit with the stalk short (c. 1 mm) or absent 46.
- 46 Fruit (including the stalk) usually rather broad and shallow, with the valves approximately equal in height to the base and the upper surface evenly rounded or raised near the style; later often opening wide 47.
- 47 Fruit with the upper surface evenly rounded and the valves, if concave, only so near the tip. Leaves usually c. 6 times as long as broad 43. *L. petersonii*
- 47* Fruit with the upper surface raised near the style, and the valves concave. Leaves no more than 4 times as long as broad 42.
- 48 Leaves usually 15-35 mm long 40. *L. javanicum*
- 48* Leaves usually 3-6 mm long 41. *L. recurvum*
- 46* Fruit (including the stalk) as deep or deeper than broad with the valves high but rounded and shorter than the base; later not opening wider than the rim 42. *L. wooroonoran*
- 44* Fruit-rim and valves very thick and woody. Sepals glabrous 44. *L. liversidgei*
- 43* Leaves acute with a short, stout, blunt point 49.
- 49 Stamens c. 2 mm long. Style-base not inset in the surface of the fruit-top 51. *L. sejunctum*
- 49* Stamens 3-5 mm long. Style-base inset in the fruit-top surface 50.
- 50 Base of the opened fruit rounded 47. *L. variabile*
- 50* Base of the opened fruit flat 48. *L. oreophilum*
- 42* Leaf-base petiolate, at least in the majority of leaves 51.
- 51 Sepals wholly or partly pubescent 52.
- 52 Fruit almost globular (before opening). Stem-flange inconspicuous 53. *L. myrtifolium*
- 52* Fruit broader than deep. Stem-flange conspicuous 53.
- 53 Hypanthium not conspicuously flared in the upper part. Leaves obovate to oblanceolate 54. *L. gregarium*
- 53* Hypanthium conspicuously flared in the upper part. Leaves very broadly obovate-elliptical 56. *L. argenteum*
- 51* Sepals glabrous, or rarely silky or minutely ciliate 54.
- 54 Seeds mostly 1.5-2.5 mm long. Fruit small or large 55.
- 55 Leaves usually more than 7 mm in length or if sometimes less than 7 mm then either the leaves not thick and glossy, or the leaves elliptical, or the flowers more than 1 cm wide 56.
- 56 Branching at an angle of c. 30°. Leaves variable but usually narrowly oblanceolate to obovate. Bark close and firm 55. *L. obovatum*
- 56* Branching at 45°-60°. Leaves various. Bark (as seen on specimens) flaking 57.

- 57 Leaf-apex usually broadly rounded, rarely broadly acute with a short blunt point 57. *L. micromyrtus*
- 57* Leaf-apex acute or acuminate and usually pungent-pointed 49. *L. novae-angliae*
- 55* Leaves usually no more than 7 mm in length, obovate, thick and glossy. Flowers usually up to 1 cm in width 58.
- 58 Stamens longer than the petals 50. *L. minutifolium*
- 58* Stamens much shorter than the petals 52. *L. rupestre*
- 54* Seeds at least 3 mm in length. Fruit large (at least 8 mm in diameter) 59.
- 59 Leaves mostly more than 10 mm long; the bases tapering 64. *L. grandiflorum*
- 59* Leaves usually 4–7 mm long; almost orbicular above a narrow petiole 63. *L. rotundifolium*
- 41* Leaves incurved (in cross-section) and pungent-pointed. Style stout and straight with a characteristic flat and proportionately large stigma .. 60.
- 60 Leaves usually spreading 61.
- 61 Flowers produced on new growth 62.
- 62 Most leaves more than 3 mm, often more than 5 mm, in width and almost flat or somewhat incurved from the margin; broadest below the centre and tapering below and above. Fruit occasionally c. 6 mm but often 8 mm or more in diameter 58. *L. scoparium*
- 62* Most leaves (3–) 2 mm or less in width and strongly incurved from the margin; tapering gradually upward from near the base and with the broadest part very close to the base. Fruit 5–6(–7) mm in diameter 59. *L. continentale*
- 61* Flowers produced on short shoots arising from older branches 62. *L. squarrosium*
- 60* Leaves erect and rather dense, giving the plant a “Broom”-like appearance 63.
- 63 Short and robust shrubs with flowers 10 mm or more, and fruit up to 10 mm, in diameter 61. *L. rupicola*
- 63* Tall and slender shrubs with flowers often less than 10 mm, and fruit often much less than 7 mm, in diameter 60. *L. juniperinum*
- 40* Anther-cells deep, not opening wide and usually divergent or separated. Leaves not glossy 64.
- 64 Flowers usually about 1.5 cm in diameter. Leaves usually more than 2 cm long; broad, often somewhat falcate and usually conspicuously 3-veined and aromatic 46. *L. morrisonii*
- 64* Flowers usually c. 1 cm in diameter. Leaves various but rarely more than 2 cm long and if falcate then slender; not conspicuously 3-veined or aromatic 45. *L. polygalifolium*
- 39* Sepals persistent. Leaves never lemon-scented. Stem-flange rarely present 65.

- 65 Stamens short in proportion to the petal-length. Style-base inset. Seeds no more than 3 mm in length 66.
- 66 Fruit-valves (at the time of opening) not conspicuously exerted . . . 67.
- 67 Leaves with a tapering pungent-pointed apex and incurved in cross-section **68. L. arachnoides**
- 67* Leaves blunt or pungent, usually flat or with the margins recurved; if the margins incurved then the apex not pungent 68.
- 68 Sepals short with the apex broadly rounded 69.
- 69 Leaves often at least 4 mm in width and twice as long . . . **69. L. thompsonii**
- 69* Leaves mostly less than 3 mm wide and more than twice as long **70. L. glabrescens**
- 68* Sepals very long-deltoid 70.
- 70 Fruit-base narrow **74. L. riparium**
- 70* Fruit broad-based **75. L. nitidum**
- 66* Fruit-valves conspicuously exerted 71.
- 71 Leaves flat or with the margins recurved; the apex usually shortly pungent 72.
- 72 Leaves not glossy on both surfaces; if glossy on the upper surface, the lower usually pubescent or dull 73.
- 73 Fruit with a distinct stalked base; the valve-surface close . . . **65. L. deunse**
- 73* Fruit sessile; the valve-surface lifting 74.
- 74 Leaves broadest near, and abruptly contracting to, the apex; grey-green (rarely green), usually less than 15 mm long, narrow and usually pubescent on both surfaces. Bark usually close and fibrous and, though shaggy in older plants, probably never exfoliating in firm layers **67. L. lanigerum**
- 74* Leaves broadest near the centre or, if broadest above the centre, tapering to the apex; green, either short and broad and very glossy on the upper surface and with a dense pubescence below, or (riparian forms) 2 cm or more in length with the lower surface glabrous, or with intermediate proportions and pubescence. Bark smooth and exfoliating, with the firm (not fibrous or papery) layers tending to persist on the stems **66. L. grandifolium**
- 72* Leaves glossy on both surfaces 75.
- 75 Hypanthium with long hairs. Fruit-base ultimately tapering (obconical) **77. L. turbinatum**
- 75* Hypanthium with short hairs. Fruit-base eventually flat . . . **76. L. petraeum**
- 71* Leaves incurved in cross-section; the apex blunt 76.
- 76 Leaves at least 5 mm in length; the apex somewhat acute **78. L. crassifolium**
- 76* Leaves 2–3 mm long, obtuse **79. L. epacridoideum**
- 65* Stamens long, all more than $\frac{1}{2}$ the length of the petals. Style-base not inset. Seeds 2.5 mm or more in length 77.
- 77 Fruit as deep as wide 78.

- 78 Leaves less than 2 cm long. Flowers white or pink 73. *L. sphaerocarpum*
 78* Leaves more than 2 cm long. Flowers red 71. *L. spectabile*
 77* Fruit wider than deep 72. *L. macrocarpum*

Specific Descriptions — Group 1

L. brachyandrum subgroup (spp. 1–12), Map 3.

1. *L. macgillivrayi* J. Thompson sp. nov.

Frutex usque ad 1 m altus. Folia crassa obovata, usque ad 8 mm longa. Flores sepalis glabratis chartaceis persistentibus. Filamenta pergracilia. Ovarium 3-loculare. Fructus 4–5 mm diametro, decidui, valvis glabratis rigidis.

HOLOTYPE: WESTERN AUSTRALIA: 30° 14' S, 119° 16' E, "breakaway" c. 2 km N. of Mt Jackson on road to Die Hardy Range, *D.J. McGillivray 3678 & A.S. George*, 4.vii.1976 (NSW).

Open divaricate shrub to 1 m tall, with firm, gnarled bark; the younger stems short and stout, with seasonal growth very limited, pubescent, terete and without flanges or ridges below the leaves but with conspicuous leaf-scars, the branching at c. 45°. *Leaves* crowded and divergent, 8 mm or less in length and up to 5 mm wide, broadly obovate, thick, incurved or folded near the apex, with a fine appressed pubescence, the apex obtuse or even somewhat emarginate, with a small umbo at the back, the base tapering to a somewhat flattened petiole of 1 mm or less. *Flowers* (not seen beyond the young-bud stage) occurring singly on modified shoots at the ends of few-leaved or leafless axillary side-branches, often at the end of a previous season's growth, frequently with 1 or 2 of the subtending leaves modified (with the blade reduced in size). *Bracts* few, enclosing the very young bud; the bracteoles large, papery and glabrous, the outer enclosing the inner and all tending to lift together as an almost spherical unit. *Hypanthium* densely covered with long white shining hairs that are loosely appressed to spreading and often curved so that the pile lies in one direction, c. 3 mm long, tapering to the base, with the upper part incurved and the top of the ovary probably glabrous. *Sepals* in the bud imbricate and almost spherical; as seen on the fruit, persistent, 1.5 mm long, very pale, glabrous and papery, ovate-deltoid and obtuse. *Petals* not seen mature. *Stamens* in bundles probably of 5–7, the filaments extremely slender, c. 3 mm long, the anther-cells <0.5mm long, parallel longer than broad and shallow. *Style* (in fruit) long and slender, somewhat broader at the base, inset, and on a distinct stout base, the stigma, relative to the style, small and somewhat lobed. *Ovary* (2–)3-locular, each loculus with c. 20 ovules in c. 6 rows on a broad placenta with a rounded surface. *Fruit* deciduous, c. 4–5 mm in diameter, the base broadly conical and densely pubescent, the valves glabrous, rigid and smooth and at first only rounded above the incurved, appressed upper part of the hypanthium but later exerted to approximately equal the base. *Mature seeds* c. 1.5 mm long, obovoid to broadly cuneiform with a long-reticulate pattern. Main flowering period: probably Aug.-Sept.

DISTRIBUTION: Known only from the Type and the other specimen cited. From separate locations in the northeast portion of the Coolgardie District of Western Australia (Map 3). In tall open shrubland on reddish loam from decaying granite.

OTHER SPECIMEN EXAMINED: WESTERN AUSTRALIA: Coolgardie: 33 km S. of Die Hardy Range gap, *George 14319*, 7.1976 (PERTH).

This species is named after D.J. McGillivray, Botanist of the National Herbarium of New South Wales who collected and photographed the first specimen. It is very distinct from all other species of *Leptospermum* and can be readily identified by the sepals. It shares several characters with the equally anomalous *L. spinescens*. The orthography of this specific name follows Rec. 73c.4.(a) of the International Code of Botanical Nomenclature (1983), and is deliberate.

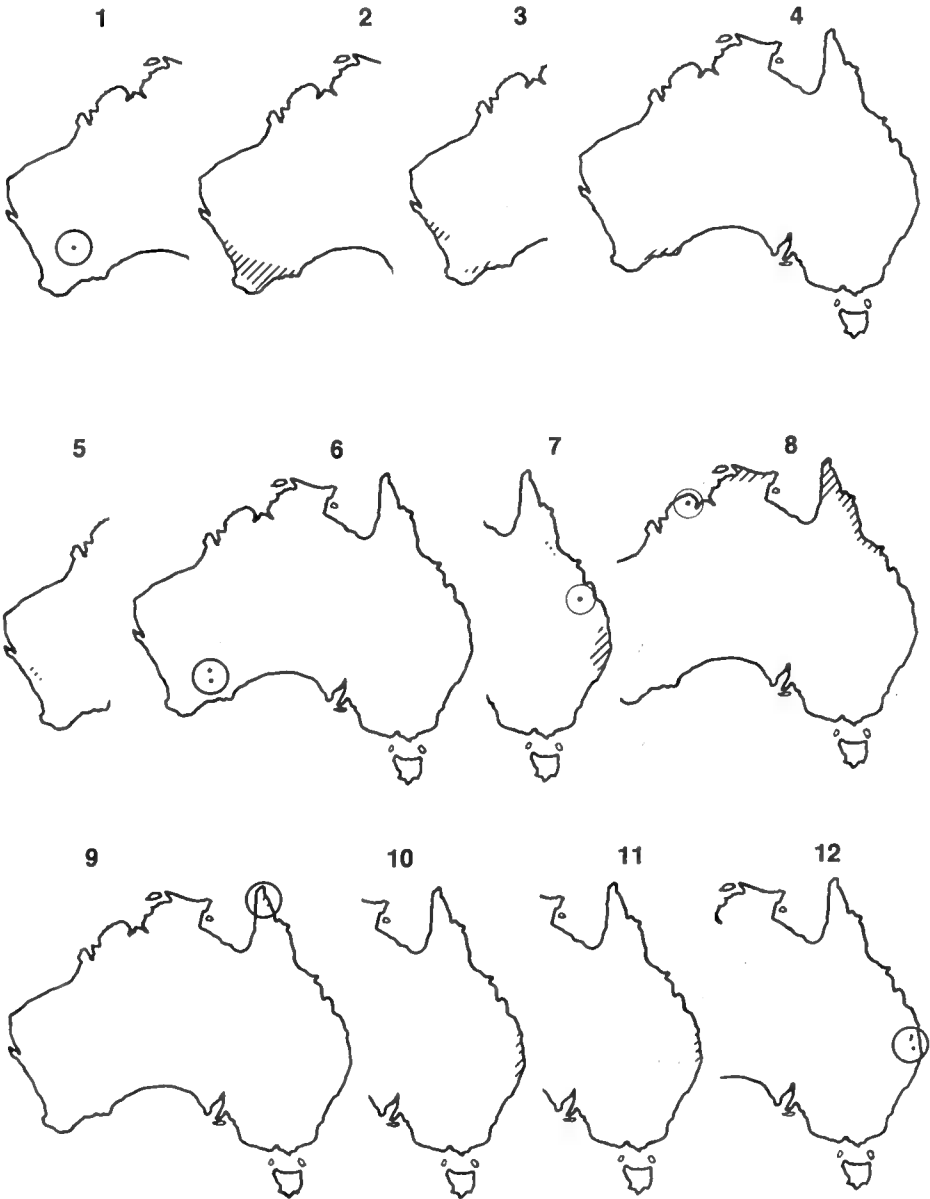
2. *L. spinescens* Endl. in Endl. et al., Enum. Pl.: 50 (1837).

HOLOTYPE: WESTERN AUSTRALIA: King Georges Sound, *Huegel* (W, n.v.).

Spinescent shrub usually less than 1.5 m tall, with rather corrugated firm but soft (corky) bark; the younger stems stout and tapering, glabrous or pubescent, terete and without flanges or ridges but with conspicuous leaf-scars, and with branching at 60° or even 90°. *Leaves* divergent, and sometimes somewhat recurved near the apex, variable in size, usually 5–15 mm long and 2–5 mm wide, obovate-elliptical, thick, usually glabrous at maturity, with the margins often tuberculate, flat to somewhat incurved or folded, the apex broadly rounded to acute, often with a short, blunt point, the base tapered to a short petiole. *Flowers* white or greenish cream, 10–15 mm in diameter with the fertile ones soon enlarging, occurring singly, each subtended by a bract, in leaf-axils or (on old wood) leaf-scars, or in axils subtended by a series of bracts, or in leaf-axils subtended only by bracteoles. *Bracts* small, often single; the bracteoles large, orbicular, concave, red-brown and scarious, and shed before or after the flower opens. *Hypanthium* with a dense silky pubescence, c. 5–8 mm long, and tapering to the base or rounded, the upper part tending to curve inward, the top of the ovary dark and glabrous. *Sepals* persistent, c. 2 mm long, hemispherical, silky pubescent with pale thin margins. *Petals* 3–6 mm long. *Stamens* in bundles of 3–7, the filaments very broad in the lower part and irregular, 2.5–4 mm long, the anther-cells c. 0.5 mm long, parallel, broad and shallow. *Style* scarcely inset, stout and broad-based, the stigma, relative to the style, large; often absent. *Ovary* 3–5-locular, each loculus with c. 80 ovules in c. 6 rows on a placenta with a rather flat surface; often absent. *Fruit* long-persistent, ultimately very gnarled and sometimes almost engulfed by stem-growth, variable in size but often more than 20 mm in diameter, widest at the base of the free part of the hypanthium with the persistent sepals and top of the hypanthium folded inward, the lower part shallow and broad-based, the valves very thick and woody, and at first smooth and somewhat raised, i.e. to about $\frac{1}{3}$ the depth of the fruit. *Mature seeds* 3.5–4 mm long, broadly cuneiform to irregularly oblong and of variable width, the outer surface of loose fibres and, before splitting, so narrowly reticulate as to appear striate. Main flowering period: Sept.–Nov.

DISTRIBUTION: In southwestern Western Australia (Map 3). On sandy and lateritic soils.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Irwin: 4 miles [6.4 km] W. of Strawberry, *Briggs NSW 154710*, 10.1960 (NSW); c. 50 km N. of Gingin, *Thompson 4535*, 9.1987 (NSW, PERTH). Darling: 9 miles [14.5 km] W. of Yancheep, *Phillips 013236*, 9.1962 (CBG, NSW); Cottesloe, *Fitzgerald NSW 154709*, 11.1900 (NSW). Avon: Tammin,



Map 3. Distribution of Group 1: subgroup 1 *L. brachyandrum* and allies. 1. *L. macgillivrayi* 2. *L. spinescens* 3. *L. oligandrum* 4. *L. maxwelli* 5. *L. exsertum* 6. *L. subtienuae* 7. *L. brachyandrum* 8. *L. parviflorum* 9. *L. purpurascens* 10. *L. whitei* 11. *L. speciosum* 12. *L. luehmannii*.

Gardner 612, 11.1920 (PERTH). Roe: Bending, *Gardner s.n.*, 9.1923 (PERTH); 100 km N. of Ravensthorpe, *Cranfield 997B*, 11.1978 (PERTH); Kukerin, *Cough 48*, 10.1962 (PERTH). Eyre: South Stirling, *Royce 6081*, 10.1959 (PERTH); 3 km W. of Israelite Bay ruins, *Crisp 4888*, 1.1979 (CBG, PERTH).

3. *L. oligandrum* Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 10: 335 (1852).

HOLOTYPE: WESTERN AUSTRALIA: *Drum[mond]* [Coll.] V, n. 129 (?KW, n.v.). ISOTYPES: MEL, NSW.

SYNONYMY: *Kunzea podantha* F. Muell., Fragm. 2: 28 (1860). *L. erubescens* var *psilocalyx* Benth., Fl Austral. 3: 109 (1867). *L. podanthum* (F. Muell.) Diels in Diels & Pritzel, Bot. Jahrb. Syst. 35: 423 (1904). LECTOTYPE: here chosen: WESTERN AUSTRALIA: Phillips Flat, [Maxwell] (MEL 615686). The original citation 'ad ripas amnium Phillips et Fitzgerald River. *Mx [Maxwell]*' is a composite locality and does not identify a particular specimen.

Leptospermopsis myrtifolia S. Moore, J. Linn. Soc. Bot. 45: 202 (1920). HOLOTYPE: WESTERN AUSTRALIA: Fitzgerald River, *Maxwell* (BM, n.v.).

Erect spreading shrub from less than 1 to more than 3 m tall with (as seen on specimens) stringy and rather flaky but close bark; the younger stems silky-pubescent but usually glabrescent, without a flange but swollen below each node and branching usually at 30°–45° and somewhat flexuose, the branch-diameter enlarging rapidly with the order of branching. *Leaves* usually diverging, 3–10 mm long and 2–4 mm wide, somewhat silky to glabrous, broadly obovate to cuneate, with the apex acute to truncate or even retuse, often infolded and with or without a very short recurved point, and tapering at the base, often into a short, <1 mm, rounded petiole. *Flowers* white, 6–10 mm in diameter, 1–3 in bract-axils at the ends of adjacent, short, leafy, leaf-subtended side-branches, often at the ends of limited development of the previous seasons branchlets, occasionally as leafless axillary shoots or even as axillary monads, and often as monads at the base of precocious new leafy growth. *Bracts* and bracteoles red-brown, broadly obovate, rather thickened at the base, all shed very early and leaving raised scars on the stem. *Hypanthium* delicate, glabrous, and often with conspicuous vertical ridges, or partly or wholly silky-pubescent, to 2–3 mm or more in length, the upper part scarcely expanded, the part about the ovary only 2–3 mm long and rather abruptly narrowing to a tapering, very slender, pedicel usually 2–5 mm long, the top of the ovary with a dense silky pubescence. *Sepals* persistent, c. 1–1.5 mm long, glabrous to densely silky-pubescent, usually, but not invariably, with densely pubescent margins, deltoid with the apex somewhat hooded, undifferentiated from the hypanthium and often with a central rib. *Petals* 1.5–c. 3 mm long. *Stamens* 1–3 per bundle, 0.75–1.25 mm long, the filaments broad in the lower part, the anther-cells c. 0.3 mm long, parallel, broad and shallow. *Style* well inset, rather stout with a large (relative to the style) stigma. *Ovary* 5-locular, each loculus with c. 20 ovules in 4 rows on a large, sometimes somewhat narrowed (wedge-like) placenta. *Fruit* deciduous, 2–4 mm in diameter, the upper part not expanded, even somewhat contracted, and not forming a conspicuous rim but bearing the persistent sepals, the lower often distinctly lobed in cross-section, with an almost inset narrow stalk several mm long, the valves not woody, exerted above the hypanthium-top especially near the style-base and later to c. ½ the depth of the broad part of the fruit. *Mature seeds* c. 1 mm long, obovoid, with a very

shallow reticulate pattern. Main flowering period: Sept.-Dec.

DISTRIBUTION: Disjunct, being widespread in the Irwin District and on adjoining parts of the northern Avon and Darling Districts; and in the southern Darling and Irwin Districts of Western Australia (Map 3). Usually in heath or scrub on sandy soils or laterite.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Irwin: 10 miles [16 km] S. of Coorow on Geraldton Highway, *Melville 4119 & Calaby*, 7.1953 (MEL, NSW); 2 km NW. of Mt Lesueur, NE. of Jurien, *Griffin 2669*, 12.1979 (PERTH). Avon: Reynold's Flora Reserve, Wongan Hills, *Beard 5131*, 10.1967 (PERTH). Darling: Mt Barker, *Oldfield* (MEL). Eyre: Phillips flat, [Maxwell] (MEL); Oldfield R. at crossing of the Esperance-Ravensthorpe road, *Orchard 1507*, 10.1968 (AD, PERTH), *Thompson 4636*, 10.1987 (NSW, PERTH). Without precise locality: S.W. Australia, *Maxwell*, (MEL).

4. *L. maxwellii* S. Moore, J. Linn. Soc. Bot. 45: 201 (1920).

HOLOTYPE: WESTERN AUSTRALIA: Fitzgerald R., Western Australia, *Maxwell 202* (BM, n.v.). **ISOTYPE:** NSW.

Shrub, low-growing and spreading or open and erect and to 2 m tall, with (as seen on specimens) bark tending to have thin flaking layers; the younger stems silky-pubescent, glabrescent; and without a flange but swollen below each node and usually branching at 30°–45°. *Leaves* usually somewhat divergent, from a few to c. 12 mm long and 1–5 mm wide, obovate, occasionally narrowly so, mostly glabrous but often with some hairs especially on the margins, the apex broadly rounded with the centre tending to recurve, the base long-tapering to a short petiole. *Flowers* white, c. 8mm, occasionally c. 12mm, in diameter, usually 2, sometimes 1, rarely 3, in bract-axils at the ends of adjacent leafless or short leafy side-branches often at the end of limited development of the previous season's growth, the terminal growth sometimes precocious leaving flowers as axillary monads at the base. *Bracts* and bracteoles red-brown, shed from the very young bud leaving prominent scars on the stem. *Hypanthium* usually marked with vertical ridges and at least for the most part glabrous although often with the base silky, usually with the part about the ovary in a large-flowered form c. 3 mm but in the more widespread smaller form c. 2 mm, above this spreading, and below tapering gradually to a slender pedicel, the top of the ovary with a dense rather erect pubescence. *Sepals* persistent, 1–2 mm long, indistinguishable in texture from the hypanthium, deltoid to long-deltoid; somewhat keeled and hooded, usually pubescent at least on the margins and at the apex, and tending to arch over the top of the ovary. *Petals* 2.5–5 mm long. *Stamens* in bundles of 1–5, the filaments broad in the lower part, the anther-cells c. 0.3mm (–0.5mm in the large-flowered form) long, parallel, broad and shallow. *Style* deeply inset, slightly tapered, the stigma small. *Ovary* 5-locular, each locus with the few ovules (varying within the flowers but usually 4–12) pendulous, or mostly so, in 2 rows on a narrow (wedge-shaped) placenta high in the locus. *Fruit* deciduous, to 5 mm in diameter (on the only specimen seen), the outer surface rather glossy and wrinkled, the upper part of the hypanthium not forming a conspicuous rim, but erect with spreading incurved sepals, the lower part somewhat shorter than broad, lobed in cross-section and rounded or tapering above a stout but tapering stalk, the valves not woody, exerted above the hypanthium-top especially near the style-base, eventually to c. 1 mm. *Mature seeds* 1.5 mm long, obovoid-cuneiform, with a very coarsely reticulate surface. Main flowering period: Sept.-Nov.

DISTRIBUTION: Widespread in the Eyre District and occasionally reaching the southern part of the Roe District of Western Australia (Map 3). In sandy soil or on coastal dunes.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Roe: Scadden [as Scanden], *Cranfield* 1065, 11.1978 (PERTH). Eyre: Fitzgerald Range, (MEL); Esperance-Ravensthorpe, *Edmiston* E. 562, 11.1973 (PERTH); c. 14 km E. of the mouth of the Oldfield R., *Eichler* 20201, 10.1968 (AD, PERTH); Merivale, *Thompson* 4632, 10.1987 (NSW, PERTH); Pt Malcolm, *Gardner & Blackall* 1196, 10.1931 (PERTH). Without precise locality: S.W. Australia, *Maxwell* (MEL).

5. *L. exsertum* J. Thompson sp. nov.

Frutex minus quam 1 m altus. Folia crassa obcordata ad obcuneata, 3–5 mm longa. Flores 5–8 mm diametro, sepalis glabris persistentibus. Ovarium 3-loculare. Fructus c. 3 mm diametro decidui, valvis glabris supra basin brevem valde exsertis.

HOLOTYPE: WESTERN AUSTRALIA: Gerber's Farm, E. of Tardun, *J.S. Beard* 6697, 27 Sept. 1973 (NSW). **ISOTYPE:** Perth.

Sparsely branched shrub less than 1 m tall, with (as seen from specimens) close firm bark; the younger stems glabrous and rather glossy, without a flange but with a swelling below each node that leaves a prominent scar on older stems, and with the branching at an angle of 45°–60°. *Leaves* at first erect and well-spaced, later spreading, mostly c. 3–5 mm long and 2–3 mm wide, broadly obcuneate to obcordate, very thick in texture and concave, sometimes somewhat glaucous or puberulous, very broadly rounded to almost emarginate at the apex, the tip recurved and often pungent-pointed, tapering at the base to a petiole. *Flowers* white, 5–8 mm in diameter, occurring singly or 2(–3) together, each in a bract-axil, at the ends of long or short leafy side-branches. *Bracts* usually red-brown and scarious, often leaf- or leaf-base-like, small, thick and tending to persist; the bracteoles thin, large, red-brown and concave, and shed from the bud. *Hypanthium* usually with a dense irregularly spreading pubescence on the wrinkled tapering part about the ovary and short pedicel, c. 2 mm deep, the upper part much expanded, erect, dark and glabrous, the top of the ovary elevated and glabrous. *Sepals* persistent, 1.5–2 mm long, deltoid, acute, somewhat keeled, glabrous, dark and scarcely differentiated from the hypanthium. *Petals* c. 3 mm long. *Stamens* in bundles of c. 5, c. 1.5 mm long, the filaments slender, the anther-cells c. 0.3 mm long, parallel, broad and shallow. *Style* inset, slender but tapering towards the small stigma. *Ovary* 3-locular, each loculus extended upward, with c. 5 pendulous ovules in 2 rows on a narrow-based, pendulous, very high placenta, the upper ovules appearing to be aborted. *Fruit* (not seen mature) deciduous, c. 3 mm in diameter, the upper part glabrous and forming a wide rim, the lower part pubescent, very short, and rather rounded above a short pubescent stalk, the valves glabrous and exserted high above the erect hypanthium-rim, almost reaching the level of the long erect sepal-tips. *Seeds* not seen mature, c. 1.5 mm long, probably rather oblong with an obviously patterned long-reticulate surface. Main flowering period: Aug.-Sept.

DISTRIBUTION: In the northwestern corner of the Avon District of Western Australia (Map 3). In sandy heath or on sandplain.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Avon: Mullewa, *Galbraith* 411, 8.1964 (MEL, PERTH); Perenjori, *Gardner* 2685, 9.1931 (PERTH).

The species is named for its long-exserted fruit-valves.

6. *L. subtenuae* J. Thompson sp. nov.

Frutex c. 1 m altus. Folia crassa anguste elliptica ad oblanceolata, 1–1.5 cm longa. Flores 8–10 mm diametro, ad apicem ramulorum tenuium dispersarum, sepalis pubescentibus vel glabris persistentibus. Ovarium 3-loculare. Fructus decidui.

HOLOTYPE: WESTERN AUSTRALIA: N. of Esperance, *C. Andrews*, Oct. 1903 (W.E. Blackall Collection, PERTH). ISOTYPE: *herb. C.A. Gardner 1267* (PERTH).

Shrub c. 1 m tall, the bark (as seen on specimens) close; the young stems very slender, at first silky-pubescent but soon becoming glabrous, without a flange but with a cup-shaped extension below each node that remains on older branches, and with the branching at an angle of c. 45°. *Leaves* rather well-spaced and erect, 3–4 mm long, and 1–1.5 mm wide, elliptical, thick, especially near the obtuse apex, concave, glabrous or silky-pubescent and tapering gradually to a slender petiole. *Flowers* white or pink, to 12 mm in diameter, occurring singly, occasionally 2 together, each in a bract-axil, at the ends of long and slender side-branches that are scattered (rather than in adjacent leaf-axils), but with most branchlets terminated by flowering shoots, and with new growth appearing to develop where flowers have been aborted rather than shed. *Bracts* scarious, pale red-brown, short and broad; the bracteoles red-brown, scarious, very large, broad and concave, all shed from the young bud leaving conspicuous scars. *Hypanthium* densely and shaggily pubescent, all over or at least on the lower part, dark-coloured and ridged, c. 3 mm long and tapering to a more or less pedicel-like base, the upper part expanded and erect, occasionally glabrous, the top of the ovary pubescent near the style but otherwise almost glabrous. *Sepals* persistent, c. 2 mm long, broadly ovate, densely pubescent to glabrous, rather keeled and hooded, and like the hypanthium in texture apart from the thin scarious margins. *Petals* c. 4 mm long. *Stamens* in bundles of 5–7, c. 1 mm long, the anther-cells c. 0.3 mm long, parallel, broad and shallow. *Style* rather shallowly inset, very broad-based, tapering to a slender upper part, with a small stigma. *Ovary* 3-locular, each loculus extended upward with c. 6–12 ovules in 2 rows on a small narrow and high placenta. *Fruit* (not seen mature) deciduous, the valves thin and raised high above the erect upper part of the hypanthium. *Mature seeds* not seen; immature c. 1.5 mm long and narrow-oblong with little surface marking. Main flowering period: Sept.-Oct.

DISTRIBUTION: In inland southwestern Australia south of Kalgoorlie (Map 3). In deep lateritic gravel.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: Coolgardie: 21 km SE. of Londonderry, *Wilson 3153*, 9.1964 (AD, NSW); 2 miles [3.2 km] N. of Daniell, *Newbey 2571*, 9.1966 (PERTH); 5 km S. of rail crossing near Daniell, *Thompson 4626*, 10.1987 (NSW, PERTH).

The species is named for the slender branchlets subtending the flowering shoots.

7. *L. brachyandrum* (F. Muell.) Druce, Bot. Soc. Exch. Club British Isles 1916 Suppl. 2: 632 (1917); Cheel, J. & Proc. Roy. Soc. New South Wales 65: 199 (1932).

BASIONYM: *Kunzea brachyandra* F. Muell., Fragm. 2: 27 (1860).

LECTOTYPE, here chosen: NEW SOUTH WALES: ad ripas fluminis Hastings, Dr. Herman Beckler (NSW 154711). ISOLECTOTYPES: NSW 154712, MEL 1539306.

SYNONYMY: *Leptospermum abnorme* F. Muell. ex Benth., Fl. Austral. 3: 109 (1867), nom. illegit. *Agonis abnormis* (F. Muell. ex Benth.) C.T. White & Francis, Bot. Bull. Dept. Agric. Queensland 22: 20 (1920). TYPE: as for *K. brachyandra*.

Shrub or small tree to c. 6 m tall, with bark seasonally exfoliating in strips to expose a smooth shining and often coloured surface below; the younger stems very slender, pubescent, becoming glabrous, with a distinct flange below each node, and branching at c. 30°. *Leaves* diverging, 20–50 mm long and usually 2–4 mm wide, linear-lanceolate, usually (when dry) slightly incurved in cross-section, with the upper surface often darker, the lower often retaining a pubescence longer, both usually ultimately glabrous, the apex acute or acuminate, infolded and usually with a short pungent point, the base somewhat tapering with the midvein thickened but the petiole negligible. *Flowers* white, c. 7 mm in diameter, occurring several (up to 7) together on condensed shoots, the shoots terminal and in upper axils, with their terminal buds developing strongly after the flowering period. *Bracts* (several below the lowest flowers) soon deciduous, those subtending flowers more persistent; the bracteoles narrow, keeled and pubescent, all shed before the flower opens. *Hypanthium* glabrous or with some silky hairs at the base, c. 3 mm long, the upper part much expanded, the lower gradually contracted to a pedicel, the top of the ovary glabrous. *Sepals* persistent, c. 1 mm long, deltoid to almost hemispherical, usually glabrous for the most part, and scarious towards the usually densely ciliate margins. *Petals* 2–3 mm long. *Stamens* in bundles of 3–5 (–7), 1–1.3 mm long, the anther-cells <0.5mm long, parallel, broad and shallow. *Style* inset, rather stout and straight, the stigma, relative to the style, large. *Ovary* 3-locular, each loculus with 40–50 ovules in c. 6 rows on a broad and large placenta. *Fruit* deciduous, to c. 4 mm in diameter, glabrous, with the upper part of the hypanthium and sepals erect or folded inward, the lower part almost hemispherical above a short stalk, the valves not woody and not exerted before opening, later raised to slightly above the hypanthium-top. *Mature seeds* c. 1 mm long, irregularly broadly cuneiform, the surface reticulate but rarely broadly so. Main flowering period: Nov.-Jan.

DISTRIBUTION: Discontinuous, from northeastern New South Wales to north Queensland (Map 3). Among rocks on creek-banks or in stream-beds, especially on sandstone and granite.

SELECTED SPECIMENS: QUEENSLAND: North Kennedy: Mt Spec, *Donohue 00008*, 5.1972 (BRI). Leichhardt: Rainbow Creek, Blackdown Tableland, *Johnson & Blaxell 744*, 9.1972 (NSW). Wide Bay: Burrum R. near the town of Howard, *White 6280*, 10.1929 (BRI, NSW). Darling Downs: Jolly's Falls, *Coveny 9959 & Haegi*, 12.1977 (NSW); between Bald Mtn & Wyberba, *Blake 4505*, 1.1933 (BRI, NSW). Moreton: Blunder Creek, *White 7197*, 10.1930 (BRI, NSW). NEW SOUTH WALES: North Coast: 7 miles [11.3 km] SSE. of Coaldale, *Thurtell & Coveny 3870*, 12.1971 (NSW). Northern Tablelands: Severn R, *Stuart NSW 154713* (NSW). Northwestern Slopes: Middle Creek, 5 km SE. of Inverell, *Millard NSW 154714*, 5.1983 (NSW).

8. *L. parviflorum* Valetton, Bull. Dép. Agric. Indes Néerl. 10: 39 (1907); Icon. Bogor 3: 93, t. 238 (1907).

TYPE: NEW GUINEA: Nova-guinea septentrionalis in monte Syap, ubi legit collector indigenus (iter Wichmannianum 1903) (n.v., identification based on above illustration).

SYNONYMY: *Agonis longifolia* C.T. White & Francis, Bot. Bull. Dept. Agric. Queensland 22: 18 (1920); Steenis, Rheophytes of the World: 325 (1981). *Leptospermum longifolium*

(C.T. White & Francis) S.T. Blake, Proc. Roy. Soc. Queensland 69: 81 (1958). HOLOTYPE: QUEENSLAND: Endeavour R., (BRI, n.v.)? ISOTYPE: NSW.

Multistemmed shrub or small tree to more than 6 m tall, with bark seasonally exfoliating in strips to expose a smooth shining and often purplish red surface below; the younger stems very slender, pendulous, glabrescent or with a long fine pubescence, without a distinct flange below each node, and with branching at c. 30°. *Leaves* diverging, 2–7 cm long and 2–10 (or more) mm wide, linear-lanceolate, glabrescent, rather thin, the lower surface paler and the margins tending to recurve, the apex usually broadly or narrowly acute with a slender infolded tip often bearing a tuft of hairs, the base tapering, often twisted, with the midrib thickened and without a petiole. *Flowers* white or cream, 2–7 mm in diameter, usually occurring several (up to 6) together, each subtended by a bract, at the ends of branches, often in groups of such shoots, and in upper leaf-axils, the terminal buds developing after flowering. *Bracts* all subtending flowers, soon deciduous; the bracteoles broadly or narrowly lanceolate or oblong, and keeled, shed before the flower opens. *Hypanthium* glabrous or with a short pubescence, 2–3 mm long, the upper part much expanded, the lower contracted to a pedicel, the top of the ovary mostly glabrous but with a dense pubescence on the valve-margins. *Sepals* persistent, 1 mm or less in length, oblong or hemispherical, the margins and apex scarious and usually densely ciliate. *Petals* 1–2.5 mm long. *Stamens* in bundles of 5 (–7), to 1.25 mm long, the anther-cells < 0.5 mm long, parallel, broad and shallow. *Style* inset, relatively stout and straight, the stigma, relative to the style, large. *Ovary* 3-locular, each loculus with 50–60 ovules in c. 6 rows on a rather large and broad placenta. *Fruit* deciduous, c. 4 mm in diameter, glabrous or pubescent, with the upper part of the hypanthium and sepals erect or infolded, the lower part almost hemispherical above a short stalk, the valves not woody and not exerted beyond the hypanthium-top. *Mature seeds* c. 1 mm long, irregularly obovoid-cuneiform, the surface narrowly reticulate. Main flowering period: July-Sept.

DISTRIBUTION: In New Guinea, the Kimberley region of Western Australia, northern Northern Territory and north Queensland (Map 3). On stream banks and on deep river sands.

SELECTED SPECIMENS: IRIAN JAYA: Subdistrict Merauke: between Boepel and Tanas, *Leefers BW 3224*, 8.1956 (L). NORTHERN TERRITORY: Finnis R., *Byrnes 1684*, 8.1969 (NSW). QUEENSLAND: Cook: Lankelly Creek, Coen, *Flecker, F.A. Rodway 13239*, 7.1949 (NSW); 34.3 km NW. of Laura P.O. towards 'Musgrave' Stn, *Coveny 7036 & Hind*, 9.1975 (NSW); Nutwood Crossing of the Edward R., 15 km NNE. of Edward R. Reserve, *Clarkson 3512*, 10.1980 (BRI, NSW). WESTERN AUSTRALIA: Kimberley: Piccaninny Creek Gorge, 15 km SE. of Bungle Bungle Outcamp, E. Kimberley, *Kenneally 9301*, 7.1984 (PERTH, NSW).

9. *L. purpurascens* J. Thompson sp. nov.

Frutex vel arbor usque ad 6 m alta, cortice laevi purpurascenti. Folia elliptica ad late lanceolata, c. 1 cm longa. Flores 3–5 mm diametro, sepalis plus minusve pubescentibus persistentibus. Ovarium 3-loculare. Fructus c. 3 mm diametro

HOLOTYPE: QUEENSLAND: 12° 24' S, 143° 07' E, southern end of Temple Bay in upper reaches of an unnamed creek between Glennie and Hunter inlets, *J.R. Clarkson 2196*, 08 Jun 1978 (NSW). ISOTYPE: BRI.

Shrub or small tree to 6 m tall, with bark seasonally exfoliating in strips to expose a smooth shining purple surface below; the younger stems slender, at first with a short appressed pubescence but ultimately glabrous, with a conspicuous flange extended near the node, and branching at 30°–45°. *Leaves* diverging, c. 1 cm long and 2–4 mm wide, elliptical to broad-lanceolate, the surfaces dissimilar, the upper firm, glossy and glabrous, the lower densely silky-pubescent and often almost hidden (in dried specimens) by the strongly recurved or revolute margins, the apex rounded with a small folded recurved tip often bearing a tuft of hairs, the base tapering with the midvein thickened and the petiole negligible. *Flowers* white, sometimes flushed with red, 3–5 mm in diameter, usually occurring several together, (? aberrantly) with occasional extra flowers, each in a bract-axil, at the ends of branches and on modified shoots in upper axils, with new growth from the terminal bud shortly after or during flowering, often so as to leave flowers as monads at the base. *Bracts* probably no more than one for each flower; the bracteoles broadly lanceolate-oblong and keeled, shed before the flower opens. *Hypanthium* pubescent with short curved hairs that are longer towards the base, c. 1.5 mm long; the upper part much expanded, the lower contracted to a pedicel, the top of the ovary usually glabrous beyond a pubescent area near the style-base. *Sepals* persistent, c. 0.7 mm long, almost hemispherical, pubescent at least in the centre and on the margins. *Petals* c. 1.5 mm long. *Stamens* in bundles of 3–5, 0.5–1 mm long, the anther-cells < 0.5 mm long, parallel, broad and shallow. *Style* inset, rather stout and straight with the stigma, relative to the style, large. *Ovary* 3-locular, each loculus with up to c. 30 somewhat pendulous ovules in 4–6 rows on a large, broad and rather high placenta. *Fruit* deciduous, c. 3 mm in diameter, closely pubescent with the upper part of the hypanthium and sepals infolded, the base rounded above a short stalk, the valves not woody, extending above the erect hypanthium-top. *Mature seeds* c. 1 mm long, narrowly obovoid, the surface narrowly reticulate. Main flowering period: June-July.

DISTRIBUTION: In far northern Queensland (Map 3). On rocky hillsides of decomposed granite.

SELECTED SPECIMENS: QUEENSLAND: Cook: 3.4 km by road NNE. of Pascoe R., *Coveny 7087 & Hind*, 9.1975 (NSW); 5 km NE. of Pascoe R. Crossing, Kennedy Road, *Hind 323*, 8.1974 (NSW); Kennedy Road, a few miles N. of Pascoe R., *Gittins 1019*, 8.1965 (NSW).

This species is named for the colour of its bark. A very graphic description, with photographs of both plant and habitat, has been given by Brass (1955).

10. *L. whitei* Cheel, J. & Proc. Roy. Soc. New South Wales 65: 199 (1932); S. T. Blake, Proc. Roy. Soc. Queensland 69: 79 (1958).

BASIONYM: *Agonis elliptica* C. T. White & Francis, Bot. Bull. Dept. Agric. Queensland 22: 16 (1920), non *Leptospermum ellipticum* Endl.

TYPE: QUEENSLAND: Beerwah, *W. D. Francis* (fl. & fr.) (BRI).

SYNONYMY: *A. elliptica* var. *angustifolia* C. T. White & Francis, op. cit.: 18. **SYNTYPES:** QUEENSLAND: Bribie Island, *W. D. Francis*, s.d. (BRI); Stradbroke Island, *C. T. White*, s.d. (BRI).

Shrub to 3 m or more in height, with bark in many rather fibrous flaking reddish brown layers, or exfoliating; the younger stems pubescent and ridged from the indistinct node-flanges, branching rather densely at c. 30°–45°. *Leaves*

diverging, up to 25 mm long and (2-) 3-4 (-7) mm wide, usually broadly to narrowly elliptical, the surfaces not markedly dissimilar but the lower often paler, glabrescent at maturity except at the base, the margins somewhat incurved, the apex usually tapering and acute with the tip tending to infold, and bluntly pointed, the base tapering with a stout midrib behind but scarcely petiolate. *Flowers* white, c. 10 mm in diameter, occurring several together, each in a bract axil, at the ends of branches, or in short dense shoots at the ends of side-branches and in the adjacent upper axils, the terminal buds of the shoots sometimes activated before the end of flowering so that flowers appear as monads at the base. *Bracts* probably no more than one per flower, broad and imbricate, forming a cone-like structure in the bud; the bracteoles more narrow, pale and pubescent, all usually shed as the flower opens. *Hypanthium* with a dense short silky pubescence, 2-3 mm long, the upper part much expanded, the lower tapering to the base, the top of the ovary glabrous except for dense hairs along the valve-margins. *Sepals* persistent, c. 1.5 mm long, short-oblong to hemispherical, obtuse, with dense long hairs in the centre and shorter hairs near the more scarious, ciliate margins, rarely the calyx almost glabrous. *Petals* 3-5 mm long. *Stamens* in bundles of c. 5, c. 1.5 mm long, the filaments very slender, the anther-cells c. 0.25 mm long, parallel, broad and shallow. *Style* inset, rather straight and slender with the stigma, relative to the style, large. *Ovary* 3-locular, each loculus with 20-c. 40 ovules in c. 6 rows on a large, broad, rather flat-surfaced placenta. *Fruit* deciduous, 3-4 mm in diameter, pubescent, broad at the top with the upper part of the hypanthium and persistent sepals infolded, the base rounded, the valves not woody, not exerted at opening, and ultimately only a little above the hypanthium-top. *Mature seeds* c. 1.5 mm long, narrowly obovate-cuneiform, the surface narrowly reticulate. Main flowering period: Oct.-Jan.

DISTRIBUTION: On the coast from Wide Bay in Queensland to Coffs Harbour in northern New South Wales (Map 3). In sandy, rather swampy, coastal heath.

SELECTED SPECIMENS: QUEENSLAND: Wide Bay: Noosa R., *Staer NSW 154715*, 9. 1911 (NSW). Moreton: Beerburrum, *Francis NSW 154717*, 11.1919 (NSW); Stradbroke Island, *White NSW 154716*, 4.1917 (NSW). NEW SOUTH WALES: North Coast: Tweed R. district, *Penfold NSW 154719*, 11.1924 (NSW); Byron Bay, *Forsyth NSW 154718*, 11.1898 (NSW); Evans Head, *Coveny 4656*, 11.1972 (NSW).

11. *L. speciosum* Schauer in Walp., Rep., Suppl. 1: 923 (1842); S.T. Blake, Proc. Roy. Soc. Queensland 69: 79 (1958).

HOLOTYPE: QUEENSLAND: in Nova Cambria australi, Moreton-Bay, *A. Cunn. Herb. no. 38*, 1824 (?), dupl. K, fide C.T. White (1942), n.v.).

SYNONYMY: *Agonis speciosa* (Schauer) C.T. White, Proc. Roy. Soc. Queensland 53: 218 (1942).

Agonis scortechiniana F. Muell., Fragm. 11: 118 (1881). **ISOTYPES:** QUEENSLAND: circum paludes insulae Stradbroke-Island, *Rev. B. Scortechini* (MEL 1539386, 1539387, 1539388).

Shrub usually 1-2 m, but occasionally to 5 m, in height, with pallid bark exfoliating in strips; the younger stems closely pubescent, very stout and indistinctly ridged below the nodes, branching rather sparsely at c. 45° or more. *Leaves* erect near the branchlet-ends but spreading or even deflexed later, mostly 20-30 mm long and 5-10 mm wide, broadly lanceolate to elliptical, long-tapering towards an acute, usually infolded and bluntly pointed apex, firm and flat with the margins tending to incurve, both surfaces pubescent at least at the base, the lower often grey-green, the base abruptly tapering, truncate or

somewhat auricled above a very short broad, almost negligible, densely pubescent petiole. *Flowers* white, c. 8–10 mm in diameter, several, often 3 or more, occurring together each in a bract axil on short dense and densely pubescent shoots at the ends of branches and in the adjacent upper axils, the terminal buds of the shoots forming branched growth after the flowering. *Bracts* of the flowering shoot probably no more than one per flower, very broad and imbricate, and forming a cone-like structure in the bud; the bracteoles broad and pubescent, tending to be shed, though some persist during flowering. *Hypanthium* with a dense spreading pubescence, c. 3 mm long and tapering to a very short pedicel, the upper part spreading, the top of the ovary glabrous with the edges of the valves pubescent, or with a pubescent area near the style-base. *Sepals* persistent, c. 2 mm long, ovate-deltoid, with long hairs dense in the centre but fewer near the scarious usually ciliate margins. *Petals* c. 3–4 mm long. *Stamens* in bundles of 5–7, c. 1.5 mm long, the anther-cells c. 0.5 mm long, parallel, broad and shallow. *Style* inset, rather straight and stout with the style, relative to the stigma, large. *Ovary* 3-locular, each loculus with c. 40 ovules in c. 6 rows on a large broad, shallow placenta. *Fruit* deciduous, c. 5 mm in diameter, pubescent, broad at the top with the upper part of the hypanthium and persistent sepals infolded, the lower part often somewhat lobed in cross-section with the base rounded, the valves not woody, exerted above the hypanthium-top. *Mature seeds* 1–1.5 mm long, narrowly obovoid-cuneiform, the surface narrowly reticulate. Main flowering period: Aug.-Sept.

DISTRIBUTION: From Fraser Island, Queensland, to the Clarence R., New South Wales (Map 3). In poor sandy soil of coastal heathy swamps.

SELECTED SPECIMENS: QUEENSLAND: Wide Bay: Woongoolbver Swamp, Fraser Island, *Willis 53/518*, 8. 1953 (NSW). Moreton: King John Creek, 1½ miles [2.4 km] N. of Caboolture, *Briggs NSW 154720*, 5.1961 (NSW). NEW SOUTH WALES: North Coast: Wardell, *Betche NSW 154721*, 8.1884 (NSW); c. 1 km N. of Evans Head on the Broadwater road, *Coveny 9898 & Haegi*, 12.1977 (NSW).

12. *L. luehmannii* Bailey, Queensland Fl. 2: 592 (1900).

HOLOTYPE: QUEENSLAND: Top of Glass House Mountain, *F. M. Bailey 4*, Oct. 1884 (BRI).

SYNONYMY: *Agonis luehmannii* (Bailey) C.T. White & Francis, Bot. Bull. Dept. Agric. Queensland 22: 21 (1920).

Shrub or small tree to 5 m tall, with smooth red-brown bark seasonally exfoliating in long strips; the younger stems at first pubescent but later glabrous, with a ridge rather than a flange below each node, and rather slender and dense in spite of their branching at an angle of c. 45°. *Leaves* rather erect at least at first, usually 1.5–4 cm long and 6–9 mm wide, elliptical, glossy at maturity and flat or almost so, the apex rounded, rarely with an obscure umbo at the tip and often with a tuft of hairs, the base tapering, usually to a very short petiole, with the base of the midrib much thickened. *Flowers* white, 6–12 mm in diameter, occurring several (up to 7) together on condensed shoots that are terminal and in the upper axils, the terminal buds developing after flowering. *Bracts* broad (with several below the lowest flowers) but soon deciduous; the bracteoles narrow and pubescent, all usually shed before the flower opens. *Hypanthium* glabrous, 2–3 mm long, with the upper part expanded and the lower tapering to a short pedicel, the top of the ovary glabrous or with hairs along the valve-margins. *Sepals* rather persistent, 1–1.5 mm long, deltoid obtuse, usually pubescent in the centre but glabrous and pale and scarious towards the usually

densely ciliate margins. *Petals* (2-)5-6 mm long. *Stamens* in bundles of 5-7, 1-2 mm long, the anther-cells c. 0.5 mm long, parallel, broad, and shallow. *Style* inset, rather stout and straight with a large stigma. *Ovary* 3-locular, each loculus with c. 40 ovules in c. 6 rows on a large and broad placenta. *Fruit* deciduous, 4-5 mm in diameter, glabrous, with the upper part expanded, and with the free part of the hypanthium and sepals erect or infolded, the lower part tapering gradually, then abruptly to a short stalk, the valves not woody, exerted c. 1 mm above the hypanthium when opening. *Mature seeds* c. 1 mm long, obovoid-cuneiform, with a long-reticulate surface. Main flowering period: Jan.-Feb.

DISTRIBUTION: On summits and slopes of the Glass House Mountains, and in the Numinbah Valley, of southeastern Queensland (Map 3). In skeletal soils on acid volcanic rocks.

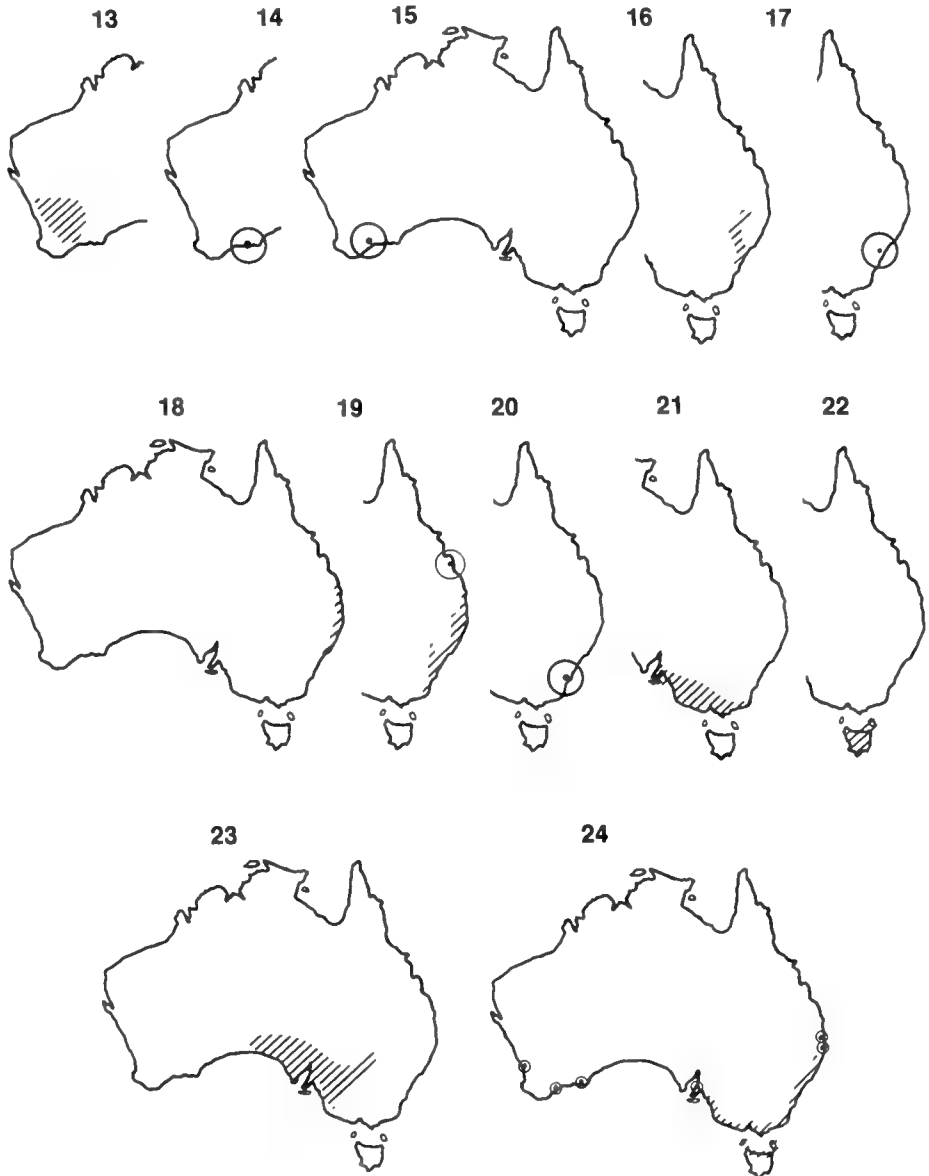
SELECTED SPECIMENS: QUEENSLAND: Moreton: Glass House Mts, NgunNgun, *Stauffer 5515 & Blake*, 1.1964 (NSW, PERTH); Mt Ngun Ngun, *Melville 3530*, 3.1953 (NSW); Mt Tibrogargan, *Whaite & Whaite 3069*, 1.1966 (NSW); Elimbah ... slopes of Stawee Mtn, *Blake 13172*, 12.1937 (NSW).

L. *erubescens* subgroup (spp. 13-24), Map 4.

13. L. *erubescens* *Schauer* in *Lehm.*, *Pl. Preiss.* 1: 121 (1844); *Benth.*, *Fl. Austral.* 3: 109 (1867) at least in part but excl. vars.

SYNTYPES: WESTERN AUSTRALIA: in glareosis sublimosis sterilibus silvae cis fl. Gordon-River (Hay), Nov. 1843; *Herb. Preiss. No. 133* (dupls. MEL); in glareosis silvae haud longe a fonte St. Rozen's-well (York), April sine flor: *Herb. Preiss. No. 134* (n.v.); Vasse-River; Mrs Molloy (n.v., the species would not be found at this locality).

Shrub to 2 or 3 m tall with (as seen from specimens) close, fibrous bark later peeling in long strips; the younger stems stout with a close pubescence, at least at first, terete, without a flange, usually spreading widely from each other at c. 60° and soon developing similar branching so as to give the plant a divaricately branched appearance. *Leaves* divergent to spreading, those subtending branches sometimes reflexed, usually 3-6 mm long and 2-4 mm wide, narrowly to very broadly obovate, thick and incurved or infolded, glabrous or with a few long silky hairs, with the apex rounded or almost truncate and tending to be keeled with a blunt point at the back, tapering to a virtually petioleless base that is almost umbonate at the back from the wide thick midrib-base; the leaves on younger growth often longer and lacking the characteristic base. *Flowers* white or pink, usually 10 mm or less in diameter, occurring singly or 2 together mostly in modified shoots at the ends of adjacent branches of several orders, the terminal buds developing after the flowering. *Bracts* usually several, broad, red-brown and rather glabrous, and often retained about a large bud; the bracteoles similar, all shed as or before the flower opens. *Hypanthium* usually densely silky pubescent but occasionally with the pubescence more spreading or absent, c. 2-4 mm long, the upper part not much expanded, the lower usually more densely pubescent and narrowed, often rather abruptly, to a slender pedicel often 2 mm or more in length, the top of the ovary with a dense short erect pubescence. *Sepals* persistent, c. 1 mm long, deltoid, pubescent but less so than the hypanthium and often dark-coloured, the margins densely ciliate. *Petals* c. 5 mm long. *Stamens* in bundles of 3-5, 1.5-2 mm long with many filaments very broad in the lower part, the anther-cells c. 0.4 mm long, parallel, broad and shallow. *Style* deeply inset, straight or stout-based and tapering to



Map 4. Distribution of Group 1: subgroup 2 *L. erubescens* and allies. 13. *L. erubescens* 14. *L. sericeum* 15. *L. confertum* 16. *L. parvifolium* 17. *L. deanei* 18. *L. semmibaccatum* 19. *L. trinervium* 20. *L. subglabratum* 21. *L. myrsinoides* 22. *L. glaucescens* 23. *L. coriaceum* 24. *L. laevigatum*.

behind the small (relative to the style) stigma. *Ovary* 5-locular, each loculus with c. 20 ovules in 4 rows on a broad and large placenta. *Fruit* deciduous, sometimes tardily, usually 4–5 mm in diameter, pubescent, the upper part scarcely expanded but forming an erect rim bearing the persistent incurved sepals, the lower short and abruptly contracted into an often almost inset slender stalk 1–3 mm long, the valves not woody, well exerted above the hypanthium-rim, especially near the style-base when opening and later for a distance of about half the depth of the broad part of the base. *Mature seeds* 1–1.5 mm long, obovoid-oblong with a rather shallowly reticulate surface. Main flowering period: July–Oct.

DISTRIBUTION: Widespread in the Avon and Roe Districts of Western Australia and in adjoining parts of the Irwin, Darling, Coolgardie and Eyre Districts (Map 4). On sand and gravel in heath and woodland.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Irwin: 7 miles [11 km] NW. of Badgingarra, *Briggs NSW 154722*, 10.1960 (NSW). Avon: Beringbooding, E. of Bonnie Rock, *Main*, 9.1957 (PERTH). Darling: 59.2 miles [95 km] from Perth towards Williams, *Canning 3725*, 9.1968 (CBG, NSW). Coolgardie: 29 miles [47 km] W. of Coolgardie, *Phillips 024128*, 9.1962 (CBG, NSW); Dundas Rocks, S. of Norseman, *Thompson 4624*, 10.1987 (NSW, PERTH). Roe: 18 km S. of Holt Rock, *Hnatiuk 760838*, 9.1976 (PERTH). Eyre: Phillips R., Highway 1, *Thompson 4640*, 10.1987 (NSW, PERTH); Ellens Peak, *Morrison*, 10.1902 (PERTH).

Specimens from some areas, especially in the Coolgardie district, have a smaller angle of branching and shorter side-shoots but are otherwise like typical *L. erubescens*.

14. *L. sericeum* Labill., Nov. Holl. Pl. 2: 9, t. 147 (1806); C.A. Gardner, J. & Proc. Roy. Soc. Western Australia 47: 61 (1964); A. S. George, Western Australian Naturalist 10: 32 (1966).

HOLOTYPE: WESTERN AUSTRALIA: in capite Van-Diemen (sphalm), [Labillardière] (FI, n.v.). [C.A. Gardner had a specimen (Cape le Grand, *C.A. Gardner 14117*, 2. Septem. 1962 (PERTH)) matched against Labillardière's specimen in Florence and labelled it TOPOTYPE.]

SYNONYMY: *Kunzea sericea* (Labill.) Turcz., Bull. Soc. Imp. Naturalistes Moscou 20: 162–163 (1847).

Shrub usually 1–3 m in height with close bark; the younger stems stout, with a close pubescence, lacking a flange below each node, and branching at c. 45°. *Leaves* erect at first but soon diverging or reflexed, most 10–20 mm long and 5–10 mm wide, obovate, flat, rather thick, densely silvery-grey-pubescent at least at first with the upper surface sometimes becoming glabrous, the apex very broadly rounded but with the upper surface indented there, often with a short point behind, the base tapering and with a short broad petiole. *Flowers* pink, 15–25 mm in diameter, occurring singly or occasionally 2 together, mostly on modified shoots at the ends of short leafy side-branches in leaf-axils, the terminal buds developing with or immediately after the flowering, occasionally leaving flowers as monads at the base. *Bracts* few, broad, red-brown, rather glabrous and often retained about a large bud; the bracteoles similar, all shed as or before the flower opens. *Hypanthium* with a dense, shining, rather spreading pubescence, 4–6 mm long, with the upper part spreading somewhat and all tapering to a short pedicel, the top of the ovary densely pubescent with short erect hairs. *Sepals* persistent, 2–3 mm long, deltoid (often longer than broad), densely silky pubescent and not distinguishable from the hypanthium. *Petals*

6–12 mm long. *Stamens* in bundles of c. 7, 3.5–4 mm long, the anther-cells c. 0.6 mm long, parallel, broad and shallow. *Style* well inset, broad-based and tapering to a small (relative to the style) stigma; occasionally absent. *Ovary* 4–6-locular, each loculus with c. 20 ovules in 4 rows on a large, rather broad placenta; occasionally absent. *Fruit* deciduous, c. 7 mm in diameter, pubescent, with a broad rim bearing the persistent sepals above, and the lower part distinctly lobed in cross-section and rounded above a short stalk often 2–3 mm long, the valves not woody and not extending beyond the hypanthium-rim. *Mature seeds* 1.5–2 mm long, irregularly obovoid-cuneiform, the surface coarsely reticulate and with vertical rows of loose cells. Main flowering period: mostly Aug.–Sept.

DISTRIBUTION: In the Esperance area, and on nearby islands, in Western Australia (Map 4). In shallow soil and rock crevices of windswept granite outcrops.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Eyre: Lucky Bay (Bay 1), E. of Esperance Bay, *Brown s.n.*, 1.1802 (NSW); West headland of Lucky Bay, *Thompson 4634*, 10.1987 (NSW, PERTH); walking track from Lucky Bay to Thistle Cove, Cape le Grand National Park, *Powell 1872*, 7.1982 (NSW); N. side of Mt Le Grand, *George 11009*, 9.1971 (PERTH); Cape le Grand, *Gardner 14117*, 9.1962 (PERTH).

15. *L. confertum* J. Thompson sp. nov.

Frutex 2–3 m altus. Folia conferta anguste clavata subtriquetra, 8–10 mm longa. Flores 12–15 mm diametro, sepalis glabratis crassis persistentibus. Ovarium 5(–7)-loculare. Fructus c. 8 mm diametro succulenti persistentes.

HOLOTYPE: WESTERN AUSTRALIA: East Mt Barren, *K. Newbey 1730*, Dec. 13 1964 (PERTH).

Shrub 2–3 m or more in height, usually erect, rigid and rather dense, with (as seen from specimens) gnarled firm bark marked by leaf- and branch-scars; the younger branches soon losing a loosely appressed pubescence to become glabrous, lacking a flange but with a conspicuous small swelling below each leaf-base, and with branching usually at c. 30° but subsequently becoming more erect. *Leaves* erect and dense, mostly 8–10 mm long and 1–1.5 mm wide, very narrowly clavate and almost triquetrous, both surfaces glabrous and light green, the upper often flat, the lower somewhat keeled, broadest near the shortly acute or rounded apex, and long-tapering to a slender petiole often 1.5 mm long. *Flowers* white (rather pink in the bud), 12–15 mm in diameter, occurring singly in consecutive axils, on short leafless modified side-shoots that develop slowly to lengthen and flower but remain leafless. *Bracts* minute, pale red-brown and keeled, tending to persist below the opened flowers; the bracteoles similar but larger, c. 1 mm long, and shed when the bud is minute. *Hypanthium* rather deeply wrinkled, glabrous or with some hairs especially near the base, to c. 4–5 mm deep, tapering to the base but with the upper part much expanded, the top of the ovary silky-pubescent. *Sepals* persistent, somewhat less than 1 mm long, glabrous, almost hemispherical, and like the hypanthium, very thick except for the very thin margins, and hooded, overlapping in the flat bud, swollen and infolded at the base. *Petals* c. 5 mm long. *Stamens* in bundles of c. 7, c. 2 mm long, the anther-cells c. 0.5 mm long, parallel, broad and shallow. *Style* deeply inset, rather stout and straight, the stigma quite large; sometimes absent. *Ovary* 5 (–7)-locular, each loculus with c. 10 ovules in 2 rows on a high narrow placenta; sometimes absent. *Fruit* rather persistent, c. 8 mm in diameter, broad- and almost flat-based, the outer surface succulent and coarsely wrinkled when dry, the upper part not expanded but erect or incurved, the sepals

persisting for some time, the valves usually shortly (to c. 1 mm) exserted. Mature seeds c. 3–3.5 mm long, irregularly oblong, the outer surface of loose fibres and, before splitting, so narrowly reticulate as to appear striate. Main flowering period: (Oct.-) Dec.-Jan.

DISTRIBUTION: Apparently endemic to East Mount Barren, on the southern coast of Western Australia (Map 4). In well-drained stony quartzite sand in heath, on rock or in rocky gullies.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Eyre: East Mt Barren, *Steedman*, 12.1931 (PERTH), 1.1938 (NSW), *Gardner 14869*, 10.1964 (PERTH), *Wilson 5466*, 10. 1966 (PERTH), *Crisp 5056*, 1.1979 (CBG, PERTH).

The species is named for its crowded leaves.

16. *L. parvifolium* Smith, Trans. Linn. Soc. London 3: 263 (1797).

TYPE: NEW SOUTH WALES: Port Jackson, *Dr White*, 1795 (LINN, n.v., fide Smith in Rees, Cycl. 20 (1812)).

SYNONYMY: *L. eriocalyx* Sieber ex Sprengel, Syst. Cur. Post.: 194 (1827). **TYPE:** NEW SOUTH WALES: Nov. Holl., *Sieber 313*, fide DC., Prodr. 3: 228 (1828)] (n.v.).

Shrub to 2 m tall, with dense slender branches and close bark occasionally tending to flake; the younger stems with long, fine, spreading hairs or silky, and later with persisting hairs or glabrescent, without a flange but with a swelling below each node that leaves prominent leaf-scars on older branches, the branching usually at c. 45°. *Leaves* diverging, mostly 3–8 mm long and 1–3 mm wide, usually narrowly to broadly obovate, very thick, usually glabrous, flat or incurved near the apex, the apex usually obtuse and rounded but occasionally broadly acute with a blunt point, the base tapering to slender petiole often 1 mm or more in length. *Flowers* white or pink, c. 10 mm in diameter, usually single on condensed shoots terminating rather long, leafy side-branches, the new growth developing after flowering. *Bracts* few, the inner very large, red-brown and firmly chartaceous, with the bracteoles similar, all forming large cone-like buds at the ends of branches and tending to remain around the opening bud. *Hypanthium* usually with dense, long, irregularly spreading hairs at least on the lower part, sometimes the hairs shorter and more sparse above, c. 2–2.5 mm long, tapering but with the upper part not much expanded and the lower part broad and rounded above a short pedicel, the top of the ovary densely pubescent. *Sepals* persistent, 1–2 mm long, short- or long-deltoid, often somewhat pubescent, paler and thinner but otherwise similar to the hypanthium, somewhat hooded and often with a ciliate or minutely erose margin. *Petals* c. 4 mm long. *Stamens* in bundles of 3–5, 1–1.5 mm long, the anther-cells c. 0.3 mm long, parallel, broad and shallow. *Style* deeply inset, with hairs on the lower part, straight-sided with a small stigma. *Ovary* usually 5-locular, each loculus with 15–30 ovules in 4–6 rows, ascending from a small placenta attached near the base of the loculus. *Fruit* often held through the season before being readily shed, c. 4 mm in diameter, usually pubescent, widest near the conspicuous rim formed by the upper part of the hypanthium and bearing the erect or infolded sepals, and rounded above a very short stalk, the valves not woody, and exserted well above the hypanthium-rim especially near the style-base, to about halfway up the persistent sepals. *Mature seeds* 1–2 mm long, obovoid, with a shallow long-reticulate surface and sometimes vertical rows of extended cells. Flowering mostly Sept.-Nov.

DISTRIBUTION: Widespread in eastern New South Wales from the North Western Slopes and adjoining Plains and Tablelands, through the Central Western Slopes, and Central Tablelands and Coast to the Nowra area of the South Coast (Map 4). Usually on poor sandy or gravelly soil on rocky ridges or in dry sclerophyll forest.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Parramatta, *Brown*, 1804 (NSW); Frenchs Forest, Sydney, *Rodway 1176*, 9.1933 (NSW). South Coast: Yalwal State Forest on Yalwal-Nowra road, *Coveny 10998 & James*, 9.1981 (NSW). Northern Tablelands: Emmaville, *Boorman NSW 14164*, 10.1911 (NSW). Central Tablelands: E. end of Mt Solitary, 5 miles [8 km] S. of Katoomba, *Constable NSW 56115*, 11.1960 (NSW). North Western Slopes: Warialda, *Boorman NSW 14170*, 10.1914 (NSW). Central Western Slopes: 8.5 miles [13 km] NE. of Gilgandra, *Biddiscombe Herb. Aust. 314*, 9.1954 (NSW); Currant Mtn Gap, 24 km E. of Rylstone, *Coveny 9551*, 9.1977 (NSW). North Western Plains: Pilliga Scrub near Narrabri, *Cleland*, 10.1918 (NSW).

Several robust specimens from the northern part of the range and from the Central Coast district appear to represent products of hybridisation with *L. trinervium*.

17. *L. deanei* J. Thompson sp. nov.

Frutex usque ad 5 m altus. Folia anguste elliptica ad oblanceolata, 1–1.5 cm longa. Flores 8–10 mm diametro, sepalis membranaceis, ex parte pubescentibus persistentibus. Ovarium 4–5-loculare. Fructus c. 3.5 mm diametro decidui.

HOLOTYPE: NEW SOUTH WALES: Devlins Creek in Pennant Hills Park, Cheltenham, 33° 45' 30" S, 150° 05' 00" E, *Coveny 11343 & Taylor*, 11.1982 (NSW).

Shrub, often very slender, up to 5 m tall with bark peeling in long strips; the younger stems slender, with at least some silky hairs and with erect rather crisped short hairs or glabrous and glossy, with the flange visible only as grooves near the conspicuous node scar, and with the branching at 30°–45°. *Leaves* divergent to spreading, mostly 10–15 mm long and 1–2 mm wide, narrowly elliptical to oblanceolate, usually glabrous, the upper surface with the margins incurved especially near the base, tapering below to a petiole-less base, the apex rather broadly acute with a blunt soft infolded point. *Flowers* white, c. 8–10 mm in diameter, occurring singly on modified shoots on slender few-leaved side-branches in consecutive axils, the new growth developing after flowering, especially strongly at the ends of branches. *Bracts* at least several, pale red-brown, rather firm, elliptical and forming long, narrow, pointed cone-like buds; the bracteoles longer and narrower, all usually shed from the unopened bud leaving conspicuous scars. *Hypanthium* smooth and mostly glabrous, c. 3 mm long, tapering to a small, usually densely silky, pedicel and with the upper part spreading widely and longitudinally ridged, the top of the ovary silky-pubescent at least on the valve-margins. *Sepals* persistent, c. 1.5 mm long, long-deltoid, thin and pale, somewhat hooded, with hairs on the margin and at the tip. *Petals* c. 5 mm long. *Stamens* in bundles of 5–7, 1–1.5 mm long, the filaments with spreading hairs, the anther-cells c. 0.4 mm long, parallel, broad and rather shallow. *Style* deeply inset, slender, scarcely tapering, with short spreading hairs on the lower part, the stigma small; sometimes absent. *Ovary* 4–5-locular, each loculus with c. 18 ovules in 4 rows on a rather shallow placenta; sometimes absent. *Fruit* deciduous, c. 3.5 mm in diameter, mostly glabrous, the upper part of the hypanthium forming a distinct rim bearing the, at first infolded and later erect or spreading, persistent sepals, the base strongly lobed in cross-section and contracting very abruptly to a rather inset silky stalk, the thin valves raised but not beyond the hypanthium-rim

until after opening. *Mature seeds* 1–1.5 mm long, obovoid-cuneiform, with a shallow-reticulate surface and often with vertical rows of looser cells. Main flowering period: Oct.-Nov.

DISTRIBUTION: Limited to a small area of the Central Coast of New South Wales near the ridge between Cowan Creek and the Lane Cove River (Map 4). In sclerophyll forest.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Calna Creek, 2 miles [3.2 km] W. of Kuringai, *Mylrea NSW 154724*, 10.1953 (NSW); Asquith, *Thomas NSW 154725*, 8.1951 (NSW); Pennant Hills Park, Cheltenham, *Thompson 4283*, 8.1982 (NSW), *Coveny 10334*, 11.1978 (NSW); Devlin's Creek in Pennant Hills Park, Cheltenham, *Coveny 11434 & Dunn*, 12.1982 (NSW); Lane Cove [?R], *Deane NSW 154726, 154727, 154728*, 10.1883 (NSW). **WITHOUT LOCALITY:** Leichhardt (MEL).

This species is named for Henry Deane, Railway Engineer, whose specimens, probably collected near his work on the North Shore railway, had lain in a query box for a hundred years.

18. *L. semibaccatum* *Cheel*, J. & Proc. Roy. Soc. New South Wales 65: 203 (1932); S.T. Blake, Proc. Roy. Soc. Queensland 69: 82 (1958).

LECTOTYPE, here chosen: NEW SOUTH WALES: Wallis Island, Tuncurry, *E. Cheel NSW 154729*, 11.5.1925 (NSW).

SYNONYMY: ?*L. grandiflorum* var. *minus* S. Schauer in *Linnaea* 15: 438 (1841). **TYPE:** QUEENSLAND: in Nova Hollandia ad sinum Moreton-Bay, *Murray* (? , n.v.).

Low dense shrub 0.5 (–2) m tall, or occasionally a small, much branched and pendulous tree, the bark close or later flaking; the younger stems with long, fine, appressed hairs and a pubescence of long appressed and/or short curled hairs persisting, without a flange but with grooves near each node, the branching at an angle of c. 30°. *Leaves* divergent, 5–10(–15) mm long and usually 1.5–2.5 mm wide, obovate to narrowly elliptical, thick and usually flat, the surface glabrous at maturity or with a short pubescence near the base of the upper surface, with the apex in general obtuse (but occasionally somewhat acute) and blunt or with a small blunt point, and tapering at the base to a rather broad, flat (but round-based) petiole. *Flowers* white or pink, from less than 10 to 15 mm in diameter, occurring singly or 2 together in modified shoots at the ends of short leafy, few-leaved or even leafless branchlets, usually in consecutive axils on adjacent branches with new growth developing after flowering. *Bracts* numerous, red-brown (or sometimes pale), rather firm, with the bracteoles very large, broad, concave and scarious, all forming rather pointed cone-like buds at the ends of branches but, except for some basal bracts, shed before or as the flower opens. *Hypanthium* usually silky-pubescent at least in part, c. 3–4 mm long, the upper part spreading widely and usually, but not invariably, glabrous, the lower narrower tapering, densely silky and contracting rather abruptly to a short densely silky pedicel, the top of the ovary silky with dense and longer hairs around the base of the style. *Sepals* persistent, less than 1.5–2 mm long, somewhat oblong and obtuse, often with scarious ciliate margins, otherwise sparsely pubescent or glabrous. *Petals* 3.5–7 mm long. *Stamens* in bundles of 5–7, c. 1.5–2 mm long, the anther-cells, c.0.4 mm long, parallel, broad and shallow. *Style* well inset, slender and scarcely tapering with a rather small stigma; often shortened and occasionally absent. *Ovary* 5–, or occasionally 3– or 4–, locular, each loculus with c. 24 ovules in c.4 rows on a large but shallow placenta; occasionally absent. *Fruit* deciduous, often variable in size but usually 4–6 mm in diameter, pubescent and succulent (coarsely wrinkled in dried

specimens), the valves densely pubescent and also rather succulent, usually above the erect upper part of the hypanthium on opening and extending little further, so as to be well below the erect or spreading sepals, forming a somewhat flat-topped fruit. *Mature seeds* c. 1–1.5 mm long, irregularly obovoid-cuneiform, with a shallow to distinct reticulate surface and with several vertical rows of loose cells. Main flowering period: Aug.-Oct.

DISTRIBUTION: From the Bundaberg area of Queensland to the Forster area of New South Wales (Map 4). On sand in poorly drained coastal sandy heath.

SELECTED SPECIMENS: QUEENSLAND: Wide Bay: Seary's Creek, c. 30 miles [48 km] NE. of Gympie, *Everist 7778*, 2.1965 (NSW). Moreton: Tugun, *White 7124*, 9.1930 (NSW). NEW SOUTH WALES: North Coast: Evans Head, *Coveny 4669*, 11.1972 (NSW); Crowdy Bay National Park, *Armstrong 1164 & Powell*, 9.1977 (NSW).

19. *L. trinervium* (Smith) J. Thompson comb. nov.

BASEONYM: *Melaleuca trinervia* Smith in White, Voyage to New South Wales: 229, t. 24 (1790).

HOLOTYPE: NEW SOUTH WALES: [Port Jackson, *White*] "t. 24, Whites voyage", Sheet 878.11 (top L.H.) herb. Smith (LINN, n.v.). This specimen though sterile is identifiable from the illustration. It was matched with the lectotype of *L. attenuatum* Sm. by D.F. Blaxell, when Australian Botanical Liaison Officer.

SYNONYMY: *Leptospermum attenuatum* Smith, Trans. Linn. Soc. London 3: 263 (1797). LECTOTYPE, here chosen: NEW SOUTH WALES: Port Jackson, *Mr White*, 1795, Sheet 878.9, R.H. specimens (LINN, n.v., photo BRI, NSW).

L. trinerve Smith, loc. cit., nom. nud. in synon.

L. stellatum Cav., Icon. 4: 16, t. 330, fig.2 (1797), partim, the protologue containing elements of *L. polygalifolium*. TYPE: NEW SOUTH WALES: Port Jackson, *herb. Née*, fl. April (MA, n.v.).

L. trinerve Smith in Rees, Cycl.: 20 (1812). TYPE: not that of *Melaleuca trinervia* but part of the protologue of *L. lanigerum* sensu Smith, Trans., Linn. Soc. London 3 (1797) non Sol. ex Aiton (LINN, n.v.).

L. pendulum Sieber ex Sprengel, Syst. Cur. Post 194 (1827). TYPE: NEW SOUTH WALES: Nov. Holl., *Sieber [312, fide DC., Prodr. 3: 228 (1828)]* (? , n.v.). ISOTYPE: G, photo NSW.

L. gnidiifolium DC, Prodr. 3:228 (1828). TYPE: Nouvelle Hollande, [illegible words,] 1822 (G, n.v., photo NSW).

L. stellatum Cav. var. *grandiflorum* Benth., Fl. Austral. 3:107 (1867). SYNTYPES: Queensland *Bowman* and Port Jackson, *herb. F. Mueller* (K, n.v.).

L. stellatum Cav. forma *fallax* Domin, Biblioth. Bot. 89:454 (1928). TYPE: Blue Mountains, *C.T. White*, 3.1910 (PRC, n.v.). ISOTYPE: BRI.

L. stellatum Cav. forma *angustifolium* Domin, loc. cit. TYPE: 'Parramatta', *Woolls* (PRC, n.v.). ?ISOTYPE: NSW.

Rigid shrub or small tree of characteristic habit (the trunk stout in proportion to rather short side-branches, probably owing to regeneration from epicormic shoots after fire), 2–5 m tall with the bark on the trunk and even small branches in many thin flaking layers; the younger stems rather stout, at first with a soft, long, loosely appressed or spreading, pubescence, later the pubescence short and close, without a flange, and with the branching at (30°–) 45°(–60°). *Leaves* erect to spreading, usually 10–20 mm long and 1–6 mm wide, broadly obovate to very narrowly elliptical and somewhat falcate, often consistent within and varying between populations and/or districts, usually silky-pubescent when young but glabrescent, the apex rounded to acuminate, usually bluntly pointed, the base tapering or rounded and scarcely or shortly petiolate. *Flowers* white, 7–15 mm in diameter, occurring singly or 2 together on condensed shoots at

the ends of short few-leaved side-branches, in consecutive axils on adjacent branches, but with axillary monads on reversion-shoots, the new growth, sometimes developing during flowering, dense from near flowers giving a clumped appearance to the foliage, or vigorous and slender from branch-ends giving a graceful appearance. *Bracts* firm and brown and forming broad cone-like buds; the upper broad and concave; the bracteoles narrower; all shed before the bud opens. *Hypanthium* densely pubescent with wide-spreading to close silky hairs, rarely glabrous, very variable in shape, the shape, size and pubescence often but not invariably associated with the leaf-shape and consistent within and varying between populations, 3 or more mm in length, gradually, or sometimes abruptly, tapering into a long to very short pedicel, the upper part not widely expanded, the top of the ovary silky-pubescent. *Sepals* persistent, 1.5–2.5 mm long, usually densely pubescent, ovate-oblong to deltoid or long-deltoid, and somewhat hooded. *Petals* 5–7 mm long. *Stamens* in bundles of c. 5, 1.5–2 mm long, with some filaments broad in the lower part, the anther-cells 0.5–0.6 mm long, parallel, much recurved and often not opening wide. *Style* inset, pubescent at the base, rather stout-based and tapering to a small stigma. *Ovary* (3–) 4–5 locular, each loculus with c. 24 ovules in 4 rows on a high, often narrow or shallow, placenta. *Fruit* soon deciduous, variable in size and shape according to the leaf- and hypanthium- type, mostly 3–6 mm in diameter, pubescent, usually lobed in cross-section and broad and straight-sided above a short stalk, the valves thin and not exerted beyond the erect hypanthium-top with erect or occasionally spreading sepals. *Mature seeds* 1.5–2 mm long, irregularly obovoid-cuneiform, the surface coarsely reticulate with loose cells. Main flowering period: usually Sept.-Oct. (coast); Nov.-Dec. (-Jan.) (tablelands).

DISTRIBUTION: In coastal districts from near Rockhampton, Queensland, to East Gippsland, Victoria, and also extending to nearby tableland areas, and the Central Western Slopes near the Hunter River, in New South Wales (Map 4). In heath, scrub and especially dry sclerophyll forest, in deep sand or shallow sandy soil among, especially sandstone, rocks.

SELECTED SPECIMENS: QUEENSLAND: Port Curtis: Mt Wheeler, *Thozet 552* (MEL). Darling Downs: 2 miles [3.2 km] SE. of Glen Aplin, *Gittins 2811*, 9.1974 (NSW). Moreton: Brisbane, on the Chermshire Hills, *Blake 23561*, 10.1970 (BRI, NSW). NEW SOUTH WALES: North Coast: O.B.X. Creek, Dalmorton-Grafton road, *Constable NSW 24339*, 10.1952 (NSW). Central Coast: Banks of the River Grose, *Brown, 1804* (NSW); Cumberland State Forest, West Pennant Hills, *Coveny 8572*, 10.1076 (NSW). South Coast: South Brooman State Forest, *Hartley 14022*, 10.1973 (CANB, NSW). Northern Tablelands: Torrington, *Boorman NSW 15023*, 1.1911 (NSW). Central Tablelands: Dante Glen track, Lawson, *Coveny 9843*, 11.1977 (NSW). Southern Tablelands: Clyde Mtn road, c. 21 km SSE. of Braidwood, *Adams & Austin 2881*, 12.1972 (CANB, NSW). Central Western Slopes: ... below Mt Dangar, 7.2 km W. of Sandy Hollow, *Coveny 10533 & P. Hind*, 12.1979 (NSW). VICTORIA: East Gippsland: Dinner Creek, Tamboon road, Lower Cann R., *Melville 2886, Wakefield & Hunter*, 1.1953 (NSW).

The pattern of variation in this polymorphic species cannot be readily explained. Although the uniformity within a stand could be caused by apomixis, the variation seen in some districts (e.g. Mittagong) would require wide outbreeding, as it often includes the extreme forms with their several apparently linked characters and many intermediate forms; while the consistency in other areas (e.g. the Upper Hunter district) of an unusual form may indicate a strong response to selection pressure. Most puzzling is the occurrence in some regions (e.g. parts of the Blue Mountains) of only two extremes of observable variation, growing in a mosaic, retaining their identity and differing so much in flowering-time as not to overlap. It could be said that selection pressure has succeeded in some areas but failed in others to produce reproductively isolated forms. However, this is, for this genus, a distinct and successful widespread species, imme-

diately recognisable (especially from its habit and bark type) in spite of the variability it shows in characters otherwise definitive of species. It is probable that these variations are brought about by a strong morphological response to some simple genetic alteration. Aspects of the pattern of variation in this species have been studied by Krauss (1986).

20. *L. subglabratum* J. Thompson sp. nov.

Frutex usque ad 2 m altus cortice lamellato. Folia obovata ad oblanceolata, plus minusve falcata, 1.5–3.5 cm longa. Flores 10–15 mm diametro, sepalis persistentibus, hypanthio subglabrato. Ovarium (4–) 5-loculare. Fructus 4–7 mm diametro decidui.

HOLOTYPE: NEW SOUTH WALES: SW. end of Shrouded Gods Mtn c. 28 km WSW. of Milton, 35° 16' S, 150° 11' E, 930 m alt., *B.G. Briggs 3544*, 23.v.1972 (NSW).

Open shrub reaching over 2 m in height but shorter in exposed situations, the rough bark flaking in thin layers (not always seen as such on specimens); the younger stems with sparse silky hairs, glabrescent, without a flange apart from a small grooved area near the node, slightly swollen below the node, with the branching often at 45°–60°. *Leaves* erect to spreading, usually 15–35 mm long and 3–7 mm wide, oblanceolate to obovate and often somewhat falcate, flat or with the margins slightly incurved, silky-pubescent when young but glabrous at maturity except near the base, with the apex obtuse to broadly acute, usually with a short blunt, or occasionally pungent, point, flat or folded below the point, and tapering at the base to a short narrow but rather flattened petiole. *Flowers* white, 10–15 mm in diameter, occurring singly on condensed shoots at the ends of short, rather stout, leafless to few-leaved axillary branchlets in consecutive axils, the new growth limited on the short branches but produced vigorously, during flowering, from the main branch ends. *Bracts* numerous, firm red-brown and chartaceous, and forming a slender cone-like bud; the bracteoles thin, long and narrow; all shed from the young bud. *Hypanthium* for the most part glabrous but usually with a close silky pubescence on the pedicel, c. 3.5 mm long, the upper part spreading widely, the lower narrowing to a very slender pedicel 1–1.5 mm long, the top of the ovary with a short silky pubescence. *Sepals* persistent, 2.5–3.5 mm long, oblong (but appearing deltoid), glabrous except for ciliate margins, the tip keeled and hooded, all thin-textured and tending to inroll. *Petals* to 6 mm long. *Stamens* in bundles of c. 7, c. 2–2.5 mm long, with some filaments broad in the lower part, the anther-cells 0.5–0.6 mm long, parallel, much recurved and not opening very wide. *Style* well inset with the base broad and pubescent, tapering to small (relative to the style) stigma. *Ovary* (4–)5-locular, each locus with c. 24 ovules in 4 rows on a rather small (and not high) placenta. *Fruit* deciduous, 4–7 mm in diameter, glabrous for the most part, distinctly lobed in cross-section below a conspicuously wide rim and abruptly constricted at the base to a somewhat inset silky-pubescent stalk, the valves thin, raised but not exerted beyond the strongly incurved hypanthium-rim, the sepals erect or spreading but not long-persistent. *Mature seeds* c. 1–1.5 mm long, obovoid-cuneiform, with a coarsely reticulate surface with loose cells. Main flowering period: Dec.-Jan.

DISTRIBUTION: Restricted to a small area of southern New South Wales mainly in the Budawang Range (Map 4). Usually in crevices or in shallow soil on the edge of sandstone escarpments.

SELECTED SPECIMENS: NEW SOUTH WALES: South Coast: North Head, Ulladulla, *Cambridge 3492*, 19.1911 (NSW); Mt Pigeon House, *Rodway 2524*, 6.1937 (NSW). Southern Tablelands: S. end Mt Owen, *Briggs 3538*, 4.1972 (NSW); Corang Arch, c. 18 km S. of Nerriga, *Telford 9637*, 12.1983 (CBG, MEL, NSW).

21. *L. myrsinoides* Schldl., *Linnaea* 20: 653 (1847).

HOLOTYPE: SOUTH AUSTRALIA: in sandigen Gegenden im Pine-forest-Walde, zwischen dem Gawler — und Lightriver, *Behr* (?HAL, n.v.).

SYNONYMY: *L. myrsinoides* var. *angustifolium* Miq., *Ned. Kruidk. Arch.* 4: 143 (1859).

TYPE: not designated.

L. myrsinoides var. *latifolium* Miq., loc. cit. TYPE: not designated.

Shrub, usually compact, 1–2 m tall, with firm bark; the younger stems glabrescent, without a flange but conspicuously swollen below the node, the branching at a variable angle of 30°–60°. *Leaves* divergent to spreading and with the apex tending to recurve, 5–10 mm long and 1–3 mm wide, usually narrowly obovate to oblanceolate, glabrescent, the margins incurved especially near the apex and usually minutely tuberculate, the apex acute with a blunt point, the base tapering to a short petiole. *Flowers* white or pink, 10–15 mm in diameter, on modified 1– (or occasionally 2–) flowered shoots at the ends of short, often rather stout, few-leaved side-branches, in consecutive axils on adjacent branches, the pubescent new growth appearing mostly near the ends of branches late during, or after, flowering. *Bracts* at least several, broad red-brown and rather firm, forming a pointed cone-like bud at branch-ends; the bracteoles large but more scarious; all falling before the bud opens, leaving prominent scars, or a few persisting about the open flowers. *Hypanthium* silky-pubescent and usually, but not invariably, with the upper part glabrous and expanded, c. 4 mm long, broad, and tapering to the base or rounded above a very short pedicel, the top of the ovary silky-pubescent at least near the style-base. *Sepals* persistent, c. 0.5 mm long, very shortly deltoid, thin pale and glabrous, continuous with, but different in texture from, the hypanthium. *Petals* c. 4–5 mm long. *Stamens* in bundles of (3–)5, c. 4 mm long, the anther cells c. 0.6–0.7 mm long, parallel, somewhat folded back and recurved, and shallow. *Style* well inset, slender with the stigma small, relative to the style; often absent. *Ovary* usually 4–5-locular, each loculus with c. 30 ovules in 4 or more rows on a large broad but shallow placenta; often absent. *Fruit* deciduous, 4–6 mm in diameter, the outer surface often succulent, widest at the erect hypanthium-rim and rounded at the base above or without a short stalk, the valves not very woody, usually extending above the erect rim and its short erect sepals. *Mature seeds* c. 1.2 mm long, broadly obovoid cuneiform, rather flattened, with a reticulate surface and sometimes rows of loose cells. Main flowering period: Oct.–Nov.

DISTRIBUTION: From the Mt Lofty Ranges and Kangaroo Island of South Australia to the Far South Coast of New South Wales (Map 4). In sandy, and often swampy, soils of coastal heath and inland heath and mallee.

SELECTED SPECIMENS: NEW SOUTH WALES: South Coast: Womboyn, *Constable NSW 30962*, 10.1954 (NSW). VICTORIA: East Gippsland: c. 8 miles [13 km] SE. of Sale, *Salasoo 4827*, 10.1971 (NSW). Port Phillip: Royal Botanic Gardens Annexe, Cranbourne, *Ross 2570*, 11.1981 (HO, MEL, NSW); Arthurs Seat, Port Phillip, *Brown*, 1.1804 (NSW). Northern Plains: “Whipstick Mallee Scrub”, 18 miles [29 km] NNE. of Bendigo, *Constable 5235*, 10.1964 (NSW). Western Highlands: 38 miles [62 km] from Horsham towards Halls Gap, *Wrigley CBG 031347*, 12.1968 (NSW). West Coastal Plains: scarp of Glenelg R. gorge, c. 5 miles [8 km] NW. of Nelson, *Melville 1564*, *Beaglehole, Finck & Finck*, 10.1952 (NSW); SOUTH AUSTRALIA: South-eastern: 4 miles [6.5 km] from Frances, towards Bordertown, *Wrigley CBG 036327*, 11.1968 (CBG, NSW). Southern Lofty: Millbrook, Torrens Gorge, *Cheel NSW 154737*, 8.1924 (NSW). Kangaroo Island: Middle R., *Ashby 762*, 10.1905 (NSW).

22. *L. glaucescens* S. Schauer, Linnaea 15: 420 (1841); Willis, Muelleria 1: 136 (1967).

NEOTYPE: TASMANIA: Western foot of Strzelecki Peaks, S.W. Flinders Island, Bass Strait ... J.H. Willis, 10 Apr. 1954 (MEL) fide Willis, Muelleria 1: 136 (1967). ISONEOTYPES: HO, NSW

SYNONYMY: *Eriostemon? trinerve* Hook., J. Bot. (Hooker) 1: 25-4 (1834) non *Leptospermum trinerve* (Smith) Smith. HOLOTYPE: TASMANIA: Lawrence 91, 1831 (K, n.v.).

L. erythrocarpum Summerh. & Comber in Comber, Field Notes Tasman. Pl. 1929-30:19, 51 (1930). HOLOTYPE: TASMANIA: Coles Bay, east of Swansea, at Hazards, 300m alt; Comber 2322, April 20, 1930 (K, n.v.).

Shrub or small tree with (as seen on specimens) close flaky bark; the younger stems with dense, long and/or short, crisped hairs but often eventually glabrous, without a flange but grooved from the edge of the node with no swelling below it, the branching usually at c. 45°. Leaves divergent to spreading, (5-) c. 10 (-20) mm long and mostly 3-6 (-8) mm wide, elliptical (often broadly so) to obovate, almost flat or with margins somewhat incurved especially near the apex and base, sometimes thick, often grey-green, glabrous or with some areas of a short pubescence, the apex very shortly acute and sometimes tending to show a blunt point, the base tapering to a distinct pale, occasionally pubescent, petiole c. 1 mm long. Flowers white, c. 15 mm in diameter, occurring as axillary monads in consecutive leaf-axils on relatively unmodified adjacent shoots, usually with several bract-scars at the base of the shoot, occasionally the lowest subtended by bracts, or on condensed shoots terminal on short branchlets, the new growth extending vigorously from the ends of the branches and less vigorously from shorter side-shoots, often during flowering. Bracts red-brown, thin but thickened at the base, and readily deciduous, usually more numerous than the flowers; the bracteoles so evanescent as to be rarely seen. Hypanthium densely silky-pubescent with long white hairs, or occasionally sparsely pubescent, especially near the top, 3-3.5 mm long, the upper part much expanded, the lower often fluted, tapering to the base or to above a relatively stout pedicel, the top of the ovary with a close silky pubescence. Sepals persistent, usually 1.5-2.5 mm long, broadly ovate to long-deltoid, silky pubescent at least in part, with scarious densely ciliate margins. Petals 4-7 mm long. Stamens in bundles of 5-7, rather irregular, c. 1.2-1.5 mm long, the anther cells to 0.5 mm long, parallel broad and shallow. Style well inset, and with some hairs at the base, slender, with a rather small stigma. Ovary 4-6-locular, each loculus with c. 10 ovules in 2 rows on a narrow and rather shallow placenta. Fruit tending to persist but not long-persistent, usually 4-5 mm in diameter, the outer surface rather glaucous, often becoming succulent, the upper part of the hypanthium usually extended and infolded bearing the persistent rather erect sepals, the lower part broadly rounded above a very short stalk, but becoming virtually sessile on older branches, the valves not woody, often extending somewhat but to form a rather flat-topped fruit. Mature seeds c. 1-1.5 mm long, rather flattened, obovoid-cuneiform, the surface shallowly reticulate often with vertical rows of loose cells, some so developed as to form a vestigial wing. Main flowering period: Jan.-Feb.

DISTRIBUTION: Widespread in Tasmania (Map 4). In wet coastal and mountain heaths.

SELECTED SPECIMENS: TASMANIA: 6 km from Strahan on Strahan-Queenstown road, Orchard 5374, 2.1981 (HO, MEL, NSW); Robbin Is., Gunn 679/1842, 10. 1837 (NSW); Lake Vera, Frenchmans Cap, Salkin NSW 154738, 2.1978 (NSW); banks of the Huon R., Brown, 5.1804 (NSW); c. ½ mile [0.8 km] from Hastings, towards Strathblane,

Canning 2450, 2.1969 (CBG, NSW); Freycinet Peninsula National Park, 4 km S. of Coles Bay township ..., *Short 1893*, 2.1983 (HO, MEL).

Specimens of this species have been wrongly identified as *L. myrtifolium* Sieb. ex DC. or *L. sericeum* Labill. by many authors.

23. *L. coriaceum* (*F. Muell. ex Miq.*) *Cheel, J. & Proc. Roy. Soc. New South Wales 57: 128 (1923).*

BASIONYM: *Fabricia coriacea* F. Muell. ex Miq., *Ned. Kruidk Arch. 4: 147 (1859).*

HOLOTYPE: SOUTH AUSTRALIA: In fruticetis locorum arenosorum Murray-scrub fluvii ostium versus, *F. Mueller* (U, n.v.). ISOTYPE: MEL.

SYNONYMY: *L. laevigatum* var. *minus* F. Muell. ex Benth., *Fl. Austral. 3: 103 (1867).*

HOLOTYPE: as for *F. coriacea*.

Spreading shrub to 2 m tall with close but probably ultimately shed bark; the younger stems with fine, silky hairs but soon glabrous, the surface rather smooth and pale, lacking a flange but grooved from beside the node and swollen below it, the branches usually erect but the angle of branching varying, usually from 30°–45°. *Leaves* divergent, often quite widely so, usually 10–20 (–30) mm long and 3–5 mm wide, ovate to oblanceolate or elliptical, flat, rather thick, and glabrous at maturity, the apex acute to obtuse or shortly acuminate, with a short point, the base tapering to a short rounded petiole. *Flowers* white, 12–15 mm in diameter, usually 2 (of disparate age) together on short modified shoots that are terminal and close in the leaf-axils, the new growth usually developing as a prolongation of the branches during flowering with little development of the flowering shoots. *Bracts* numerous, broad and pale red-brown, forming broad cone-like buds in the leaf-axils and often persisting about the flower; the bracteoles narrower than the broad inner bracts and deciduous. *Hypanthium* glabrous or silky, 2–3 mm long, broad, especially the upper part, and tapering to the base, the top of the ovary with a short silky pubescence or glabrous, the valve-margins showing as pale lines. *Sepals* persistent, 1.5–2 mm long, deltoid, rather thin in texture and paler than the hypanthium, glabrous apart from very long hairs at and near the top or somewhat silky-pubescent. *Petals* 5–7 mm long. *Stamens* in bundles of 5–7(–9), 1–2 mm long, rather irregular, the anther-cells variable, to 0.5 mm long, parallel, broad and shallow. *Style* inset, slender and often with some short hairs at the base, with the stigma, relative to the style, large; sometimes absent. *Ovary* 4– to more than 7-locular, each loculus with 7–9 ovules in 2 rows on a very narrow and rather high and shallow placenta; sometimes absent. *Fruit* deciduous but often only tardily, 5–8 mm in diameter, the outer surface turgid and becoming wrinkled, widest at the erect hypanthium-rim from which the sepals are soon shed, below this rather straight-sided, lobed in cross-section, broad-based and sessile, the valves rather rigid, exerted somewhat above the rim but so as to form a flat-topped fruit. *Mature seeds* c. 1.5–2 mm long, flattened and broadly obovoid-cuneiform, the surface broadly and somewhat coarsely reticulate and with rows of loose cells often extended into marginal wings. Main flowering period: June-Oct.

DISTRIBUTION: Widespread from the Ooldea district of South Australia to northwestern Victoria and southwestern New South Wales (see Map 4). In mallee and on dunes.

SELECTED SPECIMENS: NEW SOUTH WALES: South Western Plains: 105 km NE. of Ivanhoe, *Milthorpe 2614 & Cunningham*, 8.1974 (NSW). South Far Western Plains: 6 miles [10 km] E. of "Lethero", NE. of Wentworth, *Briggs 2786*, 5.1969 (NSW). VICTORIA: Mallee: Eastern Lookout, Wyperfeld National Park, *Briggs 2878*, 10.1969

(NSW). SOUTH AUSTRALIA: Eyre Peninsula-Nullarbor: N. of Fowlers Bay, *Giles s.n.*, 1875 (MEL). Murray: Murray Bridge, *Maiden NSW 154741*, 1.1907 (NSW).

24. *L. laevigatum* (Gaertner) F. Muell., Ann. Rep. of the Government Botanist and Director of the Botanic Garden, Victoria: 22 (1858), Fragm. 4: 60 (1883-4).

BASIONYM: *Fabricia laevigata* Gaertner, Fruct. Sem. Pl. 1: 175 (1788).

HOLOTYPE: NEW SOUTH WALES: *Banks & Solander ex Herb. Banks*, (BM, n.v.). ?ISOTYPE: NSW.

Shrub or small tree, often reaching more than 4 m in height, with close bark that tends to be shed in strips from the older trunks; the younger stems usually rather stout, with long silky hairs but soon becoming glabrous, rather smooth and pale with grooves from beside the extended node and a swollen area just below it, and with branching often at c. 45°. *Leaves* divergent, often widely so, 15-30 mm long and 5-8 mm wide, usually narrowly obovate and often rather thick-textured, flat, glabrous at maturity, the apex broadly obtuse with a small, often infolded, point, the base tapering to a short rather flattened petiole. *Flowers* white, usually 15-20 mm in diameter, usually 2 (of disparate age) together on short modified shoots that are terminal and close in the leaf-axils, the new growth usually developing as a prolongation of the branches during flowering with little development from flowering shoots. *Bracts* numerous, broad, pale red-brown, forming broad cone-like buds in the axils, and with the bracteoles somewhat narrower, most shed before the flower opens but some often persisting about the open flower. *Hypanthium* usually glabrous but occasionally with an appressed silky pubescence, more sparse on the upper part, 3-4 mm long, with the upper part expanding widely, tapering below but rather rounded above a short often turgid pedicel, the top of the ovary with a short silky pubescence, the valve-margins showing as pale lines. *Sepals* persistent, c. 2 mm long, deltoid, longer or shorter than broad, thin in texture with at least the margins paler than the hypanthium, almost glabrous but usually with long rather crimped hairs near the margin. *Petals* 5-8 mm long. *Stamens* in bundles of 5-7, 1.5-2.5 mm long, rather irregular, the anther-cells variable, often 0.6-1 mm long, parallel, somewhat folded back and recurved, and shallow. *Style* inset, slender apart from a stout base, with a relatively large stigma; sometimes absent. *Ovary* usually 6-11-locular, each loculus with c. 15 ovules in 2 rows on a very narrow and rather high and shallow placenta; sometimes absent. *Fruit* deciduous but sometimes tardily so, usually 7-8 mm in diameter, the outer surface turgid and becoming wrinkled, widest at the erect hypanthium-rim from which the sepals are soon shed, below this, rather straight-sided, lobed in cross-section, broad-based and usually with a very short stalk, the valves rather rigid, exerted somewhat above the rim but so as to form a flat-topped fruit. *Mature seeds* c. 2.5 mm long, broadly ovoid-cuneiform and flattened, the surface broadly and shallowly reticulate and usually with rows of extended cells forming a broad marginal wing. Main flowering period: Aug.-Oct.

DISTRIBUTION: On the coast from the Nambucca R., New South Wales, to the Bass Strait Islands and northern Tasmania, perhaps reaching South Australia (Map 4). The natural western limit of the species is a matter of conjecture. It is now well established in southern Queensland (by sandminers), in Western Australia (perhaps from ballast), and in many localities including parts of South Australia (as garden escapes and coastal plantings). On beach sand and dunes and on coastal cliffs.

SELECTED SPECIMENS: NEW SOUTH WALES: North Coast: Grassy Head (near Macksville), *Johnson* 7863, 1.1975 (NSW). Central Coast: Botany Bay, *Brown*, 8.1803 (NSW). South Coast: Disaster Bay, *Constable* NSW 30233, 10.1954 (NSW). VICTORIA: East Gippsland: SE. of Sale, sand dunes at Letts Beach (90 Mile Beach), *Salasoo* 4916, 10.1971 (NSW). Port Phillip: Brighton Beach, *Clifford, Rodway* No. 11266, 5.1947 (NSW). TASMANIA: Long Point, Flinders Island, *Whinray* 2441, 9.1978 (MEL, NSW); Petal Point, *Moscal* 3218, 10.1983 (HO); Marrawah, *Curtis*, 5.1947 (HO). SOUTH AUSTRALIA: Southern Lofty: Granite Island, Victor Harbor, *Briggs* NSW 154742, 8.1958 (NSW).

L. *brevipes* subgroup (spp. 25–38), Map 5.

25. *L. nitens* Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 10: 325 (1852).

HOLOTYPE: WESTERN AUSTRALIA: *Drummond* [Coll.] V, n. 28. (?KW, n.v.). ISOTYPES: NSW, PERTH

SYNONYMY: *L. erubescens* var. *strictum* Benth., Fl. Austral. 3: 109 (1867) p.p., in regard to *Drummond*, 5th Coll. Suppl. n. 28 (K, n.v.).

Slender shrub to c. 3 m in height with numerous erect branches and bark, as seen on specimens, fibrous and close but shedding thread-like pieces; the younger stems silky-pubescent, lacking any flange but grooved at the node and extended below it, the branching usually at c. 30°. *Leaves* diverging, 5–12 mm long and 1.5–3.5 mm wide, very narrowly obovate-cuneate to obovate, rather firm and at first grey-silky-pubescent though later often more, but rarely completely, glabrous, somewhat incurved in cross-section with the margins thick especially near the apex, the apex usually broadly rounded or very broadly acute but with a small blunt point behind, the base usually very long-tapering to a short petiole but sometimes short-tapering. *Flowers* white or pink, c. 7–12 mm in diameter, usually 1 or 2 (–3) on short modified shoots that are axillary or at the ends of short leafless or few-leaved side-branches close in the axils of adjacent leaves, the new growth vigorous at the ends of branches, minimal from the flowering shoots. *Bracts* few, red-brown and scarious; with the bracteoles much longer than wide; all shed from the young bud. *Hypanthium* with a shining, silky, mostly appressed pubescence, c. 2–3 mm long, tapering at first rather evenly but below the ovary more abruptly to a long, somewhat fluted or ribbed, tapering, pedicel c. 2 mm or even more in length, the top of the ovary silky. *Sepals* persistent, 1.5–2 mm long, deltoid, densely silky-pubescent and similar to the hypanthium, the apex somewhat infolded and hooded. *Petals* c. 3–5 mm long. *Stamens* in bundles of (3–)5, c. 2 mm long, the filaments broad in the lower part, the anther-cells c. 0.4 mm long, parallel, broad and shallow. *Style* well inset, rather stout, tapered below a small (relative to the style) stigma. *Ovary* 4–5-locular, each loculus with c. 20 (16–28) ovules in 4 rows on a rather small placenta. *Fruit* readily deciduous, 2.5–4 mm in diameter, the outer surface pubescent, widest in the upper part with the erect upper part of the hypanthium bearing somewhat incurved sepals, the lower part lobed in cross-section, and the base rounded above a narrow stalk, the valves thin, and exerted beyond the erect upper part of the hypanthium on opening. *Mature seeds* 1 mm long, obovoid, the surface very coarsely reticulate. Main flowering period: Aug.-Sept.

DISTRIBUTION: In the central part of the Avon and western part of the Roe and Eyre Districts of Western Australia (Map 5). In sand and gravel, especially among granite rocks.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Avon: Yorkrakine, *Gardner B 1557*, 8.1920 (PERTH). Roe: Tarin Rock, *Beard 2153*, 10.1962 (PERTH); montem Madden, *Gardner 13993*, 8. 1962 (PERTH). Eyre: crossing of Phillips R., c. 15 km SW. of Ravensthorpe on main road to Ongerup, *Haegi 1038*, 9.1976 (AD, PERTH), *Thompson 4641*, 10.1987 (NSW, PERTH).

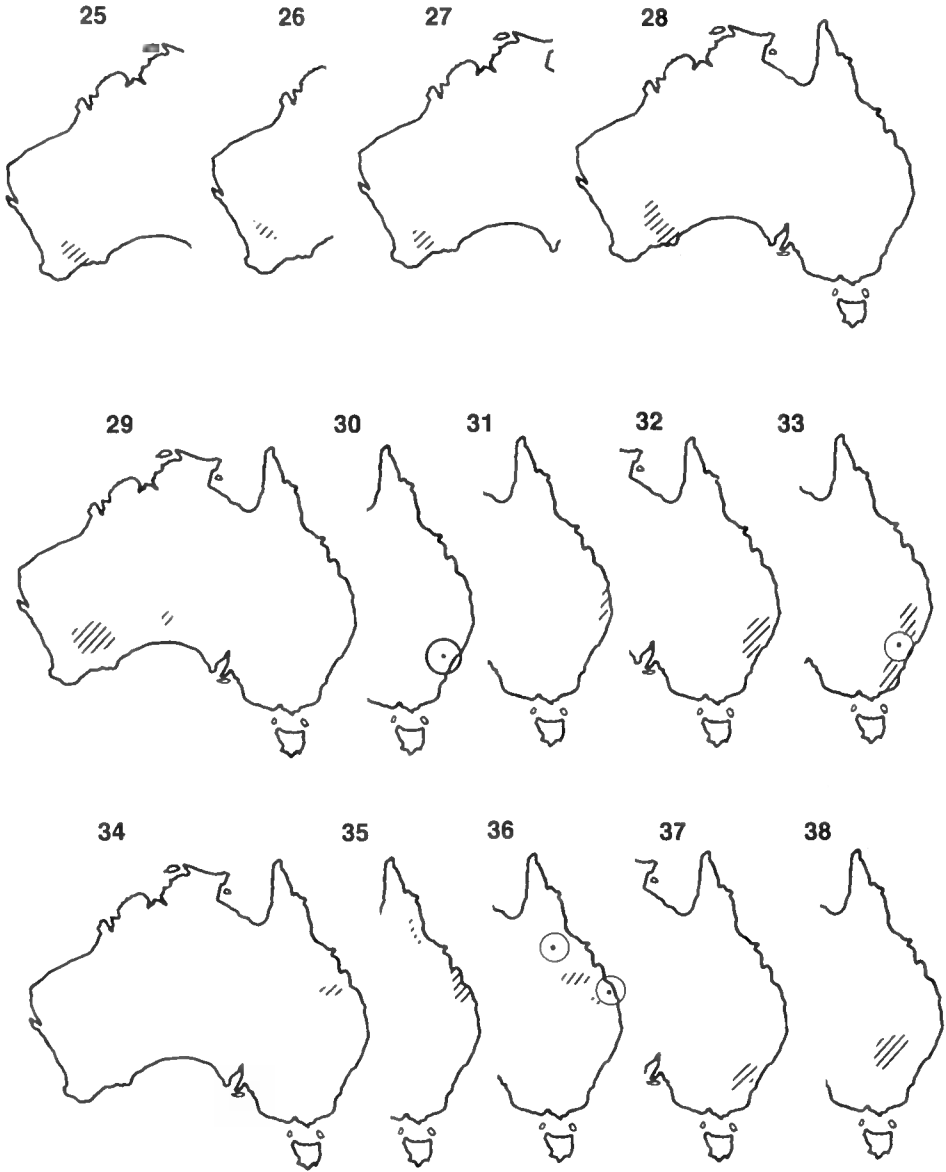
26. *L. roei* Benth., Fl. Austral. 3: 110 (1867).

HOLOTYPE: WESTERN AUSTRALIA: in the interior, *Roe* (K, n.v.). *Koch 2770* (PERTH) was matched with the Type by C.A. Gardner in 1938.

Spreading shrub to 2 m or more tall, with erect rather slender branches and bark, as seen on specimens, close but shedding fibres; the younger stems with dense or sparse, long, silky hairs and later with these more sparse or absent, with a vestigial flange just below the node and the stem thickening below, the branching at 30° or even less. *Leaves* diverging, usually 7–13 mm long and 2–3 mm wide, elongate-obovate to narrowly cuneate, infolded or incurved with thick margins especially near the apex, often silky-pubescent on both surfaces but when older sometimes glabrous, the apex rounded or somewhat acute, often recurved and usually with a small umbo at the back, the base tapering gradually usually to a rounded pale petiole up to c. 1 mm long, but sometimes sessile. *Flowers* white or pink, usually 10–13 mm in diameter, 1 or 2 on short modified shoots in adjacent leaf-axils or on the ends of adjacent short few-leaved side-branches, the new growth developing during flowering, strongly from the ends of branches but minimal from the flowering shoots. *Bracts* few, pale red-brown and scarious; with the bracteoles much longer than wide; all shed from the young bud. *Hypanthium* with a dense silky and mostly spreading pubescence, occasionally more glabrous on the upper part, c. 3–4 mm long, the upper part not much expanded, tapering a little, and below the ovary more abruptly to a long, tapering somewhat fluted or ribbed pedicel 1.5–2.5 mm long, the top of the ovary with a dense short velvety tomentum. *Sepals* persistent, 1–1.5 mm long, deltoid, undifferentiated except in their darker colour and sometimes sparser tomentum from the hypanthium, the apex tending to be hooded. *Petals* usually c. 5 mm long. *Stamens* in bundles of (1–) 3–5 (–7), c. 2 mm long, with some filaments rather broad in the lower part, the anther-cells c. 0.4–0.5 mm long, parallel, broad and shallow. *Style* well inset, with a few hairs on the broad base, and tapering behind a small (relative to the style) stigma. *Ovary* 3–4(–5)-locular, each loculus with c. 20 ovules in 4 rows on a rather small placenta. *Fruit* readily deciduous, 2.5–3 or more mm in diameter, the outer surface with a dense silky pubescence, the erect upper part of the hypanthium forming a somewhat wider rim bearing erect to incurved sepals, the lower part lobed in cross-section, and rounded above a narrow stalk, the valves thin, exerted at first to the height of the rim but extending somewhat further after the opening. *Mature seeds* c. 0.75 mm long, cuneiform, the surface (? mature) very coarsely reticulate. Main flowering period: Aug.-Oct.

DISTRIBUTION: In the central part of the Avon District of Western Australia and in the adjoining part of the Coolgardie District (Map 5). On sand or gravel or on granite outcrops.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Avon: c. 14.5 km NE. of Wubin on road to Paynes Find, *Haegi 1115*, 9.1976 (NSW, PERTH); near Bencubbin, *Ashby 3595*, 9.1970



Map 5. Distribution of Group 1: subgroup 3 *L. brevipes* and allies. 25. *L. nitens* 26. *L. roei* 27. *L. inelegans* 28. *L. incanum* 29. *L. fastigiatum* 30. *L. blakelyi* 31. *L. microcarpum* 32. *L. polyanthum* 33. *L. brevipes* 34. *L. sericatum* 35. *L. neglectum* 36. *L. lamellatum* 37. *L. multicaule* 38. *L. divaricatum*.

(PERTH); Merredin, *Koch 2770*, 9.1923 (NSW); Muntagin, *Bailey 169*, 9.1947 (PERTH). Coolgardie: Bullfinch, NNW. [as NNE.] of Southern Cross, *Rogerson 319*, 10.1966 (PERTH); Bodallin, *Thompson 4612*, 10.1987 (NSW, PERTH).

Many authors have used this name in a broad sense so as to include other species, especially *L. fastigiatum*.

27. *L. inelegans* J. Thompson sp. nov.

Frutex effusus usque ad 2 m altus. Folia obovata ad anguste elliptica, 0.5–1.5 cm longa. Flores 7–10 mm diametro, sepalis pubescentibus persistentibus. Ovarium 3–5-loculare. Fructus 3–4 mm diametro decidui.

HOLOTYPE: WESTERN AUSTRALIA: 40 km E. of Lake King, ca 33° [as 30°] 00' S lat. 120° [as 121] 07' E long., *R. Hnatiuk 760783*, 17 Sept. 1976 (PERTH).

Straggling shrub to 2 m tall with erect slender branches and bark, as seen on specimens, close but with occasional loose fibres; the younger stems with areas of long, fine appressed hairs and glabrous areas, with the flange virtually absent but the stem extended very conspicuously below each node, the branching irregular, at c. 40° or less. *Leaves* somewhat variably divergent, usually 5–15 mm long and 2–3 mm wide, obovate and often very elongate at the base, to narrowly elliptical, those of the upper branches often much shorter and more sparse, rather thick, especially near the apex, the surface incurved, densely silky-pubescent at first but often later becoming glabrous, the apex rounded or more usually acute, tending to infold and with an umbo at the back, the base very variable in the amount of taper and the length of the 0–2 mm long slender petiole. *Flowers* white or pink, usually 7–10 mm in diameter, single or occasionally 2 on short condensed shoots in adjacent leaf-axils of young growth and at the ends of short adjacent axillary branches in subsequent seasons, the new growth at the ends of some branches vigorous, but mostly tardy and minimal on side branches of the previous season. *Bracts* few, pale red-brown and scarious, both bracts and bracteoles longer than broad, and usually but not invariably shed early. *Hypanthium* densely pubescent with white appressed, or occasionally spreading, hairs, c. 2–3 mm long, the upper part not expanded, the lower abruptly contracting to a pedicel c. 1 mm long, the top of the ovary with a close velvety pubescence. *Sepals* persistent, c. 2 mm long, deltoid, often about twice as long as broad, the apex somewhat hooded, all pubescent as the hypanthium. *Petals* c. 3 mm long. *Stamens* in bundles of 1–5, 1 mm or less in length, the filaments very broad in the lower part, the anther-cells c. 0.3 mm long, parallel, broad and shallow. *Style* well inset, stout, with the stigma rather small. *Ovary* 3–5-locular, each loculus with c. 20 ovules in 4 rows on a rather small placenta. *Fruit* not persisting, 3–4 mm in diameter, the outer surface pubescent, the upper part of the hypanthium angled inward and contracted over the top with the persistent sepals erect or spreading and incurved, the lower part lobed in cross-section and rounded above a short stalk, the valves thin, and extending upward but within the upper part of the hypanthium. *Mature seeds* c. 0.75 mm long, obovoid-cuneiform, the surface broadly and at length shallowly reticulate. Main flowering period: Sept.–Nov.

DISTRIBUTION: In the western part of the Roe District of Western Australia and in adjacent parts of the Eyre District (Map 5). Usually in scrub or heath on sand or gravel.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Roe: 7.5 km WSW. of Lake Cronin, *Houston 203–17*, 10. 1978 (PERTH); 60 miles [97 km] W. of Kumarl, *Blackall 1254*, 11.1931 (PERTH). Eyre: 16.5 miles [27 km] N. of Ravensthorpe *George 309*, 9.1959 (PERTH).

This species is named for its habit which is described on many specimens as "straggling".

28. *L. incanum* Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 10: 335 (1852).

HOLOTYPE: WESTERN AUSTRALIA: *Drummond* [Coll.] V, n. 130 (?KW, n.v.). ISOTYPES: NSW, PERTH.

SYNONYMY: *L. erubescens* var. *strictum* Benth., Fl. Austral. 3: 109 (1867) p.p., in regard to *Drummond* 5th Coll. n. 130 (K, n.v.).

Compact shrub usually 1–2 m tall with slender erect branches and bark, as seen on specimens, close or lifting irregularly; the younger stems with sparse or dense, fine, appressed hairs, without a flange but with a slightly thickened area beside and a little below each node, and with the branching at c. (40°–)30° *Leaves* erect to divergent (5–)c. 15 (–20) mm long and usually 2–5 mm wide, elongate-obovate, broadest near the apex and tapering to the base, rather thick, incurved or infolded especially near the apex, and with an appressed silky pubescence or glabrous, the apex rounded or somewhat acute, tipped by a recurved blunt point, the base usually tapering gradually to a short slender petiole. *Flowers* white or pink c. 10–15 mm in diameter, 1–2(–3) together on short condensed shoots in leaf-axils and terminal on short condensed shoots in leaf-axils and terminal on short few-leaved axillary branches, the new growth produced vigorously from branch-ends during or even before flowering, also precocious but less vigorous from side-branches. *Bracts* few and bracteoles narrow, all small pale red-brown and scarious, and shed long before the bud develops. *Hypanthium* with an appressed silky pubescence, often c. 3 mm in length, the upper part conspicuously expanded, the lower gradually tapering to an itself tapering rather fluted pedicel usually 3–5 mm in length, the top of the ovary silky-pubescent. *Sepals* persistent, c. 1–2 mm long, deltoid, often longer than broad, somewhat hooded, spreading, differentiated only in colour from the hypanthium. *Petals* c. 5 mm long. *Stamens* in bundles of c. 5, c. 1.5–2.5 mm long, with a few filaments somewhat broad in the lower part and, rarely, with a few hairs, the anther-cells c. 0.4 mm long, parallel, broad and shallow. *Style* well inset, not very stout, with a medium-sized stigma. *Ovary* 3–5-locular, each loculus with c. 20–30 ovules in c. 4–6 rows in a shallow but not small (longer than broad) placenta. *Fruit* not persisting, c. 3–3.5 mm in diameter, usually with a sparse silky pubescence, the upper part expanded but the hypanthium-top erect or somewhat incurved and bearing the erect persistent sepals, the lower part somewhat lobed in cross section and tapering to a long-tapering stalk often 5 mm or more in length, the valves thin, not, or not much, exerted beyond the hypanthium on opening but later usually equal to, or slightly above, it. *Mature seeds* c. 1 mm long, obovoid, with a strong reticulate pattern. Main flowering period: July-Dec.

DISTRIBUTION: From south of Coolgardie through the western part of the Roe and Eyre Districts of Western Australia to the south coast (Map 5). On granite outcrops.

SELECTED SPECIMENS: WESTERN AUSTRALIA: Coolgardie: Knopp Rock ... Hyden-Norseman road, *Marchant* 71/552, 9.1971 (PERTH); Dundas Rocks, S. of Norseman, *Thompson* 4625, 10.1987 (NSW, PERTH); Moirs Rock, c. 70 km SW. of Norseman ..., *Haegi* 953, 9.1976 (NSW). Roe: Mt Ney, *Beard* 6391, 9.1970 (NSW, PERTH). Eyre: 11 miles [18 km] N. of Esperance, *Gardner* 2808, 10.1931 (PERTH); ... c 10 km ESE. of Howick Hill, *Donner* 2643, 9.1968 (AD, PERTH).

29. *L. fastigiatum* S. Moore, J. Linn. Soc., Bot. 45: 201 (1920).

HOLOTYPE: WESTERN AUSTRALIA: Coolgardie Goldfield in open sandy places; *Pritzel 844*, (BM, n.v.). ISOTYPE: NSW.

Shrub 1 to more than 2 m tall with numerous slender erect branches and rather close firm bark; the younger stems silky-pubescent early but becoming glabrous, usually tuberculate, without an extended flange but with a groove from beside each node, the stem usually conspicuously extended below the node, the branching at c. 45° (-30°) but soon adjusting to become erect. *Leaves* erect, 5–12 mm long and 1–4 mm wide, usually very narrowly obovate, silky but glabrescent, flat or with the margins slightly incurved, and rather thick, especially near the apex, obtuse or occasionally acute, with a small apical point, tapering at the base, usually to a slender petiole. *Flowers* white, 6–10 mm in diameter, 1 or 2 together on short condensed shoots in adjacent leaf-axils or terminal on very short axillary branches with or without leaves, the new growth developing during flowering both relatively vigorously at the ends of branches and to a restricted extent on the lateral branches. *Bracts* few, broad red-brown and scarious; the bracteoles longer and more narrow; all usually readily deciduous but occasionally persisting around mature buds. *Hypanthium* silky-pubescent, 3–4 mm long, gradually tapering from the rather expanded upper part to the somewhat fluted base, the top of the ovary silky. *Sepals* persistent, 1.5 mm long, long-deltoid, infolded near the apex and usually rather scarious and glabrous at least on the margins. *Petals* c. 3 mm long. *Stamens* in bundles of c. 5–7 or more, c. 1 mm long, the filaments not broad-based, the anther-cells c. 0.3 mm long, parallel, broad and shallow. *Style* well inset, not very stout; with a medium-sized stigma. *Ovary* 3-locular, each loculus with c. 20 ovules in 4 rows on a broad and relatively large placenta. *Fruit* not persisting, c. 3 mm in diameter, silky-pubescent, widest in the upper part, the upper part of the hypanthium forming an erect rim bearing the usually erect sepals, the lower part lobed in cross-section, and rounded above a slender stalk 1–3 mm long, the valves thin and exerted almost to the hypanthium-rim, or, especially after opening, beyond it. *Mature seeds* 1 mm long, obovoid-cuneiform, coarsely reticulate. Main flowering period: Sept.-Dec.

DISTRIBUTION: From the Coolgardie district through eremaeen regions of Western Australia to western South Australia (Map 5). The disjunction shown by present collections is likely to be negated by further collecting. On sandplain, in scrub or on rocky outcrops.

SELECTED SPECIMENS: SOUTH AUSTRALIA: North-western: Wyola Lake, *Weber 6535*, 8.1980 (AD). WESTERN AUSTRALIA: Helms: 38 miles [60 km] E. of Neale Junction, Great Victoria Desert, *George 8442*, 10.1966 (PERTH). Austin: 26 km S. of Menzies, *Thompson 4617*, 10.1987 (NSW, PERTH); Comet Vale, *Gardner 7962*, 10.1945, *11114*, 11.1953 (PERTH). Coolgardie: inter Mt Jackson et lacum Deborah, *Gardner 1911*, 10.1966 (PERTH); 50 km W. of Coolgardie, *Thompson 4614*, 10.1987 (NSW, PERTH).

Most authors have included this species in *L. roei*.

30. *L. blakelyi* J. Thompson sp. nov.

Frutex c. 1 m altus. Folia obovata ad late elliptica, 4–8 mm longa. Flores c. 7 mm diametro, sepalis persistentibus, hypanthio et pedicello longiattenuato. Ovarium 3–5-loculare. Fructus 2–3.5 mm diametro tarde decidui.

HOLOTYPE: NEW SOUTH WALES: on ridge overlooking the Upper Dam, Lithgow W[ater] S[upply], Clarence, *W.F. Blakely, Jean and W.J. Buckingham NSW 154743*, 25.11.1939 (NSW).

Broadly spreading shrub c. 1 m tall with bark, as seen on specimens of closely adhering flakes, shed in slender fibre-like strips; the younger stems slender, densely silky-pubescent at least at first, lacking a flange but broad around and below the petiole base, with branching at c. 60°. *Leaves* diverging and recurving especially near the apex, mostly 4–8 mm long and 2–5 mm broad, obovate to very broadly elliptical, often concave, both surfaces usually glabrous except for silky hairs on the base and margins, the apex (variable within the specimen) broadly rounded to acute or acuminate, and blunt to with a short, stout, rather pungent point, the base tapering gradually or more abruptly to a short, distinct, rather slender petiole often broader at the extreme base. *Flowers* white or pink, c. 7 mm in diameter, 1–4 on modified shoots, occasionally axillary but usually at the ends of short few-leaved branches in adjacent axils, with the terminal bud of the flowering shoot very precocious, elongating, vigorously near the ends of the branches before the flower buds open, leaving buds as monads in bract-axils and with a few bract-scars at the base. *Bracts* few, broad, red-brown and firmly scarious, the inner longer and the bracteoles much longer, all shed very early. *Hypanthium* very slender, usually densely silky hairy and vertically ridged, often c. 2 mm long, the upper part somewhat expanded, tapering below and then more abruptly to a long, tapering, very slender pedicel often 5 mm or more in length, the top of the ovary silky. *Sepals* persistent, c. 1–1.5 mm long, deltoid, somewhat longer than broad, and rather keeled and hooded, somewhat thinner in texture than the hypanthium and often less pubescent though sometimes with the margins ciliate. *Petals* 2–2.5 mm long. *Stamens* in bundles of 3–5, 1 mm or less in length, the filaments little broader in the lower part, the anther-cells c. 0.3 mm long, parallel, broad and shallow. *Style* shallowly inset and tapering to a small stigma. *Ovary* 3–5-locular, each loculus with c. 6–8 pendulous ovules in 2 rows on a high, large but rather shallow, placenta. *Fruit* tardily deciduous, 2–3.5 mm in diameter, glabrescent, widest at the usually erect hypanthium-rim bearing erect or spreading sepals, rather lobed in cross-section and tapering to, or somewhat rounded above, a long filiform stalk to 7 mm or more in length, the valves thin, not much, if at all, exerted beyond the hypanthium-rim after opening. *Mature seeds* not seen, probably obovoid-cuneiform, the surface of young seeds reticulate. Main flowering period: Nov.-Dec.

DISTRIBUTION: Limited to sandstone escarpments above the town of Lithgow on the Central Tablelands of New South Wales (Map 5). In very shallow soil.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Tablelands: Lithgow Water Supply, Lithgow side, *Blakely & Buckingham NSW 154744*, 12.1938 (NSW); Hassans Walls Lookout, *Briggs 6974*, 10.1978 (NSW), *Thompson 4207*, 11.1981 (NSW), *Burgess NSW 154745*, 10.1961 (NSW).

This species is named for W. F. Blakely, formerly a botanist at NSW, who prepared an unpublished manuscript description recognising this species.

31. *L. microcarpum* *Cheel, J. & Proc. Roy. Soc. New South Wales 57: 126 (1923).*

LECTOTYPE, here chosen: NEW SOUTH WALES: Copmanhurst, *E. Cheel NSW 154747*, 11.1917 (NSW).

Shrub 1–2 m or more in height with bark seen on specimens as close and shedding fibres but variously described in notes as smooth, flaking to become smooth and peeling in strips; the younger stems glabrous or with appressed fine hairs, rarely with minute hairs, and the flange a conspicuous ridge from beside

each node with the stem extended immediately below the leaf-base, the branching at c. 45°. *Leaves* divergent with those on new lateral growth crowded, often recurved, later spreading or even reflexed, from a few mm to 20 mm long and to 4 mm wide and often very variable on one plant, elliptical to narrowly oblanceolate, usually rather thick and with the margins or the whole surface incurved, glabrous at maturity except for a few hairs on the base of the upper surface, the apex obtuse to long-acuminate, incurved or infolded and usually with a conspicuous pungent point to 1 mm long, the base narrowing to a conspicuous slender petiole expanded at the extreme base. *Flowers* white, c. 8–12 mm in diameter, occurring singly or 2 together, on short modified shoots, occasionally axillary, usually at the ends of short (leafless or) few-leaved branches in adjacent leaf-axils and at the ends of longer, and older, leafy branches, the new growth developing mostly at branch-ends during flowering. *Bracts* few or more numerous, broad and red-brown, with the bracteoles thinner, longer and more narrow-based, most shed before the flower opens. *Hypanthium* densely covered with silky spreading or appressed hairs, usually 2–3 mm long, the upper part spreading, the lower 0.5 to 1.5 mm rather abruptly contracted to a tapering pedicel, the top of the ovary with a short silky pubescence dense near the style-base. *Sepals* persistent, 1–1.2 mm long, short-oblong to hemispherical, obtuse, like the hypanthium in the centre but with broad, pale, thin margins usually ciliate at the edge. *Petals* c. 3–5 mm long. *Stamens* in bundles of 3–5, 1–1.5 mm long, with some filaments rather broad in the lower part, the anther-cells 0.4–0.5 mm long, parallel, broad and shallow. *Style* variably, but not deeply, inset, and rather straight above a broad base, with a medium-sized stigma. *Ovary* (3–)4(–5)-locular, each loculus with c. 20–40 ovules in c. 4 rows on a rather large and high placenta. *Fruit* deciduous but often some persisting until the next flowering, 3–4 mm in diameter, pubescent, widest in the upper part with the erect persistent sepals on a rather erect or incurved hypanthium-rim, the part about the ovary much shorter than broad, lobed in cross section and abruptly contracting to an almost inset slender stalk 1–1.5 mm long, the valves thin, raised, especially near the style (though still rounded), above the hypanthium-rim but usually below the tips of the sepals. *Mature seeds* c. 1 mm long, obovoid-cuneiform, very dark, with a narrow-reticulate pattern and a few loose cells. Main flowering period: Mostly Aug.-Oct.

DISTRIBUTION: From the Wide Bay district of Queensland to northeastern New South Wales (Map 5). On mountains and escarpments of volcanic, granite and sandstone rock, usually in shallow soil on rock ledges or cliff-faces.

SELECTED SPECIMENS: QUEENSLAND: Wide Bay: Mt Cooroora, *White* 18927, 3.1923 (BRI, CANB, NSW). Moreton District: Mt Tibrogargan, W. of Beerburum, *Coveny* 6719 & *Hind*, 8.1975 (NSW). Darling Downs: Jollys Falls, 2 miles [3.2 km] W. of the summit, *Fisher* 282, 10.1970 (CANB, NSW). NEW SOUTH WALES: North Coast: summit, Mt Warning, *Rodway* 2968, 10.1939 (NSW); North Rocks Road, Nightcap Range ... c. 15 km W. of Mullumbimby, *Coveny* 9909 & *Haegi*, 10.1977 (NSW). Northern Tablelands: E. of Torrington, *Wissman* NSW 154748, 10.1975 (NSW). North Western Slopes: Ashford area, *Fox* NSW 154750, 9.1963 (NSW).

On the granite of northern New South Wales and southern Queensland this species grows with and resembles *L. brevipes*. However, it remains distinguishable particularly in regard to the condensation of its lateral shoots, its green coloration and the tendency for its bark to flake. It is possible that a few herbarium specimens from this region showing long narrow fruit-bases indicate hybridisation with *L. brevipes*.

32. *L. polyanthum* J. Thompson sp. nov.

Frutex vel arbor usque ad 5 m alta. Folia elliptica, 1–2.5 cm longa. Flores 5–6 mm diametro, in nodis adjacentibus numerosis in extremitatibus ramulorum, sepalis glabratis persistentibus. Ovarium c. 5-loculare. Fructus c. 3 mm diametro decidui.

HOLOTYPE: NEW SOUTH WALES: Nepean Dam, Bargo, 1250' [380 m], *E.F. Constable* NSW 129836, 1 Dec. 1953 (NSW).

Spreading shrub or small tree to 5 m tall, often of pendulous habit, with firm furrowed, ultimately somewhat flaking, bark; the younger branches very slender with a silky pubescence and also usually with areas of short erect or even antrorse hairs, the pubescence tending to persist, with the flange represented by grooves beside each node and the stem not or scarcely expanded below, and with the branching at c. 45°. *Leaves* diverging, often widely, 10–25 mm long and 2–4 mm wide, elliptical or occasionally wider above or below the middle, flat or almost so and glabrous at maturity, rather thick in drier regions but often thin, the apex obtuse or tapering, with a blunt point, the base tapering, to the same extent as the apex, to a slender petiole. *Flowers* white, 5–6(–10) mm in diameter, occurring singly or occasionally 2(–3) together on short modified shoots usually in a long series of adjacent leaf-axils on leafless nodes, the new growth very vigorous at the ends of branches, usually after flowering, with little if any development from the flowering region. *Bracts* not very numerous, broad and red-brown; the bracteoles longer; all rarely seen, shed from the young bud leaving big scars. *Hypanthium* usually glabrous, occasionally with some hairs at the base, and rather dark and turgid, c. 2 mm long, the upper part spreading widely, the lower tapering but rather abruptly rounded above a short pedicel c. 1 mm long, the top of the ovary with a close silky pubescence. *Sepals* persistent, c. 0.7 mm long, obtusely ovate with incurved margins and hooded, glabrous, similar in texture to the hypanthium, well spaced and often with a small groove at the base. *Petals* c. 3 mm long. *Stamens* in bundles of 3–5, 1–1.5 mm long, with some filaments broad in the lower part, sometimes with a few silky hairs, the anther-cells 0.4–0.5 mm long, shallow after opening and parallel but tending to both recurve and fold back. *Style* inset, broad-based and tapering, with a rather small stigma; often modified or absent. *Ovary* (3–)5(–6)-locular, each locus with c. 18 pendulous ovules in 4 rows on a large, high placenta; occasionally absent. *Fruit* very readily shed but some usually persisting until the next flowering, usually c. 3 mm in diameter, glabrous and rather glossy, widest near the erect or somewhat incurved hypanthium*-rim, lobed in cross-section and rounded above a tapered narrow stalk c. 1 mm long, the valves thin, raised, rounded, even at opening beyond the rim but usually below the erect or incurved sepals. *Mature seeds* c. 1 mm long, obovoid, very dark and closely and coarsely reticulate with lines of loose cells. Main flowering period: Oct.–Jan.

DISTRIBUTION: From the Armidale district and Warrumbungle Mountains of New South Wales, through coastal and tableland areas as far south as Wombeyan Caves (Map 5). In rocky situations on escarpments or on stream banks in rocky gullies.

SELECTED SPECIMENS: NEW SOUTH WALES: North Coast: Dibbs Head, Dorrigo National Park, *Floyd* 969, 5.1978 (NSW). Central Coast: banks of the river Hawkesbury, *Brown*, 1.1805 (MEL, NSW). Northern Tablelands: 20 km ENE. of Hillgrove, *Williams*, 1.1976 (NE, NSW). Central Tablelands: Wentworth Falls, *Jacobs* NSW 154749, 3.1936 (NSW). North Western Slopes: The Spire, Warrumbungle Mts, *Constable* NSW 129837, 5.1948 (NSW). Central Western Slopes: N. slope of Burning Mtn, 3 km NNE. of Wingen, *Pickard & Coveny* 1076, 6.1969 (NSW).

This species is named for the large number of flowers produced on each stem of the flowering region.

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33. *L. brevipes* F. Muell., Trans. Philos. Soc. Victoria 1: 125 (1855).

LECTOTYPE, here chosen: Buffalo Creek, F. Mueller, 6 March [18]53, MEL 1539307. ISOLECTOTYPES: MEL 1512928, K (n.v., photo NSW).

Spreading shrub or small tree to 4 m or more in height with close bark, firm and dark on mature trunks; the younger stems very slender, with appressed fine persistent hairs, with the flange represented only by grooves beside each node and the stem not or scarcely expanded below, and with the branching c. 30°–40°. *Leaves* diverging and sometimes later spreading, 10–>20 mm long and usually more than 5 mm broad, elliptical to narrowly oblanceolate or obovate, often rather thick in texture (? in drier situations), the apex obtuse or shortly acuminate, usually somewhat recurved with a minute pungent point, the base narrowing to a short petiole; flat or with the margins somewhat recurved, with an appressed silky pubescence or glabrous at maturity. *Flowers* white, 6–8 mm in diameter, occurring singly or 2 together on short modified shoots in leaf-axils, usually in a long series of adjacent axils, the new growth very vigorous at the ends of branches, usually during flowering, with little, if any, development from the flowering region. *Bracts* not numerous and not very broad; the bracteoles narrow-lanceolate; all shed from the very young bud. *Hypanthium* with a spreading or appressed silky pubescence, usually 2–3 mm long, the upper part not much expanded, the lower tapering rather abruptly to a pedicel whose length tends to vary from short to very long (2–> 5 mm) according to the population, the top of the ovary with a dense short silky pubescence. *Sepals* persistent, 1–1.5 mm long, obtusely deltoid, silky-pubescent but the tips sometimes almost glabrous and somewhat hooded; rather widely spaced. *Petals* c. 3 mm long. *Stamens* in bundles of 3–5, c. 1 mm long, the filaments somewhat broader in the lower part, the anther-cells c. 0.4 mm long, shallow and parallel but folded back. *Style* inset, not very broad-based, and with a large (relative to the style) stigma. *Ovary* (3–)5-locular, each loculus with c. (10–) 20 ovules in (2–) 4 rows on a large, high placenta. *Fruit* deciduous, usually 3–4 mm in diameter and pubescent, the upper part of the hypanthium forming a wide erect rim bearing erect calyx-lobes, the lower part lobed in cross-section and rounded above a slender tapering stalk occasionally only c. 2 but usually several (up to 8) mm long, the valves thin, rounded and raised above the erect rim but rarely reaching the top of the erect sepals. *Mature seeds* c. 1.25 mm long, obovoid-cuneiform, with a coarse reticulate pattern and conspicuous rows of loose cells. Main flowering period: Oct.-Dec.

DISTRIBUTION: Common in the Granite Belt of southern Queensland and through the North Western Slopes, Northern Tablelands and lower North Coastal mountains of New South Wales; rare on the Central Tablelands, but again common on the Southern Tablelands and South Coast and in northeastern Victoria (Map 5). On rock outcrops and rocky hillsides; especially on granite but on serpentines on the North Coast of New South Wales.

SELECTED SPECIMENS: QUEENSLAND: Darling Downs: 16 km WSW. of Stanthorpe, *Pedley 4140*, 9.1973 (NSW). NEW SOUTH WALES: North Coast: Ellenborough Falls, 2 km N. of Elands, *Coveny 9884 & Haegi*, 11.1977 (NSW). South Coast: Moruya, *Boorman NSW 129838*, 11.1911 (NSW). Northern Tablelands: Dandahra Creek, c. 42 ½ miles [68 km] ENE. of Glen Innes ..., *Tindale NSW 84081*, 12.1966 (NSW). Central Tablelands: Gulf Stream, Winburndale Nature Reserve, *Coveny 9636*, 10.1977 (NSW). Southern Table-

lands: Lobbs Hole, 12 miles [19 km] NW. of Kiandra, *Phillips CBG 006281*, 11.1961 (NSW). North Western Slopes: Howell, *Jackson 2258*, 10.1972 (AD, NSW). VICTORIA: North-eastern Highlands: between Mt Beauty & Falls Creek, Clover Dam area, *Beauglehole 22418*, 1.1967 (MEL, NSW). East Gippsland: \pm 3 miles [5 km] direct NE. of Bemm River Post Office, *Beauglehole 34395*, 10.1970 (MEL, NSW).

This species is very variable, but associated morphological differences tend to indicate regional forms. On available collections, subdivision of the taxon does not appear to be possible. In the Stanthorpe district (Queensland) *L. brevipes* grows with *L. microcarpum* and some specimens from this area may represent hybrids between these species. The aspect of these specimens differs from that of the form of *L. brevipes* found in this region.

34. *L. sericatum* Lindley in Mitchell, J. Exped. Trop. Australia: 289 (1848).

HOLOTYPE: QUEENSLAND: near the Pyramids [Mt Playfair district], *T. Mitchell*, 5th Sept. 1846 (n.v.). TOPOTYPE: *Mitchell 380*, Oct. 9th 1846 (BM, n.v., photo BRI, NSW).

SYNONYMY: *L. stellatum* forma *sericatum* (Lindley) Domin, *Biblioth. Bot.* 89:454 (1928).

Erect shrub 2–3 m tall, rather grey-green in aspect and with dense foliage, the bark, as seen on specimens, close and firm; the younger stems usually thin with a long, silky, mostly appressed, sometimes spreading, pubescence, with the flange represented only by grooves from the side of each node and the stem usually not or scarcely extended below, and with the branching frequent and at 45°–60°. *Leaves* divergent or occasionally spreading, most 5–10 mm long and 1.5–3 mm wide, very narrowly obovate to elliptical, flat or almost so, with a very fine mostly appressed pubescence on both surfaces, rather firm in texture, the apex rounded to broadly acute and usually with a short, broad, blunt point, the base long-tapering to a short petiole. *Flowers* white or pink, c. 10 mm in diameter, occurring, usually singly, on short modified shoots, some axillary but most at the ends of short few-leaved axillary branches, the new growth apparently always rather limited. *Bracts* few, broad, red-brown and quite thin; the bracteoles similar but larger; at least some tending to persist until the flower opens. *Hypanthium* silky-pubescent, c. 2 mm long, tapering, more suddenly near the base, to a fluted pedicel section, the top of the ovary silky. *Sepals* persistent, 1–1.5 mm long, obtusely ovate-deltoid, thin, pale and sparsely silky with ciliate margins, rather keeled with the apex distinctly hooded and keeled. *Petals* 3–4 mm long. *Stamens* in bundles of c. 5, c. 1 mm long, the filaments somewhat broader in the lower part, the anther-cells c. 0.3 mm long, parallel, broad and shallow. *Style* inset, broad-based, with a large (relative to the style) stigma. *Ovary* (? always) 5-locular, each loculus with c. 20 ovules in 4 rows on a high, rather narrow but not small placenta. *Fruit* deciduous, not seen. *Seeds* not seen. Main flowering period: Sept.–Oct.

DISTRIBUTION: In the Leichhardt District of Queensland (Map 5). Usually in crevices in sandstone escarpments.

SELECTED SPECIMENS: QUEENSLAND: Leichhardt: Blackdown Tableland, c. 35 km SE. of Blackwater, *Henderson 1067 et al.*, 9.1971 (BRI, NSW); ridge N. of Arch Creek, "Early Storms", Carnarvon Creek, *Gittins 2773*, 9.1974 (NSW); Isla Gorge about 18 miles [29 km] SW. of Theodore, *Everist 8029*, 9.1968 (BRI, NSW).

35. *L. neglectum* J. Thompson sp. nov.

Frutex usque ad 2 m altus. Folia elliptica, 1–2 cm longa. Flores 8–11 mm diametro, sepalis pallidis sericeis persistentibus. Ovarium 3–5-loculare. Fructus 3–4 mm diametro decidui.

HOLOTYPE: QUEENSLAND: 17 km W. of Paluma, *E.M. Jackes & B.R. Jackes*, 9.9.1982 (NSW 154751).

SYNONYMY: *L. attenuatum* var. *subsessile* C.T. White, Proc. Roy. Soc. Queensland 50: 76 (1939). LECTOTYPE, here chosen: QUEENSLAND: Traverston [Traviston], *C.T. White* 6353 (fl.), 6.10.1929 (NSW). ISOLECTOTYPE: BRI.

Erect shrub to 2 m tall, rarely a tree of almost 10 m, with bark close and fibrous; the younger stems often slender, silky-pubescent at least at first, with the flange represented only by grooves from beside each node with the stem not or scarcely enlarged below, and with branching at 30° (-45°). *Leaves* diverging but not spreading widely, 10–20 mm long and 2–3 mm wide, elliptical, flat and usually rather firm, and silky-pubescent, becoming more glabrous but often with some hairs remaining on the margins, the apex obtuse to acute with a very short point, the base long-tapering to a short petiole. *Flowers* white, 8–11 mm in diameter, occurring singly or, rarely, 2-together on short modified leafless shoots, in adjoining axils and terminating short leafy side-branches, the new growth usually rather limited, somewhat more vigorous at branch-ends. *Bracts* few, red-brown and firm; the bracteoles larger; all well-developed but shed before the flower opens. *Hypanthium* densely silky-pubescent, c. 3 mm long, broad above and tapering, and abruptly contracting to a short pedicel, the top of the ovary silky. *Sepals* persistent, c. 1 mm long, ovate-oblong, pale, especially at the margin and rounded apex, usually silky at least in the centre and on the margins. *Petals* c. 4 mm long. *Stamens* in bundles of c. 5, 1 mm or less in length, the slender filaments somewhat broader in the lower part, the anther-cells c. 0.4–0.5 mm long, parallel, broad and shallow but folded back. *Style* a little inset, rather stout and straight, with a medium-sized stigma. *Ovary* 3–5-locular, each loculus with c. 15 ovules in 4 rows on a very high relatively large placenta. *Fruit* deciduous, 3–4 mm in diameter, rather silky and lobed in cross-section, widest where the upper part of the hypanthium forms an erect or incurved rim bearing erect or incurved sepals, the part about the ovary much wider than deep, usually contracted abruptly to a short, c. 1 mm or less, stalk, the valves very thin, raised high above the erect hypanthium-rim even before opening, and reaching the top of the sepals. *Mature seeds* c. 1.5 mm long, irregularly and rather narrowly obovate-oblong, finely and narrowly reticulate with occasional loose cells. Main flowering period: Oct. or earlier.

DISTRIBUTION: On the coast and eastern ranges of Queensland from Herberton to the Bundaberg district (Map 5). In sandy soil in rocky places.

SELECTED SPECIMENS: QUEENSLAND: North Kennedy: ... W. of the road from Ravenshoe to Koombooloomba Dam, *Clarkson* 2673, 10.1979 (BRI, NSW). Port Curtis: Shoalwater Bay, strait S. of Townshend Is., [and] Port Clinton Port 2, *Brown*, 8.1802 (BRI, MEL, NSW); c. 22 km from Agnes Water, S. of Gladstone, *Stanley* 78185 & *Ross*, 11.1978 (BRI). Burnett: ... Biggenden Bluff, *White* 7318, 10.1930 (BRI, NSW). Wide Bay: Burrum Heads, *Watson Q.F.D.* 62/259, 11.1961 (BRI).

This species is named for the lost opportunities associated with it. Brown's specimens show two manuscript names. E. Cheel corresponded with C.T. White about it under yet another name.

36. *L. lamellatum* *J. Thompson* sp. nov.

Frutex vel arbor usque ad 5 m vel altiora cortice lamellato. Folia elliptica plus minusve falcata, 1–2 cm longa. Flores 5–13 mm diametro, sepalis glabratis vel pubescentibus persistentibus. Ovarium 3–5-loculare. Fructus 2–4 mm diametro decidui.

HOLOTYPE: QUEENSLAND: 21 miles [34 km] S.E. of Bedourie Homestead, Leichhardt District, *N.H. Speck 1843*, 14.x.1963 (NSW). ISOTYPES: BRI, CANB.

Shrub c. 3 m tall or slender tree of more than 5 m with the bark of main stems in many, often reddish, papery layers; the younger stems very slender and silky-pubescent, later with the pubescence decreasing and irregular, without a flange and not or scarcely widening at each node, the branching at 30°–45°. *Leaves* diverging, 10–40 mm long and 1.5–4 mm wide, narrowly elliptical and often somewhat falcate, flat, often grey-green owing to a dense silky pubescence, sometimes later green but usually with some hairs remaining, the apex usually tapering to a short or long, often pungent, point, the base tapering and not or scarcely petiolate. *Flowers* white, 5–13 mm in diameter, occurring singly or 2 together on short modified shoots in adjacent axils (on adjoining branches), with new growth extending vigorously at branch-ends during and after flowering. *Bracts* few, firm, broad and red-brown; the bracteoles longer and more scarious; all shed from the young bud but leaving prominent scars. *Hypanthium* longitudinally ridged with a close, short pubescence, or glabrous, c. 2 mm long, much expanded in the upper part, tapering and then more abruptly to a rather fluted, tapering pedicel usually 3–5 mm long, the top of the ovary densely pubescent. *Sepals* persistent, c. 1 mm long, obtusely broadly ovate, somewhat keeled and hooded, with wide scarious margins but otherwise like the hypanthium, glabrous or somewhat short-pubescent. *Petals* 3–5 mm long. *Stamens* in bundles of 3–7, 0.5–1.5 mm long, the filaments often somewhat broad in the lower part, the anther-cells c. 0.4–0.5 mm long, parallel, broad and shallow but folded back. *Style* inset, rather stout, with a small stigma. *Ovary* 3–5-locular, each loculus with c. 12 ovules in 4 rows on a very high, relatively large, placenta. *Fruit* deciduous, usually 2–4 mm in diameter, the upper part of the hypanthium erect forming a wider rim, the part around the ovary narrower and lobed in cross-section, often somewhat tapering but usually, at the base, rounded above a rather stout, also tapering, stalk 2 mm or more in length, the valves, even before opening, conspicuously exerted, to the level of the persistent, erect, hooded sepals or beyond, so that the broad part of the fruit often appears almost spherical. *Mature seeds* 2–2.5 mm long, narrowly obovoid-cuneiform, shallowly reticulate with rows of loose cells. Main flowering period: Aug.-Nov.

DISTRIBUTION: Common in the Leichhardt District and scattered in other parts of inland Queensland (Map 5). In sandy soil in woodland or among rocks, often of watercourses, associated with ridges, especially of sandstone.

SELECTED SPECIMEN: QUEENSLAND: Leichhardt: Salvator Rosa National Park, near Nogoia R., *Blaxell 1495 and Armstrong*, 8.1977 (NSW). Mitchell: Enniskillen, *White 12380*, 11.1943 (BRI). South Kennedy: 8 miles [13 km] E. of "Clydevale" Station, *Adams 1272*, 8.1964 (BRI, CANB, NSW). Maranoa: 14 km N. of Ogilvie road junction on "Mt Moffat" road, *Wilson 3440*, 4.1981 (NSW). Burnett: Eidsvold, *Bancroft*, 12.1924 (BRI, NSW). Wide Bay: Maryborough District, *Young*, 2.1917 (NSW).

This species is named for the unusual bark commented upon by most collectors and included in the specimen by many.

37. *L. multicaule* A. Cunn. in Field, Geog. Mem. New South Wales: 349 (1825).

HOLOTYPE: NEW SOUTH WALES: barren, brushy hills near Bathurst, A. Cunningham 127 (K, n.v., photo NSW).

Erect to almost prostrate shrub less than 2 m in height and often forming dense thickets, the bark, as seen on specimens, close and tending to shed loose fibres;

the younger stems slender and usually with a dense silky pubescence, rarely glabrous, without a flange but sometimes with a short extension below each node, and often with branching at 30° or less but frequently with the branches adjusting later to a wider angle. *Leaves* erect at first but later spreading, very variable, 2–10 mm long and 1–3 mm wide, usually narrowly to broadly elliptical or broader towards the apex, flat or tending to be concave, rarely slightly convex, usually at least in part with an appressed silky pubescence especially on the lower surface, the apex shortly acute to acuminate, rarely obtuse, with a short point tending to recurve, the base tapering to a very short broad petiole. *Flowers* pink or white, 6–10 mm in diameter, singly or occasionally 2 together on short modified shoots that are axillary in adjoining axils and at the ends of short few-leaved axillary branches, the new growth rather irregular but usually vigorous at branch ends. *Bracts* few, broad and red-brown, rather scarious, the inner and bracteoles large, the latter a little narrower, but shed before the flange opens. *Hypanthium* with appressed silky hairs occasionally the pubescence absent from the upper part or the whole, c. 2.5 mm long, the upper part spreading, the lower tapering and rather fluted above a very short, < 1mm, pedicel, the top of the ovary silky-pubescent. *Sepals* persistent, c. 1–1.5 mm long, shortly deltoid to oblong, broadly obtuse but often appearing acute because keeled and rather hooded behind the apex, the whole or at least the margins thin and pale, glabrous or pubescent especially near the centre, the margins usually with some cilia. *Petals* c. 2.5 mm long. *Stamens* in bundles of 3–5, c. 1.5 mm or less in length, with some filaments very broad in the lower part, the anther-cells c. 0.3–0.4 mm long, parallel, broad and shallow, with some folded back. *Style* scarcely inset, somewhat broad-based with a small stigma. *Ovary* 3 (–4)-locular, each loculus with up to c. 10 ovules in (2–)4 rows on a very high short, broad and rather shallow placenta. *Fruit* deciduous, c. 3.5 mm in diameter, rather silky, widest where the erect upper part of the hypanthium forms a conspicuous rim bearing erect hooded sepals, the part about the ovary conspicuously lobed in cross-section and contracting suddenly to an almost inset short stalk, the valves thin, much exerted even before opening and often extending to or beyond the tips of the large sepals. *Mature seeds* few, c. 2 mm long, obovoid-cuneiform, very dark with a very coarse almost foveate-reticulate surface. Main flowering period: Oct.–Nov.

DISTRIBUTION: Widespread on the Central and Southern Tablelands of New South Wales and in adjoining parts of the Western Slopes and Victoria (Map 5). In woodlands and on dry hillsides.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Tablelands: Hill End, *Cabbage* 2679, 7.1911 (NSW). Southern Tablelands: SE. foot of Black Mtn, Canberra, A.C.T., *Darbyshire* 1249, 10.1963 (CANB, NSW); North Queanbeyan, *Cabbage* 3370, 12.1911 (NSW). Central Western Slopes: Bowen Park, *Blakely NSW* 61319, 10.1906 (NSW). South Western Slopes: 4 miles [6.4 km] SSW. of Carabost, NE. of Holbrook, *Logan NSW* 84022, 11.1966 (NSW). VICTORIA: Northeastern Highlands: Mitta Mitta, *Clinton* 1651, 2.1918 (NSW).

38. *L. divaricatum* Schauer in Walp. Rep., Suppl. 1: 923 (1842).

HOLOTYPE: NEW SOUTH WALES: in Nov. Camb. austr. interioris [Lachlan R.], A. Cunningham 196 (? n.v.). **ISOTYPE:** K, n.v., photo NSW.

SYNONYMY: *L. trivalve* Cheel, J. & Proc. Roy. Soc. New South Wales 65: 201 (1932), as *L. trivalvum*. **LECTOTYPE,** here chosen: NEW SOUTH WALES: Dubbo to Tomingley, J.H. Maiden, September, 1898 (NSW).

Several-stemmed, erect or rather weeping shrub 1–4 m tall with compact and fibrous bark; the younger stems slender and pubescent with long appressed or, more frequently, curled or irregular hairs, without a flange but extended just below each node, the branching spaced and usually at an angle of c. 45° though often curving to make this appear smaller. *Leaves* divergent to spreading widely, 2–7 (–10) mm long and 1–2(–3) mm wide, broadly to narrowly elliptical or obovate, concave or infolded but recurving from the stem, with at least some appressed or spreading silky hairs and often, especially at the base of the upper surface, some curled hairs, the apex acute with a pungent, often slightly incurved, point, the base tapering to a short broad petiole. *Flowers* white, 6–10 mm in diameter, single, or, rarely, 2 together, on short modified axillary shoots at the ends of short crowded few-leaved shoots on crowded branches, the new growth developing at branch-ends after flowering. *Bracts* few, broad and dark red-brown, the inner and bracteoles much longer and larger, enveloping the bud but shed before it opens. *Hypanthium* with long fine spreading hairs, often more sparse on, or even absent from, the upper part, c. 2 mm long, the upper part spreading widely, the lower tapering and somewhat fluted and narrowing rather gradually to a tapered pedicel 0.5–1.5 mm long, the top of the ovary with a rather silky pubescence at least around the base of the style. *Sepals* persistent, 1–1.2 mm long, a little keeled near the tip, somewhat acute, usually deltoid, with spreading hairs at least in the centre, the margins scarious, glabrous or rarely ciliate. *Petals* 2.5–3.5 mm long. *Stamens* in bundles of 3–5, c. 1.2 mm long, with some filaments broad in the lower part, the anther-cells c. 0.4 mm long, parallel, broad and shallow. *Style* often scarcely inset, narrow with a small stigma. *Ovary* (2–) 3 (–4)-locular, each loculus with c. 12–20 ovules in 4 rows on a high, broad, small and shallow placenta. *Fruit* deciduous, c. 4 mm in diameter, with long spreading hairs, widest at the erect rim-like upper part of the hypanthium bearing erect or spreading sepals (often with inrolled or incurved margins), the part about the ovary conspicuously lobed in cross-section and rounded above an inset stalk up to 2 mm long, the valves thin, much exerted even before opening and often extending almost to the tips of the large sepals. *Mature seeds* few, c. 2.2 mm long, oblong, very dark with a very coarse almost foveate-reticulate surface. Main flowering period: Aug.–Oct.

DISTRIBUTION: On the Central Western Slopes of New South Wales and nearby on the North Western Slopes, and on the Western Plains southward from Nymagee (Map 5). Usually in sclerophyll woodland or heath, on dry hillsides or in mallee.

SELECTED SPECIMENS: NEW SOUTH WALES: North Western Slopes: Warrumbungle Ranges, *Forsyth NSW 28562*, 10.1901 (NSW). Central Western Slopes: c. 8 km N. of Tomingley on Narromine road, *Moore 6792*, 9.1974 (CANB, NSW); 14 km NE. of Alectown on Baldry road via Gingham Gap, *Coveny 10283*, 10.1978 (NSW). South Western Plains: Marobee, E. C. Repeater Station, c. 60 km S. of Nymagee, *de Nardi 609*, 9.1971 (NSW); summit of Mt Binya, Cocopara Range, *Willis MEL 503328*, 9.1969 (NSW).

Specific Descriptions — Group 2.

L. petersonii subgroup (spp. 39–44), Map 6.

39. *L. emarginatum* Wendl. f. ex Link, Enum. Hort. Berol. Alt. 2: 25 (1822).

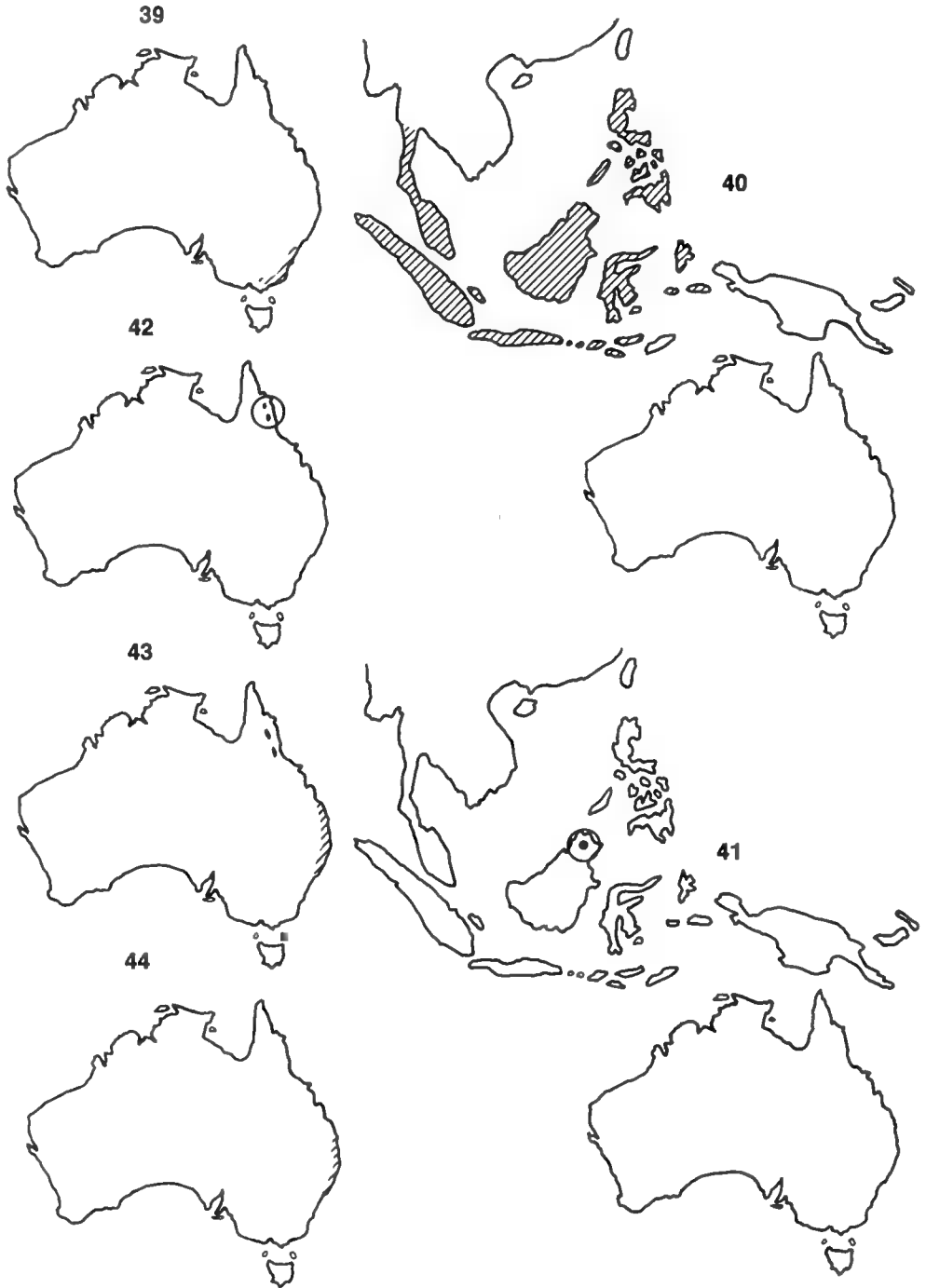
HOLOTYPE: Hab. in Australia (? B, n.v.). ISOTYPE: NSW.

SYNONYMY: *Leptospermum odoratum* Cheel, J. & Proc. Roy. Soc. New South Wales 53: 122 (1919). LECTOTYPE, here chosen: NEW SOUTH WALES: *Robt. Brown*. Iter Australiense 1802–1805 (NSW, ex E). Specimens labelled Sydney (Port Jackson), banks of the River Grose, *Robert Brown*, December 1804 (NSW ex BM (2 sheets), MEL), are probably duplicates.

Shrub to 4 m in height with rough rather irregular bark; the younger stems only briefly silky-pubescent, soon glabrous, with a wide flange, especially just below the node, carried above the side of the leaf-base, and with branching often at 30° or less. *Leaves* aromatic, divergent or later more spreading, (10–) 20–30 (–35) mm long and usually 2.5–7 mm wide, oblanceolate, narrowly obovate or elliptical, usually flat but often with a twist at the base, glabrous or with some hairs at the retuse apex, on the margins and/or at the base, long-tapering to a rather broad base. *Flowers* white, c. 7 mm in diameter, up to 5, on modified shoots, often in adjacent axils, and at the ends of short few-leaved branches in adjacent axils, usually with the terminal bud showing little or no development and with vigorous growth beyond, from branch-ends at flowering time, the new growth often reddish. *Bracts* broad and red-brown; the bracteoles longer than broad with dense fine hairs at the margins and the tip; all so soon shed as to be rarely seen. *Hypanthium* glabrous and dark-coloured with conspicuous glands, often 2–3 mm long, the upper part much expanded, all gradually tapering to a tapering pedicel 3–4 mm long, the top of the ovary glabrous. *Sepals* usually, but not invariably, deciduous, 1–1.5 mm long, almost hemispherical, glabrous except for few to numerous crisped hairs near the apex and on the margins, the centre usually dark like the hypanthium but the margins scarious and pale. *Petals* c. 3–4 mm long. *Stamens* in bundles of c. 5, 2.5–4 mm long, the anther-cells, c. 0.4 mm long, parallel, broad, often ultimately shallow but sometimes with the somewhat longer outer part deep (their opening restricted or tardy), often tending to curve back and to fold back. *Style* inset, broad-based and rather stout, with a small stigma. *Ovary* (3–) 5-locular, each locus with 40–50 ovules in 6 rows on a rather high, very large, rounded placenta. *Fruit* not persisting, 3.5–5 mm in diameter, glabrous, the upper part of the hypanthium broad, rim-like and erect, sometimes with some persisting calyx-lobes, the lower part narrower, lobed in cross-section and rather rounded above a tapering long stalk often 3–4 mm in length, the valves somewhat woody, much exerted and, before opening, high and domed so that the broad part of the fruit is almost spherical, but after opening spreading, often beyond the rim. *Mature seeds* c. 1.5 mm long, narrowly cuneiform, with an irregularly striate surface. Main flowering period: Nov.-Jan.

DISTRIBUTION: In the central and southern coastal regions of New South Wales and in East Gippsland, Victoria (Map 6). On river banks and in rocky stream beds.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Nepean R., *Deane NSW 156256*, 9.1888 (NSW). South Coast: Currawan Creek, 10 miles [16 km] from Nelligen on Braidwood road, *Constable NSW 44454*, 10.1957. Central Tablelands: Nattai R.,



Map 6. Distribution of Group 2: subgroup 1 *L. petersonii* and allies. 39. *L. emarginatum* 40. *L. javanicum* 41. *L. recurvum* 42. *L. wooroonooran* 43. *L. petersonii* a. subsp. *lanceolatum* b. subsp. *petersonii* 44. subsp. *liversidgei*.

near [Colo via] Hilltop, *Cheel* NSW 154931, 11.1911, NSW 154932, 12.1919, NSW 154933, 10.1920. VICTORIA: East Gippsland: Little R., *Whaite* NSW 154753, 1.1949.

40. *L. javanicum* Blume, Bijdr. 1: 1100 (1826).

HOLOTYPE: JAVA: in cacumine montis Gede (L).

SYNONYMY: *Macklottia javanica* (Blume) Korth., Ned. Kruidk. Arch. 1: 196 (1847).

Glaphyria nitida Jack, Trans. Linn. Soc. London 14: 128 (1823), non *Leptospermum nitidum* Hook. f. HOLOTYPE: SUMATRA: Gunong Bunko, (n.v.), fide E.D. Merrill, Jack's genera and species of Malaysian plants, J. Arnold Arbor. 33: 226 (1952).

L. alpestre Blume, loc. cit. HOLOTYPE: JAVA: in declivitatibus altioribus montis Gede (L).

L. amboinense Blume, loc. cit. HOLOTYPE: MOLUCCAS: in Moluccis ... (L). *Macklottia amboinensis* (Blume) Korth., Ned. Kruidk. Arch. 1: 196 (1847). Blume did not base this species on *Myrtus amboinense* Rumphius as is assumed by many authors.

? *L. floribundum* Junghuhn, Natuur-Genesck. Arch. Ned.-Indië 2: 34–54 (1845), non Salisb. HOLOTYPE: JAVA: javanicae alpinae, but specimen not cited (?L, n.v.). From the detailed description this taxon matches high altitude forms of *L. javanicum* except for the description of the flowers as 'solitarii, sine plures (bini, terni) in axillis foliorum'. It is possible that the congested growth referred to has caused misinterpretation of the position of flowers.

L. annae Stein in Regel, Gartenflora.: 66 (1885). TYPE: Mt Apo, Philippines, n.v., fide Merrill, Enum. Philippine Plants: 184 (1923).

A shrub or tree often gnarled, to 8 m or more in height with persistent and rather flaky bark; the younger stems with a silky often rather persistent pubescence, a flange broad and rather thick, especially near the node, and extending around the sides of the leaf-base, and branching at 30°–40°. *Leaves* divergent, usually 15–35 mm long and 3–7 mm wide, but occasionally much smaller, broadly oblanceolate to obovate or, often somewhat rhombically, elliptic, variable in texture, flat or with recurved margins, and glabrous for the most part but occasionally densely pubescent on the lower surface, the apex rounded, broadly obtuse or even minutely retuse with a small umbo behind the tip, or rather acute with a longer blunt point and somewhat recurved, often with a tuft of hairs, the base tapering, rather broad and petioleless with a thick midrib-base behind. *Flowers* white, rarely flushed pink, c. 10–12 mm in diameter, single or 2 or more together on modified shoots, terminal, in upper leaf-axils and on very short axillary branches, the rather pink new growth from the flowering region after or during flowering. *Bracts* broad, red-brown, the inner and the bracteoles relatively large and scarious, usually with dense cilia near the apex, often tending to persist about the flower. *Hypanthium* c. 2–3 mm long, very broad above and tapering to a short broad pedicel; glabrous or somewhat silky-pubescent, with the surface rather dark coloured and with conspicuous glands, the top of the ovary glabrous. *Sepals* deciduous, sometimes tardily, c. 1.5–2 mm long, oblong to almost hemispherical, usually glabrous for the most part but with dense crisped hairs at the apex, variable in texture, hypanthium-like or with scarious margins or entirely scarious. *Petals* c. 4–6 mm long. *Stamens* in bundles of c. (3–) 5–7, 2–3 mm long, the anther-cells c. 0.2–0.3 mm long, usually parallel but occasionally separating, often recurved and rather deep especially the outer part. *Style* inset, but sometimes only shallowly so, usually rather slender with a broad or narrow base and small stigma. *Ovary* 5-locular at least for the most part, each loculus with c. 12–24 ovules in c. 4–6 rows on a high, rather small placenta with an often narrow top which is usually and somewhat variously extended. *Fruit* tending to persist but not on older branches, 4–8 mm in diameter, widest at the erect, rather than extended and woody, hypanthium-rim, the lower part often somewhat lobed in cross-section, at least at first, and very broad-based above a very short pedicel, the woody

valves exerted, often forming a narrow-topped dome, to a distance almost equal to, or occasionally much exceeding, the base before opening, later spreading so as to be wider than the base and about equal to the rim occasionally with the base almost horizontal. *Mature seeds* c. 2–2.5 mm long, irregularly narrowly linear-cuneiform, striate. Flowering period: perhaps throughout the year.

DISTRIBUTION: From Burma and southern Thailand to the Philippines, Moluccas and Lesser Sunda Islands (Map 6). In sandy and rocky places, especially on high mountains, usually on sandstone, granite or ultrabasic rocks.

SELECTED SPECIMENS: BORNEO: Sabah: Peak Trail, Mt Kinabalu, 2200 m alt., *Wallace 84379*, 1.1984 (NSW). PHILIPPINES: Luzon: Lamao R., Mt Mariveles, *Borden F.B. 788*, 5.1904 (NSW). Mindanao: Surigao Province, *Ramos & Paseasio B.S. 34493*, 4.1919 (BRI, NSW); Todaya (Mt Apo), *Elmer 10628*, 5.1909 (NSW). JAVA: Mt Gede, *Junghuhn (L)*. SULAWESI: Mt Roroka Timbu summit, *V. Balgooy 3323*, 5.1979 (L). CERAM: Kairatu, Waiselang, *Kuswaka & Soepadmo 221*, 6.1959 (NSW). LESSER SUNDA ISLANDS: Manau near Ruteng, W. Flores, *Kostermans & Wirawan 594*, 4.1965 (L).

The variation in this species does not allow subdivision into subspecific taxa on the evidence available at present. It would appear that the species has become diverse because it inhabits islands and "islands" of suitable habitat, mostly on nutrient-poor soils and high mountain-tops, to which it migrated probably by long-distance dispersal, and as a single event, from northeastern Australia where closely related species are still found.

Mueller (1890) and Diels (1922, as *L. amboinense*) refer to the presence of the species in New Guinea. From the description given, of a plant with flowers in terminal heads, these references are obviously based on material of another genus.

41. *L. recurvum* Hook. f., *Icon. Pl.*: t. 893 (1852).

HOLOTYPE: BORNEO: Kina Balu, abundant, from 7000–8500 feet, whitening the top of the mountain, *H. Low, Esq. (K, n.v.)*.

Prostrate shrub, small tree or tree 20 m or more in height, with persistent rather flaky pale bark; the younger stems silky-pubescent or glabrous, with a broad and rather thick flange, especially near the node and extending around the sides of the leaf-base, the branching at c. 45°. *Leaves* divergent but usually strongly recurved so as to appear spreading, usually 3–6 mm long and 2–3 mm wide, broadly elliptical to orbicular-obovate, firm on the upper surface which is usually glabrous at least for the most part and usually glossy, the lower surface silky-pubescent or occasionally glabrous, the margins often strongly recurved, the apex strongly recurved or curled so as to appear retuse (actually broadly acute), often with a long tuft of hairs from behind the tip, the base tapering, broad and petioleless, and thickened by the stout midrib-base. *Flowers* white, c. 12 mm in diameter, single on modified shoots in upper leaf-axils and on very short axillary branches and perhaps also as axillary monads, the flowering area very condensed at branch-ends with several orders together, i.e. with a new shoot, often with pinkish-leaves, bearing new flowers found arising from the base of an old flower. *Bracts* broad and red-brown, the inner and bracteoles large, with at least some crisped hairs on the margins and at the apex, all tending to remain about the open flower. *Hypanthium* glabrous or with a somewhat spreading silky pubescence, or with dense curled hairs, the surface often tinged dark and sometimes with conspicuous glands, c. 2–3 mm long, very broad above and tapering to a very short or occasionally a 2 mm long pedicel, the top of the ovary glabrous. *Sepals* deciduous, c. 1.5–2 mm long,

almost hemispherical, variably pubescent but if almost glabrous always with crisped hairs on the margins and at the apex, usually paler and thinner towards the margin. *Petals* c. 5 mm long. *Stamens* in bundles of 5 (-7), c. 2.5 mm long, the anther-cells c. 0.3 mm long, parallel and rather deep, especially the outer part. *Style* inset, rather stout-based with a small stigma. *Ovary* 5-locular at least for the most part, each loculus with c. 20 ovules in c. 4 rows on a small high placenta, narrowed and variably extended at the top. *Fruit* tending to persist but not on older branches, c. 6-7 mm in diameter, widest just below the erect hypanthium-rim, tapering to or rounded above a short, broad, stalk-like section c. 1 mm long, the valves woody, before opening exerted to a distance almost equal to the broad part of the base, later opening wider so as to be wider than the base but about equal to the rim. *Mature seeds* c. 2-2.5 mm long, irregularly linear-cuneiform, striate. Flowering period: perhaps throughout the year.

DISTRIBUTION: Endemic on Mt Kinabalu, Borneo (Map 6). In rock crevices and in sandy soils, on granite and on ultrabasic rocks at high altitudes.

SELECTED SPECIMENS: BORNEO: Sabah: Panar Lahan, Mt Kinabalu, *Wallace 84045, 84046*, 1.1984 (NSW), *Binideh Fl. Sabah. No. 65175*, 11.1968 (L); Sayat-Sayat, Mt Kinabalu, *Wallace 84037, 84038*, 1.1984 (NSW).

The leaves of this species vary a great deal in shape, size and pubescence. In other characters it resembles *L. javanicum* from which it appears to be a high-mountain selection, endemic on Kinabalu. In view of the pattern of variability of *L. javanicum* and a similar, less successful, separation of a variant form of *L. javanicum* (Lee & Lowry, 1980) in the Celebes, this taxon is treated as a species in this work only in order to follow current usage pending a detailed study of the group of species related to *L. javanicum*.

42. *L. wooroonooran* Bailey in Bailey & A. Meston, Rep. Exped. Bellenden-Ker: 40 (1889).

HOLOTYPE: QUEENSLAND: South Peak, Bellenden-Ker, [*F.M. Bailey*, 22.6.1889] (BRI).

Dwarfed tree with a horizontal trunk and persistent and rather flaky fibrous bark; the younger stems silky, glabrescent, with a very conspicuous broad flange, broadest near the node where it is carried up beside the leaf-base and narrowing below, and with branching at an angle of 30°-45°. *Leaves* usually divergent, mostly 1.5-2 cm long and 3-7 mm wide, rather rhombically oblanceolate, silky when young, quite firm in texture (considering the habitat), the upper surface somewhat thicker so that the margins tend to recurve, otherwise flat, the apex acute and recurved so as to appear retuse, the lower part tapering to a broad virtually petioleless base thickened at the back by the stout midrib. *Flowers* white, 12-20 mm in diameter, occurring singly on modified shoots usually on very short 1-few-leaved (or with this leaf reduced to a bract) branches in adjacent axils, the somewhat reddish new growth extending from branch ends before and beyond the flowering region development. *Bracts* red-brown, rather scarios, the outer shorter, the inner and bracteoles relatively larger and concave, glabrous except near the top, and shed before the flower opens. *Hypanthium* glabrous, and often with obvious glands, 3.5-4.5 mm long, tapering from an expanded upper part to a short tapering pedicel, the top of the ovary glabrous. *Sepals* mostly readily deciduous, c. 2 mm long, broadly ovate, the centre and base thicker but the margins thin and pale, glabrous except for the dense crisped hairs on the margins and at the apex. *Petals* 4-6 mm long. *Stamens* in bundles of 3-5, 1.5- > 2 mm long, the anther-cells c. 0.5 mm long, parallel and folded back. *Style* inset, rather slender, the stigma not large. *Ovary*

5-locular, each loculus with c. 12–24 ovules in c. 4 rows on a high placenta usually with a narrow top which is not much, if at all, extended. *Fruit* persistent, 4–5 mm in diameter, the hypanthium-rim expanded, ultimately horizontal, undulating and woody, in the lower part the fruit lobed in cross-section, relatively deep and rounded above or broadly tapering to a rather stout stalk c. 1 mm long, the valves somewhat woody, usually much shorter than the deep base and not spreading wider than the rim. *Seeds* (not seen mature) c. 2.5 mm long, striate. Main flowering period: Nov.

DISTRIBUTION: On the high granite mountains of far northern Queensland (Map 6). In wet cloudy sites on exposed rock outcrops or among rocks of stream-banks.

SELECTED SPECIMENS: QUEENSLAND: Cook: Bellenden Ker, *White*, 1.1923 (BRI, NSW); summit of Centre Peak, Bellenden Ker, *Cabbage* 3829, 8.1913 (NSW), *Webb & Tracy* 10799, 11.1972 (BRI).

43. *L. petersonii* Bailey, Queensland Agric. J. 15: 781 (1905).

HOLOTYPE: QUEENSLAND: Wilsons Peak, *W.J. Peterson*, Jan. 1905 (BRI). **ISOTYPE:** NSW.

SYNONYMY: *Leptospermum flavescens* var. *citratum* J.F. Bail. & C.T. White [Queensland Agric. J., n.s. 5: 161, t. 2 (1916) nom. nud.], Bot. Bull. Dept. Agric. 18: 8, t. 2 (1916). **SYNTYPES:** QUEENSLAND: Springbrook, Macpherson Range, *C.T. White*, June 1914, Dec. 1915, Jan. 1916 (BRI).

Leptospermum citratum R.W. Challinor, Cheel & A.R. Penfold, J. & Proc. Roy. Soc. New South Wales 52: 175 (1918). **TYPE:** not designated.

Dense shrub or diffuse small tree to 5 m or more in height with rather flaky persistent fibrous bark; the younger stems slender, only briefly somewhat hirsute, soon glabrous, with a conspicuous, rather pale wide flange around each leaf-base and extending down the stem and a shallow ridge below the node, and with branching at an angle of 30°–40°. *Leaves* aromatic, divergent to spreading, rarely deflexed, usually 20–40 mm long and 2–5 mm wide, elliptical to narrowly lanceolate, flat or with the margins tending to recurve, glabrous or with some hairs near the base, sometimes, especially on young growth, thin in texture, the apex acute or rounded, often retuse, sometimes tending to recurve, occasionally apiculate, the base tapering, lacking a petiole but broad-based with the midvein stout at the back. *Flowers* white, 10–15 mm in diameter, occurring singly, rarely 2 together, on modified shoots in adjacent leaf-axils or at the ends of very short axillary branches, with little, if any, development of the terminal bud, the new growth, often tinged red or purple, extending vigorously from beyond the the flowering region. *Bracts* rather pale red-brown and scarious, the outer short and broad, the inner and bracteoles thin, very large and glabrous except at the pubescent apex, all shed from well-developed buds. *Hypanthium* glabrous or almost so, usually rather dark-coloured and with obvious glands, 3–4 mm long, the upper part widely expanded, tapering to a broad base often with a very short broad pedicel, the top of the ovary glabrous. *Sepals* deciduous, occasionally somewhat tardily, 1.5–2.5 mm long, very broadly ovate to hemispherical, scarious and glabrous except for dense, crisped, fine hairs on the margins and especially dense at the apex. *Petals* c. 5–6 mm long. *Stamens* in bundles of 5–7, 2.5–3.5 mm long, the anther-cells c. 0.3–0.5 mm long, parallel and shallow or with the often much broader outer part deep. *Style* inset, tapering to a medium-sized stigma; occasionally reduced or absent. *Ovary* 5-locular, each loculus with c. 20–50 ovules in c. 6 rows on a broad, high placenta, extended but not much narrowed at the top; occasionally absent. *Fruit* persisting but on slender branches and not found on old wood, c. 6 mm in

diameter, widest at the hypanthium-rim, the lower part very shallow and somewhat lobed in cross-section, the base broadly rounded, sometimes with a trace of a stalk, the valves rather woody, before opening exerted so as to be almost equal to the base but later spreading so as to be twice or more as deep and broader than the base, and as wide or even somewhat wider than the rim. *Mature seeds* c. 2 mm long, slender, irregularly narrowly linear-cuneiform, the surface finely striate. Main flowering period: Dec.-Jan.

DISTRIBUTION: Scattered, from tropical Queensland to the Port Macquarie district of New South Wales (Map 6). In sandy soils, along creeks and on rocky escarpments near wet sclerophyll forest or rainforest.

Key to subspecies

- 1 Leaves narrowly lanceolate to elliptical, the leaf-apex usually retuse. Leaves often strongly lemon-scented subsp. *petersonii* a.
- 1* Leaves lanceolate, the apex usually acute or rounded. Leaves not strongly lemon-scented subsp. *lanceolatum* b.

a. subsp. *petersonii*.

SYNONYMY: as for the species.

Leaves narrowly lanceolate to elliptical, tapering to a broad, usually retuse apex; often strongly lemon-scented. Main flowering period: Dec.-Jan.

DISTRIBUTION: From Fraser Island, Queensland, to the Port Macquarie district of New South Wales, on coastal flats and ranges and on the eastern edge of the Dividing Range (Map 6). On sandy soils, along creeks and on rock escarpments, often at the edge of wet sclerophyll forest or rainforest.

SELECTED SPECIMENS: QUEENSLAND: Wide Bay: Blackall Range, *White*, 4.1918 (BRI, NSW). Moreton: Mt Barney, *Telford CBG 027967*, 5.1969 (NSW). NEW SOUTH WALES: North Coast: Copmanhurst, *Blakely & Shiress NSW 143908*, 9.1922 (NSW). Northern Tablelands: Lookout Point, Gibraltar Range, *Constable NSW 143909*, 4.1956 (NSW).

b. subsp. *lanceolatum* J. Thompson *subsp. nov.*

Folia aromatica sed non vixve citriodora, apice angusto non retuso.

HOLOTYPE: NEW SOUTH WALES: cultivated Castle Hill [Sydney] from seed ex Herberton distr., *C. Debenham s.n.* [ex Museum of Applied Arts and Sciences Herbarium Sydney, N.S.W.], 9.1965 (NSW).

Leaves lanceolate, tapering to an acute or narrowly rounded and often apiculate apex; aromatic with a spice-like odour but scarcely if at all lemon-scented. Main flowering period: Jan.

DISTRIBUTION: In the North Kennedy District of tropical Queensland (Map 6). In sandy soils, on creek banks and escarpments on rainforest margins.

SELECTED SPECIMENS: QUEENSLAND: North Kennedy: Herberton, *Michael NSW 154754*, 1.1918 (NSW); Wild R. watershed, *Volk* [ex Museum of Applied Arts and Sciences herbarium], 4. 1957 (NSW), 5.1957 (NSW); Mt Spec area, 12 km W. of Paluma township, *Jackes NSW 154755*, 8.1980 (NSW).

Neither subspecies is known from a large number of field collections, and although ssp. *petersonii* is widely cultivated it is unlikely that cultivated specimens display the whole variation found within the subspecies. Certainly collections have been made in New South Wales which lack the distinctive lemon-scent and leaf-apex. Further collections of both subspecies may reveal other characters by which they can be distinguished, or on the other hand new collections may blur the distinction. It seems advisable on our present knowledge to recognise the taxa at subspecific level.

This species needs examination in relation to *L. javanicum*. Some specimens of that species from Flores in the Lesser Sunda Islands show a remarkable similarity to some specimens of the northern subspecies of *L. petersonii*. However the valves of *L. petersonii* do not appear to form an acute high dome, with the greatest height near the style, in the young fruit, a feature that appears to be characteristic of *L. javanicum*.

44. *L. liversidgei* R. Baker & H.G. Smith, J. & Proc. Roy. Soc. New South Wales 39: 124, t. 2 (1906).

LECTOTYPE, here chosen: NEW SOUTH WALES: Ballina, *D.W. Munro s.n.*, March 1905 (NSW).

SYNONYMY: *Leptospermum flavescens* var. *citriodorum* Bailey, Queensland Agric. J. 15: 781 (1905). *L. polygalifolium* var. *citriodorum* (Bailey) Domin, Biblioth. Bot. 89: 452 (1928). LECTOTYPE, here chosen: QUEENSLAND: Peel Island [Moreton Bay], *W. Soutter s.n.*, 1904 (NSW). ISOTYPE: BRI.

Compact shrub to 4 m in height, but often 0.5 m or less, with close bark; the younger stems slender, with a short, often crisped, pubescence, without a flange but enlarged just below each leaf-base, their branching at from 0° (flush with the stem) to 45° but most stems at a narrow angle. *Leaves* lemon-scented, dense and erect to spreading, usually 5–7 mm long and 1–2 mm wide, narrowly obovate, thick especially in the upper part and somewhat incurved from the margins, glabrous, with the apex broadly acute to obtuse, often with an umbo behind the somewhat recurved tip, and long-tapering at the base to an, often very short, petiole. *Flowers* white or pink, c. 10–12 mm in diameter, occurring singly on modified shoots at the ends of short few-leaved branches in adjacent axils, and occasionally of long slender leafy branches, with little, if any, development of the terminal shoot-bud, the new growth, sometimes with coloured tips, is developed vigorously elsewhere, both above and below the flowering region, at, and after, flowering-time. *Bracts* short, broad and rather pale and scarious; the bracteoles very concave, red-brown and scarious, enclosing the flat-topped young bud but soon shed so that only the bracts remain. *Hypanthium* glabrous or minutely pubescent, and dark-coloured with rather conspicuous glands, c. 2.5 mm long, at first evenly tapering, later very broad above and with a distinct broad pedicel 1–1.5 mm long, the top of the ovary glabrous. *Sepals* persistent or tardily deciduous, c. 2 mm long, almost hemispherical to deltoid, dark, with pale scarious margins, glabrous, or somewhat erose at the apex. *Petals* c. 5 mm long. *Stamens* in bundles of 5–7, 1.5–2.5 mm long, the anther-cells c. 0.4 mm long, parallel, broad and with the outer part larger and often deeper though ultimately shallow, not recurved but tending to fold back. *Style* inset, rather stout and tapering slightly to behind a very large stigma. *Ovary* (3–) 5-locular, each loculus with c. 10–20 ovules in c. 6 rows on a high placenta extended but narrowed (acute) at the top. *Fruit* persistent often with the base tending to be sunk in the stems, usually 7–10 mm in diameter, much wider than deep, with a broad, very woody, rim, below this tapering to

the base (i.e. without the pedicel found in the flower), the surface firm and wrinkled, the valves very thick and woody, on opening exerted to c. ½ the depth of the base, later spreading but not wider than the rim. *Mature seeds* c. 1.5–2 mm long, irregularly cuneiform, striate with the striations tending to lift. Main flowering period: Jan.

DISTRIBUTION: From the Bundaberg district of Queensland to Port Stephens in central New South Wales (Map 6). In coastal low-lying, sandy and peaty swampy heath.

SELECTED SPECIMENS: QUEENSLAND: Wide Bay: Fraser Island, *White*, 10.1921 (NSW). Moreton: Bilinga [as Belinga], *Jackson*, 1.1931 (NSW). NEW SOUTH WALES: North Coast: Diamond Head, Crowdy Bay National Park, *Coveny 9892 & Haegi*, 11.1977 (NSW); Bombah Point, Myall Lake, *Constable NSW 19175*, 1.1952 (NSW).

L. polygalifolium subgroup (spp. 45–51), Map 7.

45. L. polygalifolium *Salisb.*, Prodr. 350 (1796); *Domin, Biblioth. Bot.* 89: 451 (1928).

HOLOTYPE: juxta Port Jackson [New South Wales], legit *Dav. Burton* (? K, n.v.).

SYNONYMY: *L. flavescens* *Smith*, Trans. Linn. Soc. London 3: 262 (1797). **HOLOTYPE:** NEW SOUTH WALES: Port Jackson, *Mr White 878.8*, 1795, (LINN, n.v., photo NSW & BRI).

L. porophyllum *Cav.*, Icon. 4: 17, t. 330, fig. 2 (1797). **HOLOTYPE:** NEW SOUTH WALES: prope oppidum Jackson in Nova-Hollandia, herb. *Née* (MA, n.v.).

L. stellatum *Cav.*, loc. cit., partim, the protologue containing elements of *L. trinervium*. **TYPE:** NEW SOUTH WALES: Port Jackson, herb. *Née*, fl. April (MA, n.v.).

Melaleuca thea *Wendl. f. & Schrader*, Sert. Hannov.: 24, t. 13 (1797). *Leptospermum thea* (*Wendl. f. & Schrader*) *Willd.*, Sp. Pl. 2: 949 (1799). **TYPE:** The illustration, t.13.

L. flavescens var. *commune* *Benth.*, Fl. Austral. 3: 104 (1867). *L. polygalifolium* var. *commune* (*Benth.*) *Domin, Biblioth. Bot.* 89: 452 (excl. specimen cited). **TYPE:** Bot. Mag. t. 2695.

L. flavescens var. *microphyllum* *Benth.*, loc. cit. **SYNTYPES:** "chiefly in Queensland" (K, n.v.).

L. flavescens var. *leptophyllum* *Cheel* in *A.R. Penfold, J. & Proc. Roy. Soc. New South Wales* 56: 166 (1922). **HOLOTYPE:** NEW SOUTH WALES: Copmanhurst, Clarence R., *J.L. Boorman NSW (? timber no.) 11594*, 5.1916 (NSW).

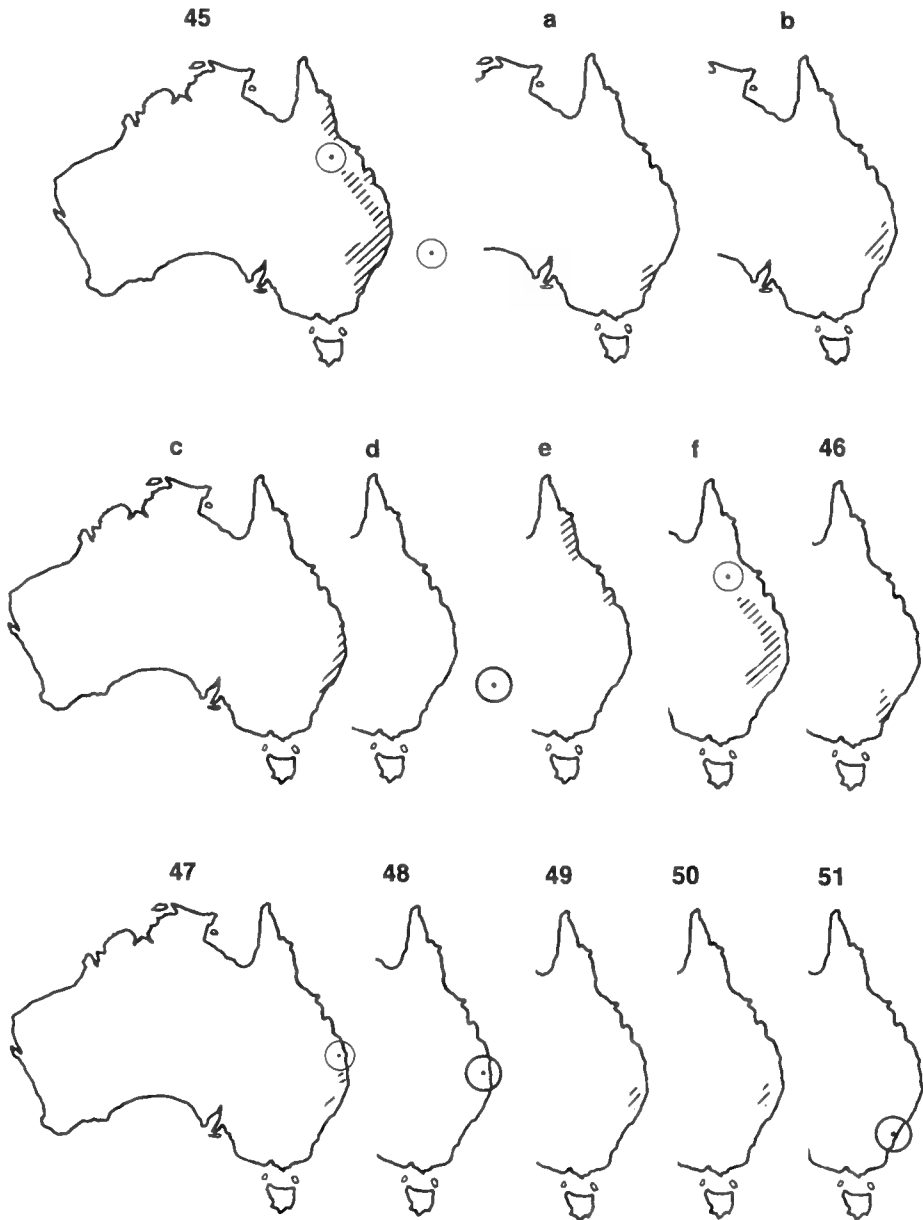
Shrub, often from 0.5 to 3 m in height, or slender to stout-trunked tree to 7 m or more, the bark usually close and firm but soft, thick and rather flaky in some arborescent forms; the younger stems at first with a short close pubescence but usually becoming glabrous, with a conspicuous flange, usually broad and often thick, especially near the node, and spreading or tending to curve around the stem, and with branching at from less than 30° to more than 60°. *Leaves* sometimes aromatic, but not strongly so, usually somewhat divergent to spreading or occasionally deflexed, from less than 5 to more than 20 mm long and 1–5, usually 2–3, mm wide, oblanceolate-elliptical to narrowly linear-elliptical, variable in texture, flat or with the margins recurved, usually glabrous or almost so, the apex broadly to narrowly acute or obtuse, the tip often recurved, with an umbo behind or with a short soft or stiff blunt point or occasionally a short pungent point, the base tapering and petioleless or virtually so. *Flowers* white, often greenish or creamy-white, or occasionally pink, usually 10–15 mm in diameter, occurring singly on modified shoots at the ends of very short or long leafy axillary branches, often in adjacent axils and on adjacent branches with the new growth extending, mostly from branch-ends during or after flowering.

Bracts broad, almost spherical, dark red-brown and scarious; the bracteoles similar, some often persisting to the opening bud stage but sometimes shed early. *Hypanthium* usually glabrous and often rather dark with somewhat conspicuous glands, usually 2–4 mm long, the upper part expanded, the lower tapering to the base or tapering to, or rounded above, a pedicel often to c. 1 mm in length, the top of the ovary glabrous. *Sepals* deciduous, 1.5–2.5 mm long, usually broadly ovate-oblong, obtuse, glabrous or with minutely ciliate margins, scarious and pale at least at the margins. *Petals* 4–6 mm long. *Stamens* in bundles of 5–7 (–9), (2–) 2.5–4 (–4.5) mm long, the filaments broad in the lower part and tending to join at the extreme base, the anther-cells 0.4–0.5 mm long, usually well separated and often tending to diverge, very deep and with their opening restricted. *Style* inset, stout-based and tapering to a variable-sized stigma; sometimes absent. *Ovary* 5-locular (rarely and ? aberrantly less or more so), each loculus with (20–) 80–100 ovules in (4–) 8 rows on a large close, or occasionally smaller and extended, placenta; sometimes absent. *Fruit* persistent but not long-persistent and enlarging, 5–8 (–c. 10) mm in diameter, widest at a narrowly extended rim and usually rounded below to the base or to a short stalk, the valves exerted, before opening with a high or broad dome rather symmetrical with the almost spherical to broad and shallow wide part of the fruit, later often but not always opening so wide as to exceed the rim and reduced the depth of the base. *Mature seeds* 1.5–2.5 (–3) mm long, irregularly narrowly linear-cuneiform, curved, and striate with the surface fibres tending to loosen and diverge. Main flowering period: Aug.-Jan.

DISTRIBUTION: From Cape York in Queensland to the central South Coast district of New South Wales, extending inland beyond the ranges and to Lord Howe Island (Map 7). Usually in sandy soil or on sandstone rocks but sometimes on basalt soils and rocks. The regional forms of this species are treated here as subspecies. It is possible that, with further study, some may be shown, as was *L. morrisonii*, to be species. They are all closer to one another than to any other species of *Leptospermum*. Each is variable and how much of this variation is a response to the habitat and how much genetic is a matter at present for conjecture. Penfold (1922) considered the analysis of the essential oils of what we now know as subspp. *polygalifolium*, *transmontanum* and *cismontanum* to show differences. Considerable uniformity in leaf-shape and other features is seen in some populations but within each subspecies there is a variety of further forms. This gives some phenotypic overlap between the subspecies as delimited here, and the extent to which this is caused by local selection of superficially similar forms or actual intermingling of the subspecies is not known. The Type subspecies is the most variable, but whether this is because it is the least specialised form or because it has originated from a merging of taxa is a further matter for speculation. The following key is based on herbarium specimens and is valid for the majority of specimens in each taxon. A number of specimens of this species cannot with confidence be assigned to subspecies. Specimens from far northern New South Wales and southern Queensland may be confused with *L. variabile* in the absence of flowers.

Key to subspecies

- 1 Leaves with the margins tending to recurve, not or rarely stiff in texture, the lower surface usually paler, the apex acute or obtuse.
- 2 Leaves usually acute or, if obtuse, more than 2 mm broad, usually more than 10 mm long, variable in colour.



Map 7. Distribution of Group 2: subgroup 2 *L. polygalifolium* and allies. 45. *L. polygalifolium* a. subsp. *polygalifolium* b. subsp. *montanum* c. subsp. *cismontanum* d. subsp. *howense* e. subsp. *tropicum* f. subsp. *transmontanum* 46. *L. morrisonii* 47. *L. variable* 48. *L. oreophilum* 49. *L. novae-angliae* 50. *L. minutifolium* 51. *L. sejunctum*.

- 3 Leaves usually glabrous, 2–3 mm wide subsp. *polygalifolium* a.
- 3* Leaves usually silky-pubescent on young growth, often more than 3 mm wide subsp. *montanum* b.
- 2* Leaves usually obtuse, c. 8–10 mm long (longer in a riparian form) and about 2 mm wide, usually a characteristic dull grey-green colour. subsp. *cismontanum* c.
- 1* Leaves usually flat and rather stiff in texture, with the lower surface not conspicuously different in colour; leaf-apex usually acute.
- 4 Hypanthium c. 4 mm long; flowers often 15 mm in diameter; leaf-colour variable subsp. *howense* d.
- 4* Hypanthium usually 2–3.5 mm long; flowers mostly 10–12 mm in diameter; leaves usually a light rather yellowish, green.
- 5 Leaves usually 1.5 mm or less in width; placenta high and with c. 20–60 ovules subsp. *tropicum* e.
- 5* Leaves usually more than 1.5 mm wide; placenta not high and with c. 80 ovules subsp. *transmontanum* f.

a. subsp. *polygalifolium*

HOLOTYPE: as for the species.

SYNONYMY: *L. flavescens* Sm., Trans. Linn. Soc. London 3: 262 (1797). *L. porophyllum* Cav., Icon. 4: 17, t. 330, fig. 2 (1797). *Melaleuca thea* Wendl. f. & Schrader, Sert. Hannov: 24, t. 13 (1797). *L. thea* (Wendl. f. & Schrader) Willd., Sp. Pl. 2: 949 (1799). *L. flavescens* var. *commune* Benth., Fl. Austral. 3: 104 (1867) p.p. *L. polygalifolium* var. *commune* (Benth.) Domin, Biblioth. Bot. 89: 452 (1928) excl. cited specimen.

Rather slender shrub 1–3 m or more in height, occasionally a small tree to 5 m or more. *Leaves* oblanceolate or occasionally almost elliptical, usually 10–20 mm long and c. 2(–3) mm wide, the apex broadly to narrowly acute with a soft or occasionally pungent short point, the margins often recurving, the surfaces usually glabrous, the lower often much paler. *Flowers* (10–)12(–15) mm in diameter, greenish or creamy white. *Hypanthium* 2.5–3.5 mm long. *Sepals* 2–2.5 mm long, usually scarious only near the margin. *Ovary* 5-locular with c. 50–100 ovules in each loculus. *Fruit* 6–10 mm or more in diameter and, after opening, with the base usually very shallow and the valves spreading widely. Mainly flowering period: Nov.–Dec.

DISTRIBUTION: Widespread on the tablelands and coast of central eastern New South Wales, extending southward along the coast (Map 7). In heath or dry sclerophyll forest, usually on sandstone, in deep sand or skeletal soils, often in moist depressions or along rocky watercourses.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Port Jackson, *White*, 1795 (photos LIVCM: 1909. LBG.8816 (LIV, NSW) and ex K (BRI, NSW)); on banks of Nepean R., c. 4 miles [6.5 km] S. of Wallacia, *Salasoo* 2653, 12.1963 (NSW). South Coast: near Burrewarra Point, S. of Batemans Bay, *Craven* 601, 10.1965 (CANB, NSW). Central Tablelands: Dante Glen track, Lawson, *Coveny* 9842, 11.1977 (NSW). Southern Tablelands: above Sassafras, *Thompson* 4055, 4.1979 (NSW).

b. subsp. *montanum* J. Thompson *subsp. nov.*

Folia plerumque 10–15(–20) mm longa et 3(–5) mm lata, margine recurvata late obtusa ad anguste acuta, pagina inferiore plerumque pallidiore.

HOLOTYPE: NEW SOUTH WALES: Yarrowitch, *J.L. Boorman NSW 15040*, 12.1912 (NSW).

Shrub often 1–2 m high, taller and often becoming a tree of 7 m or more in sheltered forest. *Leaves* oblanceolate-elliptical, usually 10–15(–20) mm long and often 3, occasionally up to 5, mm wide, the apex broadly to narrowly acute or broadly obtuse, the tip sometimes with a blunt point, the margins tending to recurve, the surfaces often at first silky, later glabrous, the lower paler. *Flowers* c. 12 mm in diameter, white. *Hypanthium* c. 3 mm long. *Sepals* c. 1.5–2 mm long, usually scarios only near the margins. *Ovary* 5-locular with c. 30–100 ovules in each loculus. *Fruit* 6–(7–8)–9 mm in diameter, ultimately with the valves spreading widely and the base flat above a distinct stalk. Main flowering period: Nov.–Jan.

DISTRIBUTION: From the mountains of southeastern Queensland, through the tablelands and adjoining coastal areas of New South Wales to Barrington Tops (Map 7). Along watercourses, among, or in crevices of, granite boulders or on basalt rock outcrops.

SELECTED SPECIMENS: QUEENSLAND: Darling Downs: Mt Cordeaux, near Cunninghams Gap, *Briggs NSW 154818*, 6.1961 (NSW). NEW SOUTH WALES: North Coast: Kendall, *Byrnes 3492*, 12.1976 (BRI, NSW). Northern Tablelands: Walcha, *Boorman NSW 143912*, 12.1912 (NSW).

This can be distinguished from other species of this region, such as *L. variabile* and *L. novae-angliae*, which are similar in appearance, by its more delicate fruit with widely spread valves and almost flat base above a short stalk.

c. subsp. *cismontanum* J. Thompson *subsp. nov.*

Folia plerumque 8–10 mm longa et 2 mm lata, obscure viridia margine recurvata, plerumque late obtusa, pagina inferiore plerumque pallidiore.

HOLOTYPE: NEW SOUTH WALES: 6 miles [10 km] NE. of Dungog on Stroud road, *J. M. Powell 200 & J. Seur*, 30.ix.1975 (NSW). ISOTYPES: K, L, n.v.

SYNONYMY: *L. flavescens* var. *microphyllum* Benth., Fl. Austral. 3: 105 (1867).

L. flavescens var. *leptophyllum* Cheel in A.R. Penfold J. & Proc. Roy. Soc. New South Wales 56: 166 (1922), quoad Typum.

Shrub 1–4 m in height, or small slender tree. *Leaves* elliptical or broader in the upper part, usually 8–10 mm long and 2 mm wide but occasionally longer and often then slender (the riparian form described by Cheel), the apex usually rounded with an umbo at the back, the margins recurved, the surfaces usually glabrous and a dull grey-green in colour, the lower usually much paler. *Flowers* c. 10 mm in diameter, white. *Hypanthium* 2.5–3 mm long. *Sepals* 1.5–2 mm long, with thin pale margins and apex. *Ovary* 5-locular with c. 80 ovules in each loculus. *Fruit* often 5–7 mm in diameter, only occasionally with the valves spreading widely and the base shallow. Main flowering period: Sept.–Oct.

DISTRIBUTION: From Fraser Island, Queensland, through coastal New South Wales, to the Gosford district (Map 7). In sandy and peaty coastal swamps, on old dunes and on hillsides, especially on sandstone, in dry sclerophyll forest.

SELECTED SPECIMENS: QUEENSLAND: Wide Bay: Fraser Is., *Queensland Director of Forests per Penfold NSW 154819*, 3.1921 (NSW), *NSW 154820*, 8.1922 (NSW). Moreton: Nundah Creek, *White*, 11.1915 (NSW), 9.1916 (NSW). NEW SOUTH WALES: North Coast: Lake Cathie, 14 km SW. of Port Macquarie, *Jackson 53*, 10.1978 (CBG, NSW). Central Coast: Kincumber road, near Gosford, *Fletcher NSW 15038*, 9.1885 (NSW).

d. subsp. *howense* J. Thompson *subsp. nov.*

Folia plerumque 5–8 mm longa et 1.5–2 mm lata, plana acuta, paginis similibus.

HOLOTYPE: LORD HOWE ISLAND: Mt Gower, a little above Get Up Place, *A.N. Rodd* 3589, 27.xi.1980 (NSW).

Bushy shrub 2 m or more in height or, in sheltered places, a tree to 6 m or more with a stout, often leaning, trunk. *Leaves* narrowly obovate-elliptical, usually 5–8 mm long and 1.5–2 mm wide, the apex acute, often with the tip recurved or with a short, blunt point, the surface flat and usually glabrous, with both sides relatively similar. *Flowers* c. 15 mm in diameter, white. *Hypanthium* c. 4 mm long. *Sepals* 2–2.5 mm long and very pale and scarious. *Ovary* 5–6 or more-locular with c. 100 ovules in each loculus. *Fruit* 5–8 mm in diameter, the valves not or tardily spreading wide. Main flowering period: Nov.-Jan.

DISTRIBUTION: In southern Lord Howe Island (Map 7). On basalt cliff-ledges and mountain summits, often in closed montane forest.

SELECTED SPECIMENS: LORD HOWE ISLAND: Boat Harbour track, *Pickard* 3540, 7.1978 (NSW), *Norris* 48, 12.1983 (NSW); summit ridge of Mt Lidgbird, *Pickard* 1452, 5.1971 (NSW); summit of Mt Gower, *Johnson & Rodd* 1364, 9.1970 (NSW).

e. subsp. *tropicum* J. Thompson *subsp. nov.*

Folia 5–20 mm longa et 1–1.5 mm lata, plerumque flavovirentia plana acuta, paginis similibus.

HOLOTYPE: QUEENSLAND: c. 10 km from Byfield on track to Five Rocks, *J.M. Powell* 882 & *J. Armstrong*, 20.ix.1977 (NSW).

Shrub from 0.5 to more than 1.5 m in height, occasionally a small tree. *Leaves* very narrowly linear-elliptical, usually 5–20 mm long and 1–1.5 mm wide, the apex tapering to an acute, often bluntly pointed and often recurved tip, the surface flat and glabrous with both sides relatively similar and usually a light, rather yellowish green. *Flowers* c. 10–12 mm in diameter, white or pink. *Hypanthium* 2–3 mm long. *Sepals* c. 2 mm long, scarious and pale, at least on the edge. *Ovary* 5-locular with 50–60 ovules on a rather small and high placenta in each loculus. *Fruit* c. 5–6 mm in diameter, often almost spherical and usually with the base deep after opening. Main flowering period: Aug.-Sept.

DISTRIBUTION: On the eastern tropical coast and ranges of Queensland, from north of Cooktown to Keppel Bay (Map 7). In wet coastal heaths, on dunes and in open woodland on sandy soils.

SELECTED SPECIMENS: QUEENSLAND: Cook: Walshs Pyramid, *Bailey*, (received 1918, NSW). North Kennedy: c. 4.2 km SW. from Herberton along Silver Valley road, *Conn and Clarkson* 1161, 5.1983 (MEL, NSW); 12 km W. of Paluma, *Jackes & Jackes*, 9.1982 (NSW). Port Curtis: Shoalwater Bay, strait S. of Townshend Is., *Brown*, 8.1802 (NSW); Byfield, *White* 8027 (*bis*), 9.1931 (BRI, NSW), *Gittins* 2551, 8.1972 (NSW).

f. subsp. *transmontanum* J. Thompson *subsp. nov.*

Folia 10–15 mm longa et 2 mm lata, flavovirentia plana acuta, paginis similibus.

HOLOTYPE: NEW SOUTH WALES: Etoo Creek, 4½ miles [7 km] NE. of Gwabegar, *L.A.S. Johnson & E.F. Constable* NSW 30226, 3. Nov. 1954 (NSW).

Shrub 1–4 m in height, or occasionally a small tree. *Leaves* narrowly, rather irregularly elliptical, usually 10–15 mm long and c. 2 mm broad, tapering to an acute, even pungent, apex, the surface flat and usually glabrous, with both sides similar and usually a light yellowish green. *Flowers* c. 10–12 mm in diameter, rather greenish white or pink. *Hypanthium* 2.5–3 mm long. *Sepals* c. 1.5–2 mm long and usually pale and scarious only at the edges. *Ovary* 5-locular with c. 80 ovules in each loculus. *Fruit* (5–) 6–7 (–8) mm in diameter, often with the valves not widely expanded and the base rather deep. Main flowering period: Aug.-Jan. (Aug.-Sept. in Queensland, Oct.-Nov. on the western slopes of New South Wales, Dec.-Jan. on the tablelands.)

DISTRIBUTION: From the White Mountains of northern inland Queensland to the Hunter River district of New South Wales (Map 7). Usually in dry sandy alluvial soil but also in rocky places especially along watercourses in dry sclerophyll forest.

SELECTED SPECIMENS: QUEENSLAND: Burke: Wall Creek, White Mtns, *Godwin NSW 154821*, 8.1984 (NSW). Leichhardt: Blackdown Tableland, summit of N. escarpment, *Gittins S/63*, 8.1964 (NSW). Burnett: Goodyer, *Michael 2958*, 9.1945 (BRI, NSW). Darling Downs: Chinchilla, *Beasley*, 5.1912 (NSW). NEW SOUTH WALES: Northern Tablelands: 38 km from Walcha on "Moona Plains" road, *Jacobs, Wilson & Lapinpuro LL02*, 9.1982 (NSW). Central Tablelands: 1 mile [1.6 km] E. of Currant Mtn Gap, Rylstone district, *Briggs NSW 154822*, 8.1961 (NSW). North Western Slopes: near Wiggins Creek, Pilliga scrub, *Thompson 2975*, 11.1978 (NSW). North Western Plains: Narrabri, *Penfold NSW 154823, 154824*, 9.1921 (NSW).

46. *L. morrisonii* J. Thompson sp. nov.

Frutex vel arbor usque ad plus quam 5 m alta. Folia elliptica ad oblanceolata saepe plus minusve falcata, 1.5–3.5 cm longa. Flores 12–15 mm diametro, sepalis glabris deciduis. Ovarium 5-loculare. Fructus 6–10 mm diametro persistentes.

HOLOTYPE: NEW SOUTH WALES: sandstone cliffs c. ½ mile [0.8 km] NW. of Dhruwalgha Mt., SE. of Robertson, *H. Salasoo 3166*, 11.1.1966 (NSW).

SYNONYMY: *L. virgatum* S. Schauer, *Linnaea* 4: 410 (1842) non Forst. & Forst. f. **TYPE:** Blue Mountains [New South Wales], *A. Cunningham*, 1822 (? , n.v.).

Bushy shrub or small tree from c. 2 to more than 5 m tall with firm ultimately corrugated bark; the younger stems with a short, rather persistent pubescence, a pale and thick flange, broad near the node but often tending to curve around the stem, and with branching at c. 30°. *Leaves* strongly aromatic, most divergent but some older ones becoming deflexed, very variable in size but most 15–35 mm long and 2–8 mm wide, usually narrowly elliptical to oblanceolate and somewhat falcate, firm and flat or somewhat recurved at the margins, silky-pubescent at first but usually soon glabrous, first on the upper surface, the apex usually tapering gradually and acute, with a blunt and often infolded point but occasionally rounded, the base tapering and not or scarcely petiolate. *Flowers* white or rather greenish creamy white, usually 12–15 mm in diameter, occurring singly in modified shoots at the ends of short, leafless to long, leafy axillary branches in adjacent axils, the new growth usually vigorous and purple and extending from branch-ends during flowering with little development later in the flowering region. *Bracts* very broad, red-brown and scarious, the inner and bracteoles large, orbicular and similar, most shed from the opening bud but some attached below the open flower. *Hypanthium* c. 4 mm deep, the upper part very broad, tapering rather abruptly to a narrow pedicel, the outer surface

glabrous and rather dark, the top of the ovary glabrous. *Sepals* deciduous, 2.5–3.5 mm long, almost spherical, very thin and scarious, pale and glabrous. *Petals* 5–7 mm long. *Stamens* in bundles of 7–9, 3.5–4.5 mm long, the filaments broad at the extreme base and tending to join, the anther-cells 0.4–0.5 mm long, often well-separated with some tending to diverge, very deep, with a broad outer edge, their opening very restricted. *Style* inset, usually very stout-based and tapering to a rather large stigma; often absent. *Ovary* 5-locular, each loculus with c. 120 ovules in c. 10 rows on a large close-set placenta; sometimes absent. *Fruit* persistent, usually 6–10 mm in diameter, widest on the extended but not very woody rim, and below this shallowly rounded above a short stalk-like section, the valves woody and before opening forming a broad high dome larger than the lower part of the fruit, later spreading, often so as to exceed the rim, the base often becoming very shallow but not flat. *Mature seeds* c. 2 mm long, irregularly narrowly linear-cuneiform or sigmoid, curved, the striate surface often loosening. Main flowering period: late Dec.-Jan.

DISTRIBUTION: In central coastal and tableland areas of New South Wales (Map 7). On exposed rocky sandstone or basalt escarpments, on hill slopes or on rocky creek banks or sandy alluvium.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Illawarra, *Macarthur 133*, 1855 (NSW). South Coast: Tianjara Creek, *Vickery NSW 14163*, 1.1937 (NSW). Central Tablelands: Excelsior, *Boorman NSW 15037* p.p., 1.1914 (NSW); Kanangra Tops, *Hind 731*, 7.1975 (NSW), *Thompson 4307*, 8.1982 (NSW); Welby Dam, *Brophy 255*, 11.1987 (NSW). Southern Tablelands: Corang R. on Nerriga-Windellama road, *Orchard 4486*, 2.1975 (NSW).

This species is named for David Morrison, whose work on genecological differentiation between related taxa in the Sydney region strongly supported the recognition of this taxon as a species. See D.A. Morrison & P.J. Myerscough (1982) and D.A. Morrison (1984).

47. *L. variable* J. Thompson sp. nov.

Frutex vel arbor usque ad 5 m vel altiora. Folia late elliptica ad oblanceolata, 1–2 cm longa. Flores c. 15 mm diametro, sepalis glabris deciduis. Ovarium 5-loculare. Fructus 6–12 mm diametro persistentes.

HOLOTYPE: QUEENSLAND: Mt Gillies, about 20 km SW. of Rathdowney on Mt Lindesay Highway, *P.R. Sharp 2438*, 18 Oct. 1978 (NSW). **ISOTYPE:** BRI.

Compact or spreading shrub 1–2 m tall or small tree to 5 m or more, the bark close and becoming rather scaly and rough; the younger stems at first silky-pubescent but soon glabrous, with a pale and thick, conspicuous flange spreading or curving around the stem and up beside the leaf-base, and with branching often, but not invariably at 30°. *Leaves* aromatic, from almost erect to irregularly spreading, mostly 10–20 mm long and 2–8 mm wide, obovate-oblanceolate to narrowly or broadly elliptical, usually completely glabrous, the margins flat or slightly recurved, the texture variable and probably dependent on habitat, the apex tapering to a distinct folded, but rarely pungent, point, very variable, the base tapering, rather flat and virtually petiole-less. *Flowers* white, c. 15 mm in diameter, single, on modified shoots that are occasionally axillary but mostly at the ends of short several-leaved branches, the new growth, reddish and often dense, produced beyond the flowering region at flowering time. *Bracts* red-brown, the inner and bracteoles larger, thin and very broad but enclosing only the very young bud. *Hypanthium* glabrous and rather dark, with conspicuous glands, c. 4–6 mm long, with the upper part broadly

expanded, and tapering, sometimes rather abruptly, and the base rounded above a short tapered broad pedicel, the top of the ovary glabrous. *Sepals* deciduous though occasionally tardily so, very broadly ovate, c. 3 mm long, usually dark with pale margins, completely glabrous. *Petals* 6–8 mm long. *Stamens* in bundles of c. 7, 3–4 mm long, the broad bases of the filaments sometimes tending to form an irregular ring, the anther-cells c. 0.5–0.6 mm long, parallel, at least for the most part, often rather recurved, variable but usually rather deep, especially the outer part, or with the outer part wide and shallow. *Style* inset, stout and broad-based, long-tapering to behind a rather large stigma. *Ovary* 5-locular, each loculus with c. 80 ovules in 8 rows on a large closet-set placenta. *Fruit* persistent, very variable, 5–12 mm in diameter, widest at the narrow erect rim, the lower part shallow and broad-based above a very short stalk absent from older fruit, the valves woody, much exerted, before opening forming a depressed dome shorter than or symmetrical with, occasionally somewhat broader than, the base, later spreading but rarely extending far, if at all, beyond the rim, the base often somewhat turbinate. *Mature seeds* 2–2.5 mm long, irregularly narrowly linear-cuneiform, curved, striate. Main flowering period: Mostly Sept.-Oct.

DISTRIBUTION: On the mountains of southeastern Queensland and scattered on the tableland escarpment and coastal ranges of New South Wales to the Taree district (Map 7). On rocky summits or ridge-tops, in heath, skeletal soil or rock crevices, on sandstone, granite or volcanic rock.

SELECTED SPECIMENS: QUEENSLAND: Wide Bay: Mt Perry, *Keys 583*, (NSW). Moreton: Mt Maroon, *Gillieatt 184*, 8.1964 (BRI), *Armstrong 1132 & Powell*, 9.1977 (NSW). NEW SOUTH WALES: North Coast: c. 1.2 km NW. of Mt Banda Banda, *Haegi 1585*, 9.1978 (NSW); Gloucester Buckets, *Coveny NSW 154756*, 1.1967 (NSW), *Maiden NSW 15039*, 9.1897 (NSW 15039).

This species is named for its variability in many characters, especially those of leaf-width and fruit-size, that appear to vary in specimens from the same locality. Narrow-leaved forms may be confused with *L. polygalifolium* subsp. *transmontanum* and *L. novae-angliae* in the absence of flowers.

48. *L. oreophilum* J. Thompson sp. nov.

Frutex 1–2.5 m altus. Folia elliptica, 1–1.5 cm longa, manifeste glandulosa. Flores 12–20 mm diametro, sepalis glabris deciduis. Ovarium 5-loculare. Fructus 7–10 mm diametro persistentes, valvis valde patentis.

HOLOTYPE: QUEENSLAND: Ngungun, Glass House Mountains, *Johnson NSW 154760*, 13.6.1951 (NSW).

Shrub usually 1–2.5 m tall with firm rough bark; the younger stems minutely and often densely hirsute with a flange widest near each node and extending beside the leaf-base, often to form a rim below the node, and with the branching at 30°–45°. *Leaves* divergent with some later spreading, mostly 10–15 mm long and 2–4 mm wide, elliptical, at first silky, later becoming rather glabrous and glossy but often with dense hairs at the base, somewhat thick in texture with dense prominent glands, with the apex acute and tending to infold, with a very short, thick, blunt point which is somewhat recurved, and tapering in the lower-part to a petioleless base. *Flowers* white, c. 12–20 mm in diameter, occurring singly on modified shoots at the ends of adjacent short or long leafy branches, the new growth pinkish, extending densely rather than vigorously from branch-ends and to some extent from below young fruit. *Bracts* not seen mature, pale red-brown and scarious, the innermost and bracteoles very broad

and enveloping at least the rather young bud. *Hypanthium* glabrous or with dense, very short, crisped hairs, not very dark, but with conspicuous glands, 2.5–4 mm long, the upper part somewhat expanded so that it tapers strongly and rather evenly to the base or to a very short broad pedicel, or is rounded above this region, the top of the ovary glabrous. *Sepals* deciduous, c. 3 mm long, almost orbicular, pale and scarious with the centre somewhat darker, completely glabrous. *Petals* 4–8 mm long. *Stamens* in bundles of 7–9, c. 5 mm long, the broad bases of the filaments tending to form an irregular ring at the base, the anther-cells c. 0.5–0.6 mm long, parallel, at least for the most part, often recurved but not much folded back, rather deep and not opening very wide, the outer edge of the wide outer part flattened. *Style* inset, though not deeply so, stout and broad-based, with a rather small stigma. *Ovary* 5-locular, each loculus with c. 80 ovules in 8 rows on a rather large placenta extended at the top. *Fruit* persistent, c. 7–10 mm in diameter, widest at the slightly extended and woody rim and below this very shallow above a very short stalk-like base not seen in older fruit, the valves woody and before opening forming a high dome usually c. twice as deep as the base, later spreading wider than the rim with the base of the fruit becoming extremely shallow or virtually flat. *Mature seeds* c. 3.5 mm long, very irregularly narrowly linear-cuneiform, curved, striate. Main flowering period: Sept.–Dec.

DISTRIBUTION: On the Glass House Mountains of southern Queensland (Map 7). On rocky crests and escarpments of volcanic rock, in shallow soil or rock crevices.

SELECTED SPECIMENS: QUEENSLAND: Moreton: Ngungun, *McKenzie s.n.*, 12.1979 (BRI); Cruikneck, *Goy*, 5.1935 (BRI); Mt Tunbubudla, c. 5 km W. of Beerburum, *Clarkson 166*, 9.1976 (BRI).

This species is named for its mountain-top habitat.

49. *L. novae-angliae* J. Thompson sp. nov.

Frutex usque ad 2 m altus. Folia valde varie elliptica, 0.5–1.5 cm longa, interdum pungentia. Flores 10–12 mm diametro, sepalis glabratis deciduis. Ovarium 5-loculare. Fructus minus quam 5 usque ad plus quam 12 mm diametro saepe longipersistentes.

HOLOTYPE: NEW SOUTH WALES: top of Bald Rock Mountain, 15 miles [24 km] north of Tenterfield, *E.F. Constable 2074*, 31.III.1962 (NSW 66832).

Shrub usually 2 m or less in height with bark lifting and flaking; the younger stems usually with a close silky pubescence, later becoming glabrous, with a pale and thick flange, widest near the leaf-base and tending to curve around the stem, and with branching at c. 45°. *Leaves* usually rather dense and erect to narrowly divergent, very variable, 5–15 mm long, and 1–4(–5) mm wide, irregularly broadly to very narrowly elliptical, often thick with the surface at least somewhat, often much, incurved in cross-section, glabrous and often with conspicuous glands, the apex tapering, acute or acuminate with a short, usually pungent, point, the base tapering, often to a short broad petiole. *Flowers* white, most 10–12 mm in diameter, occurring singly on modified shoots at the ends of dense short or long leafy axillary branches, with most new growth extending from the flowering region after flowering. *Bracts* red-brown and scarious, the inner very broad and concave, sometimes held about the open flower. *Hypanthium* glabrous or almost so, dark and with conspicuous glands, c. 4 mm long, with the upper part much expanded and tapering, the lower narrower and rather rounded above a short pedicel, the top of the ovary glabrous. *Sepals*

deciduous, scarious, broadly ovate, obtuse, c. 2.5 mm long, glabrous. *Petals* c. 5 mm long. *Stamens* in bundles of 5–7, 2.5–4 mm long, the anther-cells c. 0.5 mm long, parallel, at least for the most part, thickened in the inner part, the outer deep and broad, with the opening rather restricted, recurved and sometimes folding back. *Style* inset, stout, with a medium-sized stigma; often absent. *Ovary* 5-locular, each loculus with c. 80 ovules in 8 rows on a large, broad, close placenta; sometimes absent. *Fruit* often long-persistent and enlarging, very variable in size, from less than 5 to more than 12 mm in diameter, widest at the scarcely extended rim with the lower part almost hemispherical, the surface soon lifting and later becoming scaly, the valves woody, exerted as a dome rather symmetrical with the base, later spreading, and with the surface lifting and then somewhat broader than the base. *Mature seeds* 1.5–2 mm long, narrowly linear-cuneiform, striate. Main flowering period: Oct.–Nov.

DISTRIBUTION: Widespread on the Northern Tablelands of New South Wales and adjoining parts of the Western Slopes and Queensland, extending into the coastal region only on the escarpment inland from Coffs Harbour (Map 7). In shallow soil associated with rocky, especially granite, outcrops, or in rock crevices.

SELECTED SPECIMENS: QUEENSLAND: Darling Downs: Girraween National Park near Wyberba, *Blake 23679*, 11.1971 (BRI, NSW). NEW SOUTH WALES: North Coast: Wild Cattle Creek, Dorrigo, *White 7531*, 10.1930 (BRI, NSW). Northern Tablelands: Top of Bald Rock Mtn, 15 miles [24 km] N. of Tenterfield, *Thompson 4193*, 7.1981 (NSW); Big Spirabo Mtn, 20 miles [32 km] SSE. of Tenterfield, *Constable 7068*, 8.1966 (NSW); Point Lookout, Dorrigo Plateau, *Williams 676*, 11.1958 (NSW). North Western Slopes: Pindari Dam, Severn R., 15 miles [24 km] NE. of Bukkulla, *Lane NSW 154774*, 6.1970 (NSW).

This species is named for the New England region of New South Wales, its major habitat.

The close-set placenta distinguishes fruiting specimens of small-leaved forms of this species from *L. minutifolium* where, in the fruit, the placenta extends into the loculus.

50. *L. minutifolium* C.T. White, Proc. Roy. Soc. Queensland 57: 26 (1947), quoad Typum.

HOLOTYPE: QUEENSLAND: base of Mt Norman via Wallangarra, *Mrs M.S. Clemens*, Nov. 1944 (BRI).

SYNONYMY: *L. flavescens* var. *minutifolium* F. Muell. ex Benth., Fl. Austral. 3: 105 (1866). **HOLOTYPE:** NEW SOUTH WALES: New England, C. Stuart (K, n.v.). **?ISOTYPE:** NSW. *L. polygalifolium* var. *minutifolium* (F. Muell. ex Benth.) Domin, Biblioth. Bot. 89: 452 (1928).

Shrub from less than 1m to 2m or more in height with, as seen on specimens, close or smooth and flaking bark; the younger stems relatively stout and usually appressed-hirsute, with a thick, pale flange, especially near the node, spreading or tending to curve around the stem, and with branching at 45° but often curving so as to appear at a smaller angle. *Leaves* usually dense and diverging widely or spreading, mostly 2–4 but up to 7 mm long and usually 2 mm wide, narrowly to broadly obovate, thick, especially near the apex, usually concave and glossy and, for the most part glabrous, with prominent glands, the apex rounded or somewhat acute with an umbo behind, the base gradually tapering, the petiole negligible or very short and rather narrow. *Flowers* white, usually c. 8 mm in diameter, single on modified shoots at the ends of short or long leafy

axillary branches in adjacent axils on adjacent branches, the new growth developing strongly from branch-ends and less so from some flowering shoots after or sometimes during flowering. *Bracts* mostly small and scarious, the inner and bracteoles very concave and red-brown, enclosing only the very young flat-topped bud, all soon shed. *Hypanthium* glabrous, dark and with rather conspicuous glands, 2–3 mm long, widely expanded at the top and with the lower part tapering to, or somewhat rounded above, a short pedicel, the top of the ovary glabrous. *Sepals* deciduous, 1.5–2 mm long, very thin and pale, very obtuse, oblong and glabrous. *Petals* 2.5–3 mm long. *Stamens* in bundles of 3–5, 3–3.5 mm long, with some filaments broad at the extreme base, the anther-cells c. 0.3–0.4 mm long, tending to separate, occasionally to diverge, very deep, failing to open wide, and somewhat folded back. *Style* inset, stout with a large stigma. *Ovary* 5(–7)-locular, each loculus with c. 70–80 ovules in c. 8 rows on a large and somewhat extended placenta. *Fruit* persistent, 5–7 mm in diameter, widest near the scarcely extended rim, with the lower part rather hemispherical or wider above a scarcely perceptible stalk, the surface soon lifting and later often flaky, the valves very woody, at first raised to a dome equal to or somewhat shorter than the base, later spreading but seldom, and then scarcely, wider than the rim. *Mature seeds* c. 2 mm long, irregularly narrowly linear-cuneiform, striate. Main flowering period: Oct.–Nov.

DISTRIBUTION: On the Northern Tablelands and nearby Western Slopes of New South Wales and in the “Granite Belt” of southern Queensland (Map 7). In swamps and on rocky creek banks, especially in elevated places.

SELECTED SPECIMENS: QUEENSLAND: Darling Downs: Girraween National Park, near Wallangarra towards Mt Norman, *Blake 23704*, 11.1971 (BRI, NSW). NEW SOUTH WALES: Northern Tablelands: Torrington, *Boorman NSW 14161*, 11.1919 (NSW); Wollomombi to Guy Fawkes, at Point Lookout turnoff, *Johnson NSW 17473*, 11.1931 (NSW). North Western Slopes: Guyra-Tingha road, 10 miles [16 km] from Tingha, *Blakely, McKie & Youman NSW 143920*, 11.1929 (NSW).

The extended top on the placenta distinguishes fruiting material from small-leaved forms of *L. novae-angliae* which have a close-set placenta.

C. T. White included specimens now placed in *L. novae-angliae* and *L. gregarium* in his concept of this species.

51. *L. sejunctum* J. Thompson sp. nov.

Frutex 1–1.5 m altus. Folia elliptica ad oblanceolata, 1–2 cm longa, manifeste glandulosa. Flores sepalis tarde deciduis. Ovarium 5-loculare. Fructus c. 8 mm diametro persistentes, valvis non valde patentis.

HOLOTYPE: NEW SOUTH WALES: Flat Rock Creek on Yalwal road, 3.4 km SW. of Nowra, 34° 54' S, 15° 34' E, alt. 15 m, *R. Coveny 10976 & T. James*, 30.ix.1981 (NSW). **ISOTYPES:** AD, BRI, CANB, CBG, HO, K, L, MEL, MO, PERTH.

Shrub 1–1.5 m tall with close grey bark; the younger stems glabrous or almost so, with a pale, thick and conspicuous, not very wide flange tending to curve about the stem and scarcely extended beside the leaf-base, and with the branching at c. 60°. *Leaves* somewhat aromatic, at first erect, later diverging, mostly 10–20 mm long and 3–4 mm wide, oblanceolate to elliptical, glabrous, rather thick and with dense prominent glands, the apex usually tapering gradually to a conspicuous, but folded and blunt rather than pungent, point, the base tapering, flat and petioleless. *Flowers* not seen at maturity but, from traces and fruit, assumed to be on modified shoots in axils and on very short leafless axillary

branches, occasionally on leafy axillary branches, with the new growth appearing pinkish and extending both from flowers and from branch-ends. *Bracts* pale red-brown, the innermost and bracteoles (seen about several buds) pale, scarious and very broad and enveloping (as in *L. variabile*). *Hypanthium* (seen from one bud, and one old flower) glabrous and dark, with conspicuous glands, c. 2 mm long, broad above and tapering evenly to above a very short pedicel, the top of the ovary glabrous. *Sepals* tardily deciduous, c. 2 mm long, broadly ovate, dark in the centre but with scarious margins, glabrous except for hairs at the top or also on the margins. *Petals* not seen mature. *Stamens* in bundles of c. 7, c. 2 mm long, the filaments broad in the lower part and fused into bundles at the base, the anther-cells c. 0.5 mm long, parallel, somewhat recurved and rather deep on the outer part. *Style* not or scarcely inset, slender apart from a broad base, the style small; sometimes reduced or absent. *Ovary* 5-locular, each loculus with c. 80 ovules in 8 rows on a rather high, stout, broad but relatively short placenta often somewhat extended at the top; occasionally absent. *Fruit* persistent, usually c. 8 mm in diameter but variable in size, widest at the erect or somewhat incurved rim, the lower part shallow and broad-based above a very short stalk absent from older fruit, the valves woody, much exerted before opening and forming a dome approximately equal to the base although with rather variable proportions, on opening extending but rarely much, if at all, beyond the rim, the base somewhat turbinate. *Mature seeds* c. 2.5 mm long, irregularly narrowly linear-cuneiform, curved, striate. Main flowering period: not known.

DISTRIBUTION: Found only in the Nowra district of coastal New South Wales (Map 7). In sandy soil on sandstone.

SPECIMENS EXAMINED: NEW SOUTH WALES: Central Coast: summit of Alum Rock, Bomaderry Creek, near Nowra, *Rodway NSW 154759*, 12.1944 (NSW). South Coast: Flat Rock Creek, 1.6 miles (2.6 km) SW. of Nowra on the Yalwal road, *Coveny 3989 & Bisby*, 3.1972 (NSW).

This species is named for its separation as to locality from the somewhat similar *L. variabile* and *L. oreophilum*.

L. myrtifolium subgroup (spp. 52–64), Map 8.

52. *L. rupestre* Hook. f., Icon. Pl.: t. 308 (1841).

SYNTYPES: TASMANIA: Summit of Mt Wellington and other mountains in Van Diemen's Land, *Lawrence, Fraser, R. Gunn n 295* (K, n.v.). In NSW there are specimens from Mt Wellington, *Gunn 295/1842*, dated 28.9.39, 31.1.40 and 30.10.40.

SYNONYMY: *L. scoparium* var. *microphyllum* S. Schauer, *Linnaea* 15: 425 (1841). **HOLOTYPE:** TASMANIA: in Insula Van-Diemen monte Wellington, *A. Cunn. 44*, 1819 (? , n.v.).

[*L. humifusum* A. Cunn. ex Schau., loc. cit., nom. nud.]

L. grandifolium var. *compactum* F. Muell. in Miq., *Ned. Kruidk. Arch.* 4: 144 (1859). **TYPE:** TASMANIA: in montosis 3–4000 pedes altis, *F. Mueller*, s.d. (?U, n.v.).

Shrub rarely more than 1.5 m in height, usually low-growing and spreading over the surface of boulders, the bark flaky; the younger stems with a long, later short, silky pubescence, rarely glabrous, with an often conspicuous and rather thick and broad flange near the node with a ridge extending below, and close branching, usually at c. 30°, though often curving later. *Leaves* aromatic, divergent, (2–)5–7(–9) mm long and usually 2–3 mm wide, generally broadly to narrowly obovate to elliptical, longest in more sheltered places, often rather

glossy, thick and usually almost flat, often with prominent glands, glabrous or with some hairs especially on the margins, occasionally silky-pubescent, the apex broadly acute to obtuse or rounded with the tip usually recurved and thickened behind and somewhat infolded in front, the base tapering to a slender petiole to 1 mm long. *Flowers* white, 7–10 mm in diameter, occurring singly or occasionally 2 together on modified shoots on very short usually few-leaved axillary branches, with pink-tinged new growth extending, mainly from branch-ends during flowering, but after flowering often with a little development in the flowering region. *Bracts* broad, red-brown and scarious, the inner and bracteoles very broad and enveloping the young bud but shed well before the flower opens. *Hypanthium* usually glabrous, occasionally with a silky pubescence at the top and base, rarely entirely pubescent, 2–3 mm long, the upper part broadly expanded, the lower abruptly contracting to a slender pedicel c. 1 mm long, the top of the ovary glabrous. *Sepals* deciduous, c. 2 mm long, broadly ovate to oblong with the apex rounded, scarious and glabrous except for the minutely ciliate margins. *Petals* 3–3.5 mm long. *Stamens* in bundles of 3–5, 1.5–2 mm long, the filaments often very broad in the lower part but scarcely united, the anther-cells 0.3–0.4 mm long, parallel, and somewhat deeper in the outer part. *Style* inset, stout with a medium-large stigma. *Ovary* 5-locular, each loculus with c. 30 ovules in c. 6 rows on a rather large extended placenta. *Fruit* long-persistent but not much enlarged, usually c. 4–5 mm in diameter, widest at a rather extended woody rim, the lower part usually hemispherical above a short stalk, the surface lifting and ultimately scaly and gnarled, the valves very woody and, before opening, exerted as a dome that is usually indented in the centre and equal to, or shorter than, the broad part of the base, the valves later spreading, sometimes so as to exceed the width of the rim and depth of the base. *Mature seeds* c. 2(–2.5) mm long, narrowly linear-cuneiform, curved, striate. Main flowering period: Jan.-Feb. (–Mar.).

DISTRIBUTION: Widespread on mountain-tops in Tasmania (Map 8). Among boulders in exposed places.

SELECTED SPECIMENS: TASMANIA: Mt Barrow, *Canning* 2635, 2.1969 (CBG, NSW); Mt Field National Park, c. 30 m SE. of Sitzmark Ski Lodge, *Short* 1821, 1.1983 (HO, MEL, NSW); Mt Wellington, *Gunn* 295/1842, 9.1839, 1.1840, 10.1840 (NSW); summit of Table Mtn, near Derwent R., *Brown*, 3.1804; The Pinnacle, Mt Wellington, *Garden* NSW143916, 1.1949 (HO, NSW).

53. *L. myrtifolium* Sieber ex DC., Prodr. 3: 228 (1828).

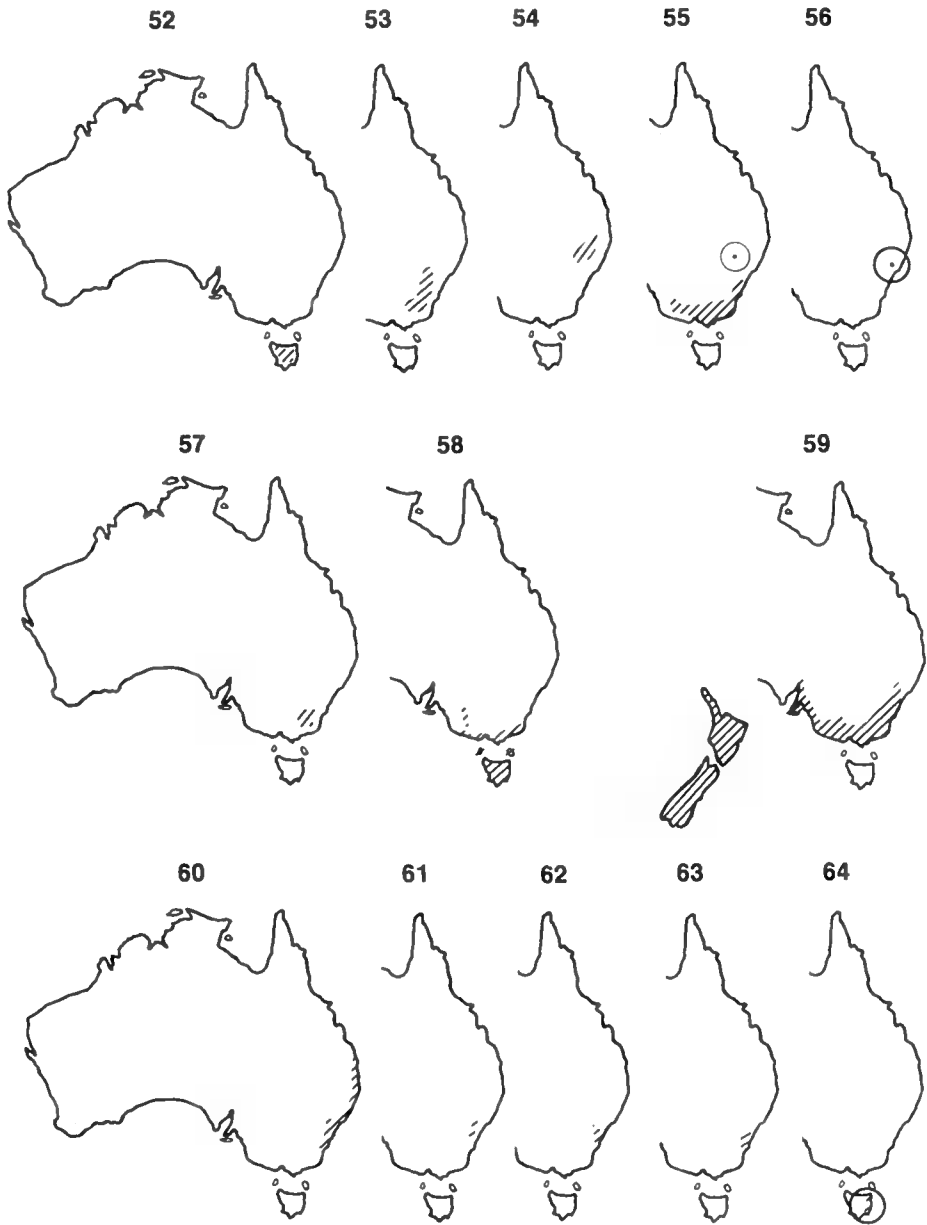
HOLOTYPE: NEW SOUTH WALES: New Holland, *Sieber* 314 (G, n.v., photo NSW).

SYNONYMY: *L. thymifolium* Cunn. in Field, Geogr. Mem. New South Wales (1825), non Hoffmannsegg. **HOLOTYPE:** NEW SOUTH WALES: Macquarie River, *A. Cunningham* 108, 1822 (K, n.v.).

L. cunninghamii S. Schauer, Linnaea 15: 420 (1841), quoad Typum. **HOLOTYPE:** NEW SOUTH WALES: in sylvae palud. Novae Cambriae austral. int., *A. Cunningham herb.* n. 108, 1822 (K, n.v.); there are also elements of *L. multicaule* in the protologue of this species.

L. pubescens Lam. var. *parviflorum* Domin, Biblioth. Bot. 89:453. **HOLOTYPE:** so auf den Bergen in Victoria (PRC, n.v., but identified from the locality and description).

Slender shrub 1–2(–3) m in height with a close bark forming flaky layers on old plants; the younger stems densely pubescent, with some hairs short, crisped and irregular and others longer and tending to spread, the flange usually narrow and often short, but tending to be thick and extended just below the node, and the branching at 60°. *Leaves* at first divergent, later often spreading, usually 5–10 mm long and 2–5 mm wide and broadly obovate to oblanceolate or



Map 8. Distribution of Group 2: subgroup 3 *L. myrtifolium* and allies. 52. *L. rupestre* 53. *L. myrtifolium* 54. *L. gregarium* 55. *L. obovatum* 56. *L. argenteum* 57. *L. micromyrtus* 58. *L. scoparium* 59. *L. continentale* 60. *L. juniperinum* 61. *L. rupicola* 62. *L. squarrosus* 63. *L. rotundifolium* 64. *L. grandiflorum*.

elliptical, usually pubescent with silky appressed hairs giving a grey-green appearance, occasionally the hairs few or absent; rather thick with prominent glands, the surface flat or slightly incurved in cross-section, the apex acute to broadly rounded with a minute, usually blunt point towards the back, and often somewhat recurved, and frequently infolded, near the tip, the base tapering to a thick petiole usually less than 1 mm long but occasionally longer. *Flowers* white, 7–11 mm in diameter, occurring singly or occasionally 2 together in modified shoots usually at the ends of short few-leaved branches in adjacent leaf-axils, the new growth dense and vigorous at the ends of branches during or after flowering with little development in the flowering region. *Bracts* rather firmly scarious, red-brown, the inner and bracteoles large and concave, usually shed shortly before the flower opens. *Hypanthium* densely pubescent with silky appressed or, more frequently, rather spreading hairs, and occasionally with crisped hairs, with obvious glands showing through the pubescence, 2–3 mm long, the upper part somewhat expanded, the lower lobed in cross-section and rather rounded above a distinct pedicel 0.5–1 mm long, the top of the ovary glabrous. *Sepals* deciduous, c. 1.5 mm long, somewhat scarious, very broadly ovate to oblong or almost orbicular, densely pubescent with short crisped hairs and/or long silky hairs. *Petals* 3.5–4.5 mm long. *Stamens* in bundles of (1–)3(–5), c. 2 mm long, the anther-cells c. 0.5 mm long, parallel, slightly or scarcely recurved but often folded back, somewhat deep in the outer part. *Style* inset, rather stout with a rather small, relative to the style, stigma; often absent. *Ovary* (4–) 5 (–6)-locular, each loculus with c. 40 ovules in 4 rows on a short, rather high loculus somewhat acute and extended at the top; sometimes absent. *Fruit* often long-persistent, usually 5–6 mm in diameter, not extended at the erect rim, the lower part usually almost hemispherical and broad-based above a short stalk, when young with the surface soon lifting, later gnarled, the valves woody and, before opening forming a high dome so that the broad part of the fruit is almost spherical, after opening spreading but seldom much, if at all, beyond the rim. *Mature seeds* 2–2.5 mm, irregularly narrowly linear-cuneiform, curved, striate. Main flowering period: Dec.-Feb.

DISTRIBUTION: Widespread on the Central and Southern Tablelands of New South Wales, in adjoining parts of the Western Slopes in the south, and in northeastern Victoria (Map 8). Usually in damp, poorly drained, often rather peaty, sandy soils in woodland, often on the margins of high altitude swamps, occasionally on rocky creek banks.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Tablelands: Gosling Creek, Canobolas State Forest, 9 miles [14.5 km] S. of Orange, *Johnson NSW 25002*, 8.1953 (NSW); 18 km NW. of Taralga, 3 km from Wombeyan Caves ..., *Tyrrel 111 & Streimann*, 8.1978 (CBG, NSW). Southern Tablelands: Murray Gap, A.C.T., *Burbidge 6949*, 2.1961 (CANB, NSW); Wilsons Valley, Kosciusko National Park, *Thompson 2810*, 2.1978 (NSW). South Western Slopes: Burrinjuck, *Boorman NSW 54765*, 2.1911 (NSW). VICTORIA: East Gippsland: Little River, Wulgulmerang, c. 33 miles [53 km] NNE. of Buchan, *Melville 3017 & Wakefield*, 1.1953 (NSW). Northeastern Highlands: Mt Buffalo, Eagle Point area, *Willis*, 2.1963 (MEL, NSW).

This species hybridises with *L. continentale* in eastern and southern parts of its range and with *L. obovatum* in the northern part.

54. *L. gregarium* J. Thompson sp. nov.

Frutex c. 2 m altus. Folia subcrassa late obovata ad oblanceolata pubescentia, 0.5–1 cm longa. Flores ad 10 mm diametro, sepalis pubescentibus deciduis. Ovarium 5-loculare. Fructus 4–5 mm diametro persistentes.

HOLOTYPE: NEW SOUTH WALES: 10 km from Ebor on Guyra road, *J. Thompson 4196*, 23.7.1981 (NSW).

Shrub, usually about 2 m tall, with close bark that (from specimens) appears to be shed at times in fibrous strips or small flakes to leave a smooth surface; the younger stems with a close pubescence, a conspicuous flange usually tending to curve slightly around the stem, and with branching c. 45° but often narrowing subsequently. *Leaves* usually crowded and at first rather erect, later more spreading, mostly 5–10 mm long but occasionally to 15 mm, and usually 2.5–4 mm wide, broadly obovate to oblanceolate, rather thick, with prominent glands and usually closely pubescent with the pubescence of silky hairs on young leaves giving way to short rather crisped hairs, somewhat incurved in cross-section, the apex obtuse to broadly acute, often with a short blunt point, the base tapering to a very short broad petiole. *Flowers* white, 10 mm or less in diameter, occurring singly or occasionally 2 together on modified shoots on leafless or few-leaved axillary branches in adjacent axils and on adjacent branches, the new growth extending densely, mostly from branch-ends after flowering. *Bracts* thin, scarious and pale to red-brown, the inner and bracteoles large and concave but enclosing only the rather small bud, very deciduous. *Hypanthium* with a dense long, usually crisped pubescence or, occasionally, glabrous, rather dark with rather obvious glands, c. 3 mm long, the upper part slightly expanded, the lower tapering slightly and then abruptly above a very short pedicel, the top of the ovary glabrous. *Sepals* deciduous, 1.5–2 mm long, almost orbicular to obtusely deltoid, rather scarious but densely pubescent. *Petals* c. 3–4 mm long. *Stamens* in bundles of 3–5, 1.5–2 mm long, the anther-cells, c. 0.5 mm long, parallel, recurved and often somewhat folded back, deep with the outer part wide. *Style* inset, broad-based and rather stout, with a rather large stigma; often absent. *Ovary* (4–) 5-locular, each loculus with c. 60 ovules in 8 rows on a short high extended placenta; sometimes absent. *Fruit* persistent, variable in size, 4–(5–6)–8 mm in diameter, widest at the rim, the lower part narrower and, when young, lobed in cross-section and with the surface lifting, later gnarled, the valves woody and before the opening forming a dome, usually depressed in the centre, higher than or approximately equal to the broad part of the base, the whole being broader than deep, after opening the valves spreading but often not as wide as the rim, occasionally wider but still remaining comparable in depth to the round base. *Mature seeds* c. 2 mm long, irregularly narrowly linear-cuneiform, curved or sigmoid, striate. Main flowering period: Nov.–Dec.

DISTRIBUTION: On the Northern Tablelands and Western Slopes of New South Wales and in the “Granite Belt” of Queensland (Map 8). In high-altitude swamps or in rocky places along streambanks.

SELECTED SPECIMENS: QUEENSLAND: Darling Downs: Wallangarra, *Boorman NSW 154764*, 4.1914 (NSW). NEW SOUTH WALES: Northern Tablelands: Stonehenge, *Maiden NSW 154763*, 12.1899 (NSW); Hanging Rock near Nundle, *Cheel NSW 154762*, 4.1926 (NSW). North Western Slopes: Bundulla State Forest, Warrumbungle Ranges, *Burrows NSW 154761*, 10.1918 (NSW).

This species is named for its tendency to grow in dense stands in swampy areas.

55. *L. obovatum* Sweet, Fl. Austral.: t. 36 (1827)28).

TYPE: A plant, grown from seed collected by C. Frazer in New South Wales, raised at the nursery of Whitley, Brames and Milne, at Fulham, illustrated by Sweet, loc. cit.

SYNONYMY: *L. flavescens* var. *obovatum* (Sweet) F. Muell. ex Benth., Fl. Austral. 3: 104 (1867).

Dense erect shrub often 2 m or more in height with close and firm bark; the younger stems with a close appressed pubescence, a flange thick near the node and somewhat broader there, otherwise not very broad or thick but quite conspicuous, and with branching at c. 30°. *Leaves* aromatic, erect to spreading or even deflexed, 5–20 mm long and 2 to more than 8 mm wide, narrowly oblanceolate to very broadly obovate, glabrous or with some appressed pubescence, at least at first, usually rather thick with the margins tending to incurve, or occasionally recurve, the apex usually very broad and retuse, occasionally round and rarely acute with a short pungent point, the base long-tapering to a short or negligible petiole. *Flowers* white, 8–12 mm in diameter, occurring singly or occasionally 2 together on modified shoots on very short few-leaved or leaf-less branchlets, in adjacent axils on adjacent branches, the new growth vigorous from the ends of branches, usually but not invariably well beyond the flowering region at flowering, with negligible development from the flowering shoot. *Bracts* red-brown, broad and scarious, the ultimate and the bracteoles large and enclosing the shortly pointed bud, all readily deciduous. *Hypanthium* rather dark, and glabrous or with a short irregular pubescence, 2.5–3.5 mm long, the top very broad, tapering, and the lower part somewhat lobed in cross-section and narrowing to, or somewhat rounded above, a short pedicel, the top of the ovary glabrous. *Sepals* deciduous, 2–2.5 mm long, glabrous or with ciliate margins, pale and scarious, broadly ovate to almost orbicular, or oblong. *Petals* 3–4 mm long. *Stamens* in bundles of 5–7, 2–2.5 mm long, the anther-cells c. 0.5 mm long, parallel recurved and folded back to some extent, very broad and deep in the outer edge and with the inner thickened, their opening rather restricted. *Style* inset, broad-based and tapering, and with the stigma rather large; sometimes absent. *Ovary* 5-locular, each loculus with c. 60 ovules in 6–8 rows on a large, broad, sometimes somewhat extending placenta; sometimes absent. *Fruit* persistent, 5–8 mm in diameter, widest at the scarcely extended rim, the lower part rather shallow and rounded above a very short stalk, the surface occasionally lifting, often flaking, later flaky, the valves woody, at first raised so as to be symmetrical with the surface lifting, and ultimately spreading wide so as to be much wider than the now very shallow base. *Mature seeds* 2–2.5 mm long, irregularly narrowly linear-cuneiform, curved, striate. Main flowering period: Nov.-Jan.

DISTRIBUTION: From an isolated occurrence in the Pilliga Scrub at the foot of the Warrumbungle Mountains in New South Wales, through Central and Southern Tableland and Coastal regions to western Victoria (Map 8). Often in swampy places but more frequently among granite or sandstone rocks on the edges of swift-flowing streams.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Springwood, *Boorman NSW 154773*, 1.1901 (NSW). South Coast: Whipstick Creek near Burragate, *Thompson 4257*, 3.1982 (NSW). Central Tablelands: Rydal to Fish R. and Sidmouth Valley, *Maiden & Cambage NSW 143930*, 4.1909 (NSW). Southern Tablelands: Snowy R., just above Guthega Dam, *Thompson 4266*, 3.1982 (NSW). North Western Slopes: Warrumbungle Ranges, *Forsyth NSW 154772*, 10.1899 (NSW). VICTORIA: East Gippsland: Wangarabelle, *Beaglehole 33700*, 8.1970 (MEL, NSW), *Thompson 4237*, 3.1982 (NSW). Western Coastal Plains: Glenelg R., Cherrypool, Henty Highway, *Beaglehole 4718*, 3.1957 (MEL, NSW).

56. *L. argenteum* J. Thompson sp. nov.

Frutex 1–2 m altus. Folia subcrassa obovata-elliptica, 0.5–1.5 cm longa, junioribus sericeis. Flores 8–12 mm diametro, sepalis pubescentibus deciduis. Ovarium 5-loculare. Fructus 5–7 mm diametro persistentes.

HOLOTYPE: NEW SOUTH WALES: Upper Gummi Creek (Mt Royal Range), 4200 ft [1280 m] alt., [Upper Manning R.] R. W. Earp NSW 154771, 27 Jan 1957 (NSW).

Shrub often 1–2 m tall, occasionally up to 7 m, with, as seen from specimens, rather smooth close bark that tends to be shed in strips or flakes; the younger stems with a dense close pubescence, sometimes glabrescent, a conspicuous, spreading flange, broad and thick especially at the node, and branching at c. 45°. *Leaves* at first diverging only narrowly but soon at least some spreading widely, most 5–15 mm long and about ½ as wide, very broadly obovate-elliptical, thick, and almost flat, with somewhat prominent glands, ultimately glabrous or almost so but the young growth grey with silvery pubescence, the apex with an umbo at the back, obtuse, from very broadly rounded to almost acute, the base tapering, usually to a short petiole. *Flowers* white, c. 8–12 mm in diameter, occurring singly or occasionally 2 together on modified shoots on short, often very short, leafless or few-leaved axillary branches, the new growth dense and vigorous from branch-ends during flowering, i.e. with the flowering region below it, and very limited and later from near the flower. *Bracts* rather pale, red-brown and scarious, the inner and bracteoles longer, elliptical and concave, enclosing only the very young pointed bud. *Hypanthium* usually with a few short irregular hairs on the expanded upper part, 2–3 mm long, somewhat lobed in cross-section, rather dark and glabrous, and very broad above a narrow, densely hairy, pedicel c. 1 mm long, the top of the ovary glabrous. *Sepals* deciduous, c. 2 mm long, broad-ovate and obtuse to almost spherical, pubescent at least in part, the hairs longer and dense at the apex, scarious with wide pale margins. *Petals* c. 4–5 mm long. *Stamens* in bundles of c. 5, 2–3 mm long, the anther-cells c. 0.5 mm long, parallel, rather deep in the inner and wide in the outer part, recurved and tending to fold back. *Style* inset, broad-based but tapering towards a rather small stigma. *Ovary* 5-locular, each loculus with c. 40–45 ovules in 6 rows on a high, short broad extending placenta. *Fruit* rather long-persistent, 5–7 mm in diameter, widest at the erect rim, the lower part broader than deep, the surface lifting and later becoming scaly, the valves woody and exserted, before opening, to a height almost equal to the depth of the broad part of the base, after opening spreading and becoming wider and higher than the shorter rounded base. *Mature seeds* c. 2 mm long, narrowly linear-cuneiform, curved, and striate. Main flowering period: Jan.

DISTRIBUTION: Endemic on the Barrington Tops of eastern New South Wales, at high altitudes (Map 8). Along watercourses or in swamps, on basaltic soils.

SELECTED SPECIMENS: NEW SOUTH WALES: Northern Tablelands: Tubbrabucca, Tomalla Tableland, Earp NSW 154770, 1.1956 (NSW); Barrington Tops, Boorman NSW 154769, 12.1915, Harrison NSW 154768, 1.1925 (NSW), Munro NSW 154766, 1.1953 (NSW), Benson NSW 154767, 12.1981 (NSW).

This species is named for the colour of its young growth.

57. *L. micromyrtus* Miq., Ned. Kruidk. Arch. 4: 145 (1859)⁶.

HOLOTYPE: VICTORIA: Mt Aberdeen, F. Mueller, s.d. (?U, n.v.).

Rather woody spreading shrub from less than 1 to more than 3 m tall, with (as seen on specimens) rather flaking bark; the younger stems closely pubescent or glabrous and rather stout, with the flange inconspicuous, thick only at the nodes, and usually narrow there, and the branching at c. 60° or more but usually soon curving so as to appear at a narrower angle. *Leaves* strongly

aromatic, erect or diverging, usually (5-) 10-15 mm long and 5-10 mm wide, obovate, often very broadly (almost orbicular), rarely narrowly, flat or somewhat recurved, thick in texture and sometimes with prominent glands, usually glabrous but often with pubescent margins, the apex usually broadly rounded with an umbo at the back but occasionally broadly acute with a short blunt point, the base tapering to, or rounded above, a short petiole. *Flowers* white, 12-15 mm in diameter, occurring singly, occasionally 2 together in modified shoots at the ends of very short axillary branches in adjacent axils, the new growth extending from branch-ends well beyond the flowering region before flowering with little or none from the flowering area. *Bracts* red-brown and scarious, broad, the inner and bracteoles large and concave, enclosing the round-topped bud and shed just before it opens. *Hypanthium* glabrous and dark, with conspicuous glands, 2-4 mm long, with the upper part somewhat expanded and the lower somewhat lobed in cross-section and rounded at the base above a narrow pedicel of variable length (0- c. 1 mm), the top of the ovary glabrous. *Sepals* deciduous, c. 2.5 mm long, almost orbicular, pale, scarious and glabrous. *Petals* c. 5 mm long. *Stamens* in bundles of 5 (-7), 1.5-2.5 mm long, the anther-cells c. 0.6 mm long, parallel, only slightly recurved and folded back, the inner part conspicuously thickened, the outer deep and broad. *Style* well inset, slender, with a medium-sized stigma; often absent. *Ovary* (4-) 5-locular, each loculus with c. 80 ovules in c. 8 rows on a broad rather high placenta; sometimes absent. *Fruits* long-persistent and often tending to become submerged in the outer layers of the stem, very variable in size, usually 5-8 mm in diameter, widest at a somewhat extended rim, the lower part broad and rounded or rather turbinate with the surface lifting, later very gnarled and flaky, the valves very woody, at first raised to about the equivalent of the broad shallow base, later with the surface often raised and smooth, often tardily dehiscent with the open valves often scarcely spreading, occasionally extending beyond the rim. *Mature seeds* c. 2 mm long, narrowly linear-cuneiform, curved, and striate. Main flowering period: Jan.-Feb.

DISTRIBUTION: On the Southern Tablelands of New South Wales and the high mountains of northeastern Victoria (Map 8). On steep windswept rocky slopes in shallow soil or in rock crevices; on granite.

SELECTED SPECIMENS: NEW SOUTH WALES: Southern Tablelands: summit of Mt Coree, A.C.T., *Darbyshire* 151, 2.1961 (CANB, NSW); Little Bald Rock Range, Jounama Peaks, Yarrangobilly, *de Beuzeville* NSW 143927, 9.1922 (NSW); Tinderry Mts, 8 miles [13 km] E. of Michelago, *Briggs* NSW 143914, 12.1965 (NSW). VICTORIA: Northeastern Highlands: Pine Mt., c. 90 km ENE. of Wodonga, *Willis*, 1.1964 (MEL, NSW); Buffalo Mt, *Cambage* 3721, 1.1913 (NSW).

58. *L. scoparium* Forst. & Forst. f., Char. Gen.: 72, t. 36, figs. f)1 (1776).

LECTOTYPE: the plate (t. 36) as to figs g-l, fide McVaugh, *Taxon* 5: 142 (1956).

SYNONYMY: *Melaleuca scoparia* (Forst. & Forst. f.) L.f., *Suppl. Pl.*: 343 (1781). *Philadelphus scoparius* (Forst. & Forst. f.) Sol. ex Aiton var. *linifolius* Sol. ex Aiton, *Hortus Kew.* 2: 156 (1789). *Melaleuca scoparia* var. *diosmatifolia* Wendl. f. 7 Schrader, *Sert. Hannov.*: 24, t. 14 (1797). *L. scoparium* var. *linifolium* (Sol. ex Aiton) R. Br. ex Aiton, *Hortus Kew*, ed. 2, 3: 181 (1811). *L. linifolium* (? Sol. ex Aiton) Dum.-Cours., *Bot. Cult.*, ed. 2, 5: 384 (1811) (This name, not previously used in specific rank, is placed as a variety of *L. scoparium* here and is, therefore, invalid). *L. scoparium* var. *forsteri* S. Schauer, *Linnaea* 15: 425 (1841).

P. scoparius var. *myrtifolius* Sol. ex Aiton, loc. cit. **TYPE:** NEW ZEALAND: *herb. Banks* (BM, n.v.). *M. scoparia* var. *myrtifolia* (Sol. ex Aiton) Wendl. f. & Schrader, loc. cit. *L. scoparium* var. *myrtifolium* (Sol. ex Aiton) R. Br. ex Aiton, loc. cit.

P. aromaticus Sol. ex Aiton, loc. cit. (a plant with a deciduous calyx).

L. floribundum Salisb., Prodr.: 349 (1796), nom. illegit. TYPE: NEW ZEALAND: herb. Banks (BM, n.v.).

P. floribundus Usteri ex Roemer & Usteri, Bot. Mag. (Römer & Usteri) 3: 177, t. 2 (1790). TYPE: a cultivated plant.

L. scoparium var. *parvum* Kirk, Stud. Fl. New Zealand 158 (1899). TYPE: NEW ZEALAND: near Wellington (? , n.v.).

L. scoparium var. *prostratum* Kirk, loc. cit. TYPE: NEW ZEALAND: on mountains (? , n.v.).

L. nichollsii (sphalm. *nichollii*) Dorr. Sm., Gard. Chron., ser. 3, 43: 399 (1908) in obs.; op. cit. 53: 255 (1913). TYPE: ?.

L. scoparium var. *nichollii* Turrill, Bot. Mag.: t. 8419 (1912). TYPE: ?Bot. Mag. t. 8419.

L. scoparium var. *eximium* B. L. Burtt, Bot. Mag.: t. 9582 (1939-40). TYPE: cultivated from seed collected near Port Arthur, Tasmania, by H. F. Comber, flowering 1935 (?K, n.v.).

Shrub usually c. 2 m tall but occasionally reaching 4 m or more, dwarfed in exposed places, the bark usually close and firm, rarely layered; the younger stems with a long fine silky pubescence but usually soon becoming glabrous, with a conspicuous but not usually much extending flange usually curving round the stem, often with a ridge below the node, and with branching usually at 45°. *Leaves* mostly widely divergent, spreading or even deflexed, variable in size and shape, often with the region or habitat, from less than 7 to more than 20 mm long, usually 2-6 mm wide, narrowly to broadly elliptical, or broadly lanceolate or oblanceolate, with those of new shoots usually larger and often silvery pubescent but soon becoming glabrous, firm or thick especially near the tip and most with the margins incurved or infolded especially in the upper part, occasionally flat and usually minutely tuberculate, the apex tapering to an often acuminate pungent point, the base tapering (except in very narrow leaves) somewhat variably to a short often stout-based, but sometimes negligible, petiole. *Flowers* white or, rarely, pink or red, usually 8-12mm in diameter, occasionally larger, occurring singly, rarely (?aberrantly) several on modified shoots on very short leafless or few-leaved, occasionally many-leaved, branches in adjacent axils and on adjacent branches, with the new growth dense from branch-ends after flowering. *Bracts* broad, scarious and red-brown, the inner and bracteoles larger and enclosing the young bud, most, or all, shed early. *Hypanthium* glabrous or rarely with a sparse, short, pubescence and usually rather dark, sometimes with obvious glands, 2-3 (-4) mm long, the upper part widely expanded, the lower rather lobed in cross-section and tapering or somewhat rounded, usually above a distinct pedicel, the top of the ovary glabrous. *Sepals* deciduous, usually c. 2mm long, oblong to broadly deltoid and sometimes extended at the base, scarious and glabrous or with minutely ciliate margins. *Petals* 4-7mm long. *Stamens* in bundles of 5-7 (-9), c. 2.5-3.5 mm long, the filaments broad-based but scarcely joined, anther-cells 0.5-0.7mm long, parallel, with a deep outer part but opening wide and thickened, especially the inner part, usually not much if at all recurved but often tending to fold back. *Style* inset, stout and straight-sided with a large stigma; often reduced or absent. *Ovary* 5-locular, each loculus with c. 100 ovules in c. 8 rows on a large, broad and thick, somewhat extended placenta; sometimes absent. Fruit long-persistent and enlarging, usually 6-9, occasionally more than 10 mm in diameter, widest at the scarcely extended rim, the lower part rounded or broadly rounded, at first above a very short stalk, the surface usually close, the valves very woody, at first exerted as a dome, indented in the centre, symmetrical, or almost so, with the base, later spreading, often not beyond the rim but frequently widely extending, especially on older fruit, so that the base becomes shallow. Mature seeds 2-3.5mm long, irregularly narrowly linear-cuneiform or sigmoid, curved, striate. Main flowering period: Oct.-Feb.

DISTRIBUTION: Scattered on mainland Australia from Mt Imlay on the far south coast of New South Wales to the Grampians in western Victoria and widespread in Tasmania and New Zealand (Map 8). Especially in rocky and/or moist sandy heath but often riparian along swift-flowing streams.

SELECTED SPECIMENS: NEW SOUTH WALES: South Coast: Mt Imlay near Eden, *Boorman NSW 154778*, 12.1916 (NSW). VICTORIA: East Gippsland: Upper Genoa., c. 4 miles [6.5 km] E. of Coopracambra Mtn, *Melville 2901 & Wakefield*, 1.1953 (NSW). Western Highlands: W. slopes of Mt William, Serra Range, *Briggs 2895*, 10.1969 (NSW). TASMANIA: Bass Strait, Kents Group, *Brown*, 12.1803 (NSW); Rocky Cape, *Phillips 031234*, 11.1965 (CBG, NSW); *Richley 12*, 10.1975 (HO); 2.5 km N. of Coles Bay along the road to Swansea, *Short 1911*, 2.1983 (MEL, NSW); Strahan; near the wharf, *Rodway 1531*, 10.1933 (NSW); Macquarie heaths, *Meschal 5456*, 1.1984 (HO). NEW ZEALAND NORTH ISLAND: Whararoa County, c. 10.5km due W. of Kaeo, *Orchard 3597*, 10.1972 (NSW); Pinnacles track, Kaueranga Valley, Coromandel, *Gardner 395*, 1.1973 (NSW). South Island: Upper gorge of R. Waimakariri, *Cockayne 5119*, 12.1901 (NSW).

This species is very variable with different forms in different districts and habitats. A number of variants have been found in New Zealand where Holocene extension of range has encouraged diversity. The species is widely used in horticulture where cultivars vary a great deal in size, colour (of both floral and vegetative features) and shape.

59. *L. continentale* J. Thompson sp. nov.

Frutex usque ad 2 m vel altior. Folia lanceolata pungnetia, (0.5–) 1 (–1.5) cm longa. Flores c. 10mm diametro, sepalis glabris deciduis. Ovarium 5-loculare. Fructus 6–7mm diametro persistentes.

HOLOTYPE: NEW SOUTH WALES: Rocky top, Kanangra, *J. Thompson 4304*, 30.8.1982 (NSW).

SYNONYMY: *L. scoparium* forma *angustifolium* Miq., Ned. Kruidk. Arch. 4: 47 (1859). **TYPE:** SOUTH AUSTRALIA: Rivoli-bay [Rivoli Bay], *F. Mueller*, s.d. (U, n.v.).

Straggling slender shrub, occasionally tree-like, 1–2(–4) m tall, with close firm bark except in very old plants where it may peel in flaky strips; the younger branches pubescent with long, fine, appressed, often persistent hairs, a conspicuous but not very wide flange often curving around the stem, usually somewhat thicker below the node, and with branching often at 45°. *Leaves* usually spreading but often recurving or deflexed, (5–) 10 (–15) mm long and usually 1–3 mm wide, lanceolate (often narrowly) or less frequently oblanceolate, silky on young shoots, and glabrescent or with the long fine pubescence often retained, rather thick and rigid and incurved or infolded, often strongly, in cross-section, especially toward the apex, occasionally flatter and less rigid, the apex long-tapering to a pungent point and almost terete just behind this, the base tapering to a distinct, occasionally indistinct, broad-based often somewhat triquetrous petiole, the margins often minutely tuberculate. *Flowers* white or, rarely, flushed pink, 6–11, usually c. 10 mm in diameter, occurring singly, rarely 2 together, on modified shoots on very short leafless or few-leaved axillary branches in adjacent axils on adjacent branches; the new growth often dense and vigorous, occasionally pink, developing from branch-ends, during and after flowering. *Bracts* broad, red-brown and stiffly scarious; the inner and bracteoles large and enveloping the young bud, shed early, occasionally with a few persisting. *Hypanthium* usually glabrous rarely with some

hairs at the base, rather dark coloured, 2–2.5 mm long, the upper part expanding widely, the lower rather lobed in cross-section and rounded or almost truncate above a narrow pedicel, the top of the ovary glabrous. *Sepals* deciduous, usually 1.5 mm long, ovate-oblong with the apex rounded, glabrous or with ciliate margins, pale and scarious, the base occasionally extending. *Petals* c. 3–5 mm long. *Stamens* in bundles of 5 (–7), 1.5–2 mm long, the filaments sometimes broad in the lower part and tending to join at the base, the anther-cells 0.4–0.5 mm long, parallel, with a deep outer part but opening wide and thickened, not recurving but tending to fold back. *Style* inset, stout and straight-sided with a large stigma; often reduced or absent. *Ovary* (4–) 5-locular, each loculus with c. 60 ovules in 6 (–8) rows on a large, deep and broad, somewhat extended placenta; sometimes absent. *Fruit* often long-persistent, but usually not enlarging, usually 6–7 mm in diameter, occasionally larger, widest near the scarcely extended or woody rim, the lower part broad and curved to a somewhat flattened base or to above a short stalk, the surface close and ultimately gnarled, the valves at first exerted to form a sometimes rather flat-topped dome usually almost equal to the base, though variable, later expanding, usually so as to slightly exceed the rim. *Mature seeds* 2–3 mm long, irregularly narrowly linear-cuneiform or sigmoid, curved, striate. Main flowering period: Oct.-Jan.

DISTRIBUTION: From central eastern New South Wales to southeastern South Australia (Map 8). In forest or open sandy swampy places.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Royal National Park on plateau above Audley, *Thompson 2765*, 11.1977 (NSW). South Coast: 4 miles [6.5 km] W. of Green Cape, *Constable NSW 30435*, 10.1954 (NSW). Central Tablelands: 6 km WNW of Mittagong, *Thompson 4070*, 12.1980 (NSW). Southern Tablelands: NW. side of Black Mtn, Canberra, A.C.T., *Pullen 2110*, 7.1960 (CANB, NSW). Central Western Slopes: Ulan, Mudgee-Cassilis road, *Johnson & Constable NSW 16228*, 8.1950 (NSW). South Western Slopes: 4 miles [6.5 km] SSW. of Carabost, *Logan NSW 94784*, 12.1966 (NSW). VICTORIA: East Gippsland: 4 km SW. of Bemm River township along margin of Sydenham Inlet, *Haegi 1675*, 2.1979 (NSW). Port Phillip: Port Phillip, *Luehmann*, 1891 (NSW). Coastal Plains: Anglesea, *Huggins 61*, 2.1983 (MEL, NSW). SOUTH AUSTRALIA: Southern Lofty: near Adelaide, *Cleland*, 1898 (NSW). Kangaroo Island: mile [0.8 km] E. of Karatta, *Phillips 023804*, 9.1965 (CBG, NSW). South-eastern: near Mt Compass, *Webster 19083*, 11.1973 (NSW).

This species is named for its distribution which is (with the exception of Kangaroo Island) limited to the mainland of Australia. This is in contrast to its close relative, *L. scoparium*, which inhabits, for the most part, Tasmania, the Bass Strait Islands and New Zealand. The species are difficult to differentiate as both are extremely variable and form local phenotypically similar variants. Both grow in East Gippsland where each presents a very different aspect. It is possible that a widespread population has been divided by the formation of Bass Strait and that the mainland has subsequently been reinvaded by the southern isolate.

60. *L. juniperinum* Smith, Trans. Linn. Soc. London 3: 263 (1797).

HOLOTYPE: NEW SOUTH WALES: Port Jackson, *J. White s.n.*, herb. *Smith 878.17*, 1795 (LINN, n.v.; LIVCM, n.v., photo NSW).

SYNONYMY: *L. scoparium* var. *juniperinum* (Smith) Domin, Biblioth. Bot. 89: 453 (1928).

L. aciculare S. Schauer, Linnaea 15: 429 (1841). *L. scoparium* var. *aciculare* (S. Schauer) Domin, loc. cit. SYNTYPES: In Nov. Holl. orientale and sinum Moreton-Bay et in Nova

Cambria australe, v.s. spont. (? , n.v.). The protologue may include other elements.

L. aciculare var. *majus* S. Schauer, loc. cit. SYNTYPES: ad sinum Moreton Bay [Queensland], *A. Cunningham* (a. 1824) and in Nova Cambria australe (? , n.v.).

L. aciculare var. *minus* S. Schauer, loc. cit. TYPE: QUEENSLAND: ad sinum Moreton Bay, *A. Cunningham* (1. 1824) (? , n.v.).

Erect, compact, "Broom"-like shrub often 2–3 m tall, with close bark; the younger stems slender, often with a pubescence of long, fine, usually appressed hairs, and a flange not wide but conspicuous especially at the node and tending to curve around the stem, the branching often at 30° or if at c. 45° tending to become more erect. *Leaves* dense, at first almost erect though later often rather spreading, the youngest silvery silky but soon becoming glabrous, usually narrowly elliptical or narrowly lanceolate, from less than 5 to more than 15 mm long and up to 2 mm wide (with occasional leaves more), usually rather thick especially near the almost terete apex, and usually almost flat and with some incurving especially in the upper part, the margins often minutely tuberculate, the apex tapering to a pungent point, the base usually little tapering and contracting to a very short, rather triquetrous but sometimes imperceptible petiole. *Flowers* white, 6–10 mm in diameter, occurring singly, or rarely 2 together, on modified shoots at the ends of very short usually several-leaved branches in numerous adjacent axils on adjacent branches, the new growth vigorous from branch-ends after, or during, flowering with no development from the flowering region. *Bracts* broad and concave, red-brown and scarious, the inner and bracteoles enveloping only the very young bud. *Hypanthium* glabrous or with a short irregular pubescence, 1.5–2 mm long, the upper part somewhat expanded and tapering, the lower rather lobed in cross section, usually more abruptly tapered to, or narrowly rounded above a pedicel to c. 0.5 mm long, the top of the ovary glabrous. *Sepals* deciduous, usually 1.5 mm long, broadly ovate, obtuse scarious and glabrous. *Petals* often c. 3.5 mm long. *Stamens* in bundles of 5–7, 1–1.5 mm long, the anther-cells c. 0.3 mm long, parallel, opening widely, and shallow but with a broad and relatively deep outer part. *Style* inset, rather slender with a very large stigma; often reduced or absent. *Ovary* 5-locular, each loculus with c. 40 ovules in c. 6 rows on a broad, short, extended placenta; sometimes absent. *Fruit* rather long-persistent but not much enlarged, rarely more than 7 mm in diameter, often smaller, the rim narrow but woody, below this the base somewhat tapered or shallowly rounded and its surface close, the valves woody, exerted, at first as a rather flat-topped lobed dome, depressed in the centre and varying from larger to smaller than the base, later expanding and spreading, often so as to equal or exceed the rim. *Mature seeds* c. 2 mm long, irregularly narrowly linear-cuneiform, striate. Main flowering period: irregular, mostly Nov.-Dec.

DISTRIBUTION: In coastal eastern Australia from Fraser Island, Queensland, to Ulladulla in New South Wales, extending inland to the Blue Mountains of New South Wales and the northern edge of the Southern Tablelands (Map 8). In swamps on sandy soils and on sandstone escarpments.

SELECTED SPECIMENS: QUEENSLAND: Wide Bay: Fraser Is., *Hubbard 4590/A*, 10.1930 (NSW). Moreton: Broadwater, near Brisbane, *Hubbard 4334*, 10.1930 (NSW). NEW SOUTH WALES: North Coast: Lighthouse Beach area S. of Port Macquarie, *Pullen 4261*, 1.1967 (CANB, NSW). Central Coast: Port Jackson, *Brown, 1803–5* (NSW). South Coast: Dampier State Forest, c. 25 km W. of Moruya, *Pullen 4946*, 6.1973 (CANB, NSW). Central Tablelands: Blackheath, *Constable NSW 5276*, 2.1948 (NSW). Southern Tablelands: Mt Budawang, *Rodway 3065*, 1.1940 (NSW).

Most authors have included *L. continentale* in their concept of *L. juniperinum*. These species are similar and some specimens are hard to place, but whether these represent hybrids between the species where their ranges adjoin, a merging of forms to indicate no distinction at specific level between the taxa, or a local modification of one to resemble the other, requires further study.

61. *L. rupicola* J. Thompson sp. nov.

Frutex plerumque minus quam 1 mm altus. Folia anguste lanceolata pungentia, 1–2 mm longa. Flores 10–12 mm diametro, sepalis glabris deciduis. Ovarium 5-loculare. Fructus 6–10 mm diametro persistentes.

HOLOTYPE: NEW SOUTH WALES: Nellies Glen, 1 mile [1.6 km] W. of Blackheath, 3300 ft [1000 m], *E. F. Constable* NSW 42755, 16.10.1957 (NSW).

Robust but low-growing shrub usually 1 m or less in height, with close and firm bark, the younger stems rather stout, with a long, appressed pubescence at least at first, and a conspicuous and not very wide flange, wider and thicker near the node, extended rather than curving around the stem, the branching at 45°–60°. *Leaves* mostly erect to narrowly divergent, at least at first, and crowded, narrow-lanceolate, c. 10–20 mm long and 1–3 mm wide, glabrescent, and often thick in texture, especially near the apex, the apex long-tapering to a pungent point, the base more gradually tapering, broad, rather triquetrous and petioleless, the margins often minutely tuberculate. *Flowers* white, 10–12 mm in diameter, single on modified shoots at the ends of very short but usually several-leaved axillary branches in adjacent axils on adjacent branches, the new growth from branch-ends during flowering. *Bracts* broad, red-brown and scarious, the inner larger and enveloping the young bud, but shed early. *Hypanthium* glabrous, rather dark and often with conspicuous glands, c. 3 mm long, the upper part not much expanded, the lower usually little tapering and usually rather broadly rounded above a short narrow pedicel, the top of the ovary glabrous. *Sepals* deciduous, c. 2mm long, rather pale, especially on the margins, and scarious, broadly ovate to almost orbicular, glabrous. *Petals* c. 5 mm long. *Stamens* in bundles of 5–7, c. 1.5–3 mm long, the filaments not or scarcely joined, the anther-cells c. 0.7 mm long, parallel, deep in the outer part but opening wide, thickened but rather flat and shallow, not recurved but tending to fold back. *Style* well inset, stout and straight with a very large stigma; often undeveloped. *Ovary* 5-locular, each loculus with c. 80 ovules in c. 8 irregular rows on a large, deep and rather extended placenta; sometimes absent. *Fruit* long-persistent, 6–10 mm in diameter, widest at the erect or spreading and rather woody rim, the lower part usually almost hemispherical with a stalk occasionally tending to persist a while, the surface sometimes tending to lift in large flakes but mostly close, ultimately gnarled, the valves at first not much exerted, the dome wide and shallow but the fruit often tardily opening and then the dome often raised to about the depth of the base, the open fruit with the valves ultimately spreading well beyond the rim and much deeper than the then-shallow base. *Mature seeds* c. 2 mm long, irregularly linear-cuneiform, curved, striate. Main flowering periods: Mar.-May and Sept.-Oct.

DISTRIBUTION: In central eastern New South Wales (Map 8). Associated with high sandstone cliffs and escarpments.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Kangaroo Valley, *Cheel* NSW 154779, (NSW). Central Tablelands: 2 km SW. of Glen Davis, *Coveny* 9450 & *Telford*, 5.1977 (NSW); Berrima, *Maiden* NSW 154780, 9.1901 (NSW).

This species is named for its habitat; the epithet, being a latin substantive in opposition, does not agree in gender-ending with the generic name.

62. *L. squarrosus* Gaertner, *Fruct. Sem. Pl.* 1: 174, t. 35, fig. 3 (1788); B.L. Burt, *Bot. Mag.*, under t. 9582 (1939).

TYPE: The plate accompanying the description, based on a specimen in the Banksian herbarium: New South Wales, *Banks and Solander*, 1770 (BM, dupl. NSW).

SYNONYMY: *L. scoparium* var. *squarrosus* Dum. — *Cours.*, *Bot. Cult.*, ed. 2. 5:384 (1811). *L. scoparium* var. *vulgare* Domin, *Biblioth. Bot.* 89: 452 (1928).

L. persiciflorum Reichb., *Iconogr. Bot. Exot.* 3: 8, t. 220 (1830).

L. baccatum var. *roseum* S. Schauer, *Linnaea* 15: 429 (1841). TYPE: probably the plate, t. 220 (n.v.).

L. scoparium var. *grandiflorum* Hook., *Bot. Mag.*: t. 3419 (1835). TYPE: cultivated at Kew from seed collected at Port Jackson in 1817.

Rather open woody shrub of somewhat variable habit, from less than 1 to more than 4 m tall with close firm bark; the younger stems often rather stout, with a silky pubescence of long fine hairs but soon becoming glabrous, with a conspicuous, usually thick and often spreading flange, especially near the nodes, and with branching at c. 45°. *Leaves* usually widely divergent, spreading or deflexed, glabrescent, very variable within and between plants, mostly 5–15 mm long and 2–5 mm wide, usually broadly elliptical to broadly ovate-lanceolate, occasionally narrower, rarely almost orbicular, usually thick in texture with the, often minutely tuberculate, margins incurved to inrolled or folded, especially near the apex, the apex channelled or terete and tapering to a pungent point, the base tapering to a short broad-based but often negligible petiole. *Flowers* white or pink, the diameter varying from less than 10 to more than 20 mm, occurring singly on modified shoots on very short, leafless or few-leaved axillary branches in adjacent axils on adjacent branches, the new growth vigorous from the ends of branches of a previous season's flowering. *Bracts* very broad, thinly scarious and dark red-brown, the inner and bracteoles very large and concave, enclosing large buds and often retained almost until the flower opens. *Hypanthium* glabrous, dark and often with conspicuous glands, 2.5–4 mm long, the upper part at most slightly spreading, the lower almost straight-sided and broad-based, lacking a pedicel, the top of the ovary glabrous. *Sepals* deciduous, 2–3 or more mm in length, broadly ovate and extended at the base, rather pale, scarious and glabrous. *Petals* 3–7 mm or more in length. *Stamens* in bundles of 7–9, usually c. 3–4 mm long, the anther-cells c. 0.7 (–0.8) mm long, parallel, deep in the outer part but opening wide and thickened, usually not much recurved but tending to fold back. *Style* inset, very stout with a very large stigma; often incompletely developed or lacking. *Ovary* 5-locular, each loculus with c. 80 to 120 ovules in 8–12 irregular rows on a large, broad and deep, somewhat extended placenta; sometimes absent. *Fruit* long-persistent, rarely less than 8 mm, often 12 mm or more, in diameter, widest at the narrow woody rim, the lower part deeply or shallowly rounded, often rather flat-based, the valves very woody, forming an often-flattened dome variously exerted in proportion to the base, and on older fruit often large and wider than the base. *Mature seeds* 3–4 mm long, irregularly linear-cuneiform, striate. Main flowering period: irregular but often Mar.-Apr.

DISTRIBUTION: In coastal and adjacent tableland areas of central eastern New South Wales (Map 8). Mostly on skeletal sandstone soils.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Berowra, *Boorman NSW 14159*, 3.1918 (NSW); Royal National Park near Governor Game Lookout, *Coveny 7303*, 12.1975 (NSW). South Coast: Junction of Point Perpendicular and Currarong roads, Currarong, *Coveny 10953 & James*, 9.1981 (NSW). Central Tablelands: Boronia Point, Mt Wilson, *Johnson & Constable NSW 19182*, 7.1951 (NSW). Southern Tablelands: Corang Trig., Northern Budawang Range, *Olsen 993*, 2.1969 (NSW).

63. *L. rotundifolium* (*Maiden & Betche*) *F. Rodway ex Cheel*, J. & Proc. Roy. Soc. New South Wales 53: 122 (1919).

BASIONYM: *L. scoparium* Forst. & Forst. f. var. *rotundifolium* Maiden & Betche, Proc. Linn. Soc. New South Wales 25: 101 (1900).

HOLOTYPE: NEW SOUTH WALES: Tallwong, [south of Shoalhaven River,] *W. Forsyth NSW 154775*, 1.1900 (NSW).

Shrub from less than 1 to 2 m or more in height with close and ultimately gnarled bark; the younger stems stout, with a dense pubescence of short ascending to recurved hairs and, at first, some long silky hairs, and with a short dense spreading pubescence persisting, without a perceptible flange or with a flange seen only as a thickening below each node, and with branching at 45°–60°. *Leaves* usually somewhat spreading or recurved, mostly 4–7 mm long and as wide, in general orbicular but sometimes longer than broad or broader than long, glabrous or with some minute pubescence, usually rather thick and incurved in cross-section, or incurved top and bottom and somewhat recurved between, the apex rounded, acute or acuminate, usually infolded, and strongly recurved with a short, usually blunt, but occasionally somewhat pungent point, the base tapering, rounded or somewhat cordate above a distinct pubescent petiole to 1 mm or more in length. *Flowers* white to somewhat purplish pink, to more than 30 mm in diameter, occurring singly on modified shoots at the ends of many-leaved adjacent axillary branchlets, with the new growth, often coloured-tipped, extending vigorously from branch-ends during flowering and some development from flowering shoots or later branches after flowering. *Bracts* very broad and concave, light to dark red-brown, the inner and bracteoles larger and darker and often enveloping the almost mature bud. *Hypanthium* glabrous or with an appressed pubescence at the base and top, rarely with a dense silky pubescence all over, 3–6 mm long, the upper part spreading widely, the lower narrower and usually rounded, often above a short pedicel, the top of the ovary glabrous. *Sepals* deciduous, broadly ovate to oblong, c. 3–4 mm long, the apex acute or rounded but usually incurved so as to appear acute, glabrous except for a tuft of hairs near the apex or, occasionally, silky-pubescent, and scarious with pale margins. *Petals* c. 8–12 mm long. *Stamens* in bundles of c. 9, 4–6 mm long, the filaments with their extreme bases broad but scarcely joined, the anther-cells c. 0.7 mm long, parallel, often, but not always, recurved, opening wide to show dark inner and outer thickening. *Style* not or scarcely inset, very stout with a large stigma; often absent. *Ovary* 5-locular, each loculus with c. 80 ovules in 8 rows on a large broad and relatively short, rather high and close (but with the tip extended) placenta; sometimes absent. *Fruit* long-persistent, usually 8–12 (–15) mm in diameter, widest near the slightly woody but little-extended rim, the base usually almost hemispherical but occasionally shallower and broader and occasionally with a very short stalk, the valves very woody, exerted at first so as to be more or less symmetrical with the base, after opening often not at first spreading widely at the apex, but tearing the base of the style as they part, later often somewhat wider than the rim. *Mature seeds* 4–5 mm long, irregularly narrowly linear-cuneiform, striate. Main flowering period: Oct.–Dec.

DISTRIBUTION: On the tableland escarpment of central eastern New South Wales southward of Sydney, and extending to the coast near Jervis Bay (Map 8). Usually in skeletal soils on sandstone.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: plateau edge above Jamberoo Pass, SE. of Robertson, *Pullen 4054*, 4.1961 (CANB; NSW). South Coast: E. approaches to Pigeon House Range . . ., *Corrick 7030*, 10.1985 (MEL, NSW). Central Tablelands: Gold Gully, Penrose, *Blakely et al. NSW 14175*, 10.1939 (NSW). Southern Tablelands: Nowra road, 4 miles [6.5 km] E. of Nerriga, *Adams 1462*, 10.1965 (CANB, NSW).

64. *L. grandiflorum* Lodd., Bot. Cab.: t 514 (1821).

TYPE: Native of Van Diemen's Land. A cultivate plant represented by the above illustration.

SYNONYMY: *L. flavescens* var. *grandiflorum* (Lodd.) Benth., Fl. Austral. 3: 105 (1867).

L. nobile F. Muell. ex Miq., Ned. Kruidk. Arch. 4: 145 (1859). **TYPE:** TASMANIA: *Stuart, s.d.* (? MEL or U, n.v.).

L. rodwayanum Summerh. & Comber, in Comber Field Notes Tasman. Pl. 1929–30: 55 (1930), Gard. Chron. ser. 3, 100: 176 (1936). **HOLOTYPE:** TASMANIA: Coles Bay, east of Swansea, at Hazards, 300 m alt., April 20, 1930, *Comber 2322* (K, n.v.).

Much-branched shrub 1.5 to 5 m or more in height with, as seen on specimens, rough and close bark; the younger stems with a rather stiff white shining, mostly appressed, pubescence with a few curled hairs, and a flange inconspicuous, narrow and somewhat thick, and seen only near the node, the branching at c. 45°. *Leaves* at first rather erect, later diverging, with some spreading or deflexed, (5–) 10–15 (–18) mm long and (2–) 4–8 mm wide, narrowly to broadly obovate or elliptical, thick, greyish-green, often with a dense appressed pubescence and rather prominent glands, almost flat but tending to infold near the apex, which is obtuse or very shortly acute or retuse, often with a minute recurved blunt point, the base tapering to a short, broad petiole and often slightly twisted. *Flowers* white (? or pink), c. 20 mm in diameter, occurring singly on modified shoots at the ends of very short to long leafy branches, with the new growth developing densely and often vigorously from branch-ends and to a lesser extent from the flowering shoot during and after flowering. *Bracts* red-brown and scarious but not seen about large buds. *Hypanthium* rather dark and wrinkled, glabrous or with a short pubescence on the base, c. 3 mm long, the upper part broadly expanded and tapering, the lower tapering to a pedicel c. 1 mm long; the top of the ovary glabrous. *Sepals* deciduous, 2.5–3.5 mm long, broadly ovate to orbicular, obtuse, dark with the margins pale glabrous or with some minute hairs especially near the top, and with densely ciliate margins. *Petals* c. 8 mm long. *Stamens* in bundles of c. 7, 4–5 mm long, with some filaments broad-based but only just or scarcely joined, the anther-cells c. 0.6 mm long, parallel, rather recurved with thickening of the inner part and some broadening of the outer. *Style* scarcely inset, rather stout, with a medium-sized stigma; often absent. *Ovary* 5-locular, each loculus with c. 60 ovules in 6 rows from a very high, sometimes small, close-set placenta; sometimes absent. *Fruit* long-persistent and tending to enlarge, 9–12 mm in diameter, widest at the very narrow but rather woody rim, scarcely narrower below, the base usually almost hemispherical and sessile, its surface lifting or flaking and ultimately rather smooth, the valves very woody, forming a shallow, rather flat-topped dome much shorter than the base, opening tardily and scarcely expanding. *Mature seeds* c. 4 mm long, irregularly linear-cuneiform, striate. Main flowering period: ?Feb. (could be out of season flowers)–Apr.

DISTRIBUTION: Endemic in eastern Tasmania, mostly on and near the Freycinet Peninsula (Map 8). On granite rocks.

SELECTED SPECIMENS: TASMANIA: 5 miles [8 km] N. of Cranbrook near Tasman Highway, *Himson*, 2. 1970 (NSW); Mt Amos, *Whaite* 2671, 12.1962 (NSW); Cape Degerando, *Olsen* 129, 1.1967 (HO, NSW); Cape Hauy, Tasman Peninsula, *Kantvillas & Jarman* 16, 11. 1979 (HO).

L. lanigerum subgroup (spp. 65–79), Map 9.

65. *L. deuense* J. Thompson sp. nov.

Frutex. Folia elliptica usque ad c. 3 cm longa. Flores c. 15 mm diametro, sepalis pubescentibus tarde deciduis. Ovarium 5-loculare. Fructus c. 8–10 mm diametro, vix cogniti.

HOLOTYPE: NEW SOUTH WALES: 35° 55' S, 149° 54' E, alt. 450 m, c. 2 km N. of Coondella Trig., Deua National Park, *P. Gilmour* 4139, 15 Feb. 1984 (NSW). ISOTYPES: CBG, MEL.

Leafy densely branched shrub with, as seen from specimens, rough close bark; the younger stems numerous and relatively stout, pubescent, without a conspicuous-flange but broad below each node and grooved beside it, branching at c. 45°. Leaves divergent, rather variable in size to c. 30 mm long and c. 6 mm wide, elliptical, recurved at the margins with the upper surface rather glossy and the lower with a dense, close, short and tightly crisped pubescence, the somewhat infolded apex with an acute, often strongly recurved, stout, sometimes rather pungent, point, the base tapering with the conspicuous midrib thick near the distinct pubescent petiole. Flowers white, c. 15 mm in diameter, occurring singly or 2 together on modified shoots at the ends of short several-leaved branches, the terminal bud developing during or soon after flowering. Bracts red-brown, but not seen about large buds. Hypanthium with a dense, short, crisped pubescence and often also with some fine straight hairs, c. 4 mm long, the upper part broadly expanded and the lower shortly, broadly, rounded or tapering above a distinct, stout, pedicel 1 mm or more in length, the top of the ovary glabrous. Sepals persistent but often shed from young fruit, 3–4 mm long, deltoid, sometimes longer than broad, the tip broadly acute, occasionally rather hooded, densely pubescent. Petals c. 7–8 mm long. Stamens in bundles of 7–9, c. 4 mm long, (and free,) the anther-cells c. 0.7 mm long, parallel, not much folded or recurved, and opening wide to show considerable thickening. Style inset, stout with a stout base, the stigma not large. Ovary 5-locular, each loculus with 60–80 ovules in 6–8 rows on a broad, high and rather tilted placenta. Fruit (few seen) probably rather variably persistent, c. 8–10 mm in diameter, widest at the somewhat extended rim, the base deep and rounded above a short stout stalk, the surface rather close and wrinkled, the valves woody, forming a very shallow dome with a central small depression, appearing to open tardily and scarcely expanding. Mature seeds 3 mm long, narrowly linear-cuneiform, striate. Main flowering period: unknown.

DISTRIBUTION: Known only from a restricted area in the mountains behind Moruya on the South Coast of New South Wales (Map 9). On a rocky rhyolitic ridge.

OTHER SPECIMENS EXAMINED: NEW SOUTH WALES: South Coast: Deua National Park, *Boland* 1988, 5.1984 (FRI, NSW), 2030, 6.1984 (NSW).

This species is named for the region of its collection near the Deua River that forms part of the headwaters of the Moruya River.

66. *L. grandifolium* Smith, Trans. Linn. Soc. London 6: 299 (1802).

HOLOTYPE: NEW SOUTH WALES: Port Jackson, *J. White per A.B. Lambert, herb. Smith 878.10*, 1795 (LINN, n.v.; LIVCM, n.v., photo NSW).

SYNONYMY: *L. lanigerum* var. *grandifolium* (Smith) Hook. f., Fl. Tasman.: 139 (1856). *L. pubescens* var. *grandifolium* (Smith) Domin, Biblioth. Bot. 89: 453 (1928).

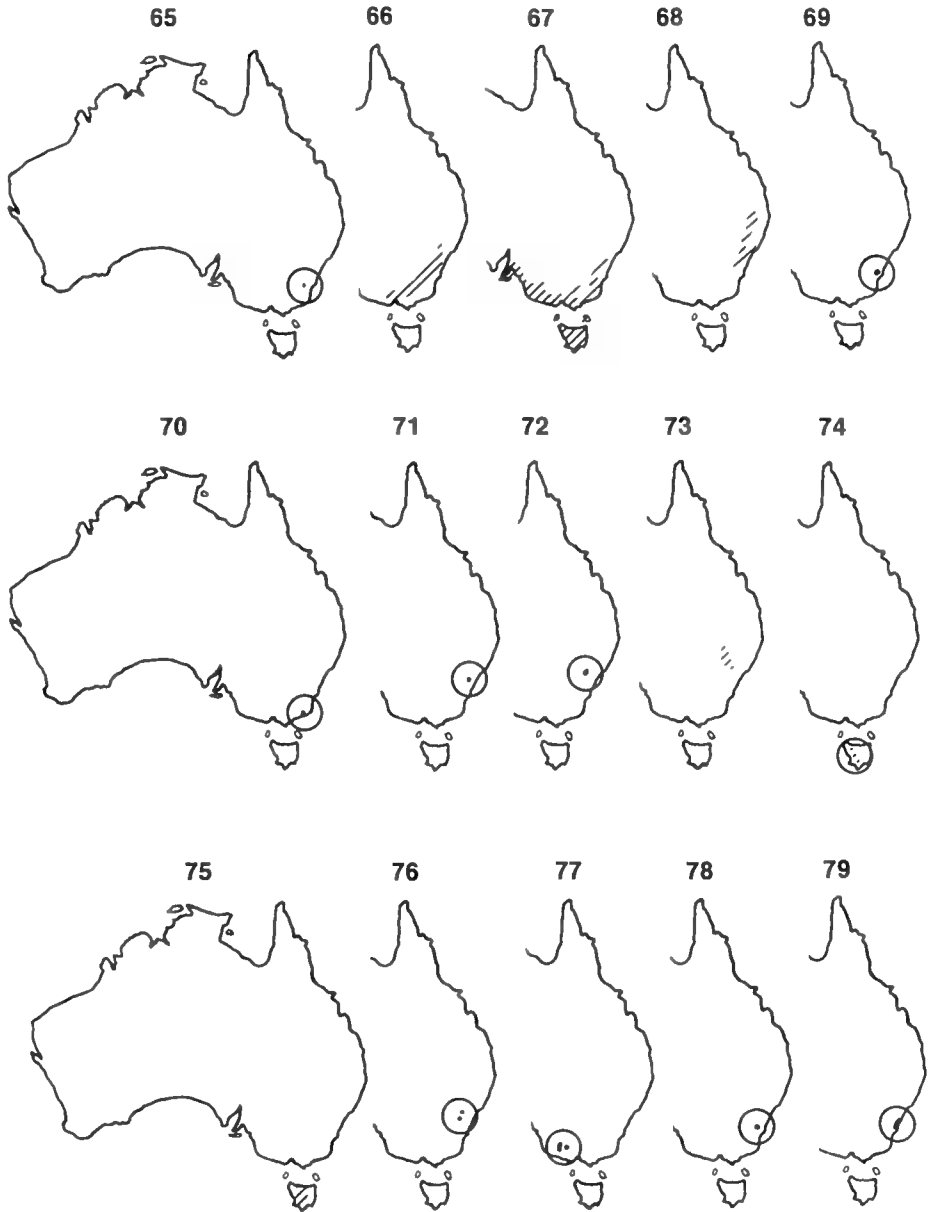
L. subargenteum Gand., Bull. Soc. Bot. France 65: 26 (1918).

HOLOTYPE: VICTORIA: near Harrietville, *Audas 6.1910* (LY, n.v., photo NSW).

Shrub c. 1.5 m or more in height, or small tree to more than 6 m, with smooth exfoliating bark that tends to remain about the stems; the younger stems stout and at first densely villous, later closely pubescent, with the flange seen only as a thickened area below each node, and the branching at 45° or, especially in riparian forms, 30° or less. *Leaves* erect to widely divergent, usually 10 to more than 30 mm long and c. 3–7 mm wide, oblong or oval with the upper surface glossy and the lower felted, or, in riparian forms, narrowly elliptical or obovate with the lower surface glabrous, often intermediate in these characters, the margins recurved or flat, the apex tapering to an, often conspicuous, pungent point, the base broadly or narrowly tapering to a distinct short petiole. *Flowers* (12–) 15 (–18) mm or more in diameter, white, single on modified shoots at the ends of, often densely, leafy side-branches, the new growth, often very silvery-pubescent, extending from beyond the flowers after flowering. *Bracts* very broad, stiff and pale yellow-brown, the inner and bracteoles from very broadly obtuse to tapering, and approximately equal, soon allowing the bud to protrude but often held about the flower. *Hypanthium* densely villous or occasionally with an appressed silky pubescence, usually 3–5 mm long, the upper part somewhat expanded, the lower tapering to or rounded above the base or with a very short pedicel, the top of the ovary glabrous. *Sepals* persistent, 3–4 mm long, ovate-deltoid, densely long-pubescent, villous or appressed-pubescent, and pale, with the tip infolded and hooded. *Petals* c. 4–7 mm long. *Stamens* in bundles of 7–9, c. 3.5 mm long, the anther-cells c. (0.5–) 0.7 mm long, parallel, recurved but not much folded back, very much thickened and opening wide but the outer part deep and often broad. *Style* well inset, often stout, at least at the base, with a medium-sized stigma. *Ovary* 5-locular, each loculus with 50–60 ovules in c. 6 rows on a large, close, somewhat inset placenta. *Fruit* long-persistent, 8–10 mm in diameter, the rim slightly or scarcely extended, the lower part rounded and often very broad-based, the surface lifting and becoming very flaky, the valves very woody and forming a rather low, centrally depressed dome, on opening the surface often lifting and the valves raised a little further, and spreading usually so as ultimately to exceed the base in width. *Mature seeds* c. 2–2.5 mm long, narrowly linear-cuneiform, curved, striate. Main flowering period: Oct.-Jan.

DISTRIBUTION: From the Sydney district of coastal New South Wales through the Central and Southern Tablelands to northeastern Victoria (Map 9). In sandy swamps and along watercourses.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: banks of the River Grose, *Brown*, 1804–1805 (NSW). Central Tablelands: 1½ km N. of Cherry Tree Hill on Ilford road, *K. Wilson 2429 & Waterhouse*, 8.1979 (NSW); on banks of river at Fitzroy Falls, *Rodway 230*, 11.1920 (NSW). Southern Tablelands: Big Badja Mountain, c. 40 km NE. of Cooma, *Pullen 8544*, 10.1973 (CANB, NSW); Maclaughlin R., SE. of Nimmitabel, *Salasoo 2061*, 1.1961 (NSW). VICTORIA: Eastern Highlands: The Playgrounds, 2.5 km



Map 9. Distribution of Group 2: subgroup 4 *L. lanigerum* and allies. 65. *L. euense*. 66. *L. grandifolium*. 67. *L. lanigerum*. 68. *L. archnoides*. 69. *L. thompsonii*. 70. *L. glabrescens*. 71. *L. spectabile*. 72. *L. macrocarpum*. 73. *L. sphacrocarpum*. 74. *L. riparium*. 75. *L. nitidum*. 76. *L. petraeum*. 77. *L. turbinatum*. 78. *L. crassifolium*. 79. *L. epacridoideum*.

SE. of Mt Cobberas No 1, *Walsh 869*, 2.1982 (MEL, NSW). Western Highlands: on Lerderberg R., 2 miles [3.2 km] below Blackwood, *Whaite NSW 154788*, 12.1953 (NSW).

This species is variable, different leaf-forms being found in different parts of its range and in different habitats. The Type specimen represents the large-leaved riparian form found on sandstone creek banks in the northern Sydney district.

67. *L. lanigerum* (*Sol. ex Aiton*) Smith, *Trans. Linn. Soc. London* 3: 263 (1797).

BASEONYM: *Philadelphus laniger* Sol. ex Aiton, *Hortus Kew.*, ed. 1, 2: 156 (1789).

TYPE: A plant cultivated from seed collected at Adventure Bay, Tasmania by Furneaux, in March 1773 (BM, n.v.). See Aiton, *op. cit.* 157 and Nelson, *Telopea* 2 (4): 347 (1983).

SYNONYMY: *P. laniger* var. *canescens* Sol. ex Aiton, *loc. cit.* TYPE: A plant from the above source.

P. laniger var. *piliger* Sol. ex Aiton, *loc. cit.*

L. pubescens Willd., *Sp. Pl.* 2: 950 (1799–1800) non Lam. (at least as to Type). *L. lanigerum* var. *pubescens* DC., *Prodr.* 3: 227 (1828), nom. illegit. *L. lanigerum* var. *pubescens* (Willd.) Hook. f., *Fl. Tasman.*: 139 (1856). TYPE: plant from the above source.

L. australe Salisb., *Prodr.* 350 (1796). TYPE: as for *P. laniger*.

L. microphyllum F. Muell. ex Miq., *Ned. Kruidk. Arch.* 4: 142 (1859), non Hoffmansegg. TYPE: SOUTH AUSTRALIA: Rivoly-bay [Rivoli Bay], *F. Mueller*, s.d. (U, n.v.).

L. microphyllum var. *viride* F. Muell. ex Miq., *loc. cit.* TYPE: SOUTH AUSTRALIA: Rivoly-bay, *F. Mueller* (U, n.v.).

L. microphyllum var. *glaucum* F. Muell. ex Miq., *loc. cit.* TYPE: SOUTH AUSTRALIA: Rivoly-bay, *F. Mueller* (U, n.v.).

L. pubescens forma *angustifolia* Miq., *Ned. Kruidk. Arch.* 4: 143 (1859). SYNTYPES: Barossa [South Australia]; ad ripas Yarra [Victoria] (U, n.v.).

L. pubescens forma *minor* Miq., *loc. cit.* TYPE: TASMANIA: Van Diemensland, *Stuart* (U, n.v.).

L. lanigerum var. *montanum* Rodway, *Tasman. Fl.* 52 (1903). TYPE: TASMANIA: not designated (“common in many parts [of Tasmania] in humid forests and subalpine localities”).

Shrub or tree to 5 m or more in height, with close, usually firm, bark, at least on young plants; the younger stems rather stout and densely pubescent with short, and especially when very young, long, spreading hairs, without a flange but often widened below the leaf-base, and branching mostly at c. 45°. *Leaves* mostly divergent to spreading, from a few mm to 15 mm long, and mostly 2–4 mm wide, oblong to narrowly oblanceolate, usually grey-pubescent at least on the lower surface but sometimes glabrous on the upper surface, and rarely glabrous on both, the upper surface sometimes rather thick but rarely glossy, the margins usually but not invariably recurved, often strongly, the apex tapering rather abruptly and infolded behind a short pungent or blunt point, the base tapering to a distinct though often very short, often broad-based, petiole. *Flowers* white, c. 15 mm in diameter, occurring singly on modified shoots at the ends of short densely leafy side-branches, the subtending leaves often longer-petiolate or otherwise modified, the new growth very dense, extending from beyond the flowers after flowering. *Bracts* broad, stiff and pale- or red-brown, the inner somewhat larger than the broad bracteoles that allow the pubescence of the bud to protrude, many often tending to remain about the flower. *Hypanthium* densely villous, 3–5 mm long, the upper part expanded, the lower shallowly rounded or broadly tapered, often with a minute narrow pedicel, the top of the ovary glabrous. *Sepals* persistent, 2–4 mm long, deltoid to long-deltoid, densely villous or long-silky-pubescent, pale and with the tip often

folded or hooded. *Petals* c. 6 mm long. *Stamens* in bundles of c. 7, c. 2–3 mm long, the anther-cells c. 0.5 mm long, parallel, much-thickened and wide open, deeper in the outer part, recurved but scarcely folded back. *Style* well inset, broad-based but slender, with a small stigma; often absent. *Ovary* (4–) 5-locular, each loculus with c. 50 ovules in 4–6 rows on a high, usually somewhat inset, placenta rather or very extended at the top; sometimes absent. *Fruit* persistent, 5–10 mm in diameter, the rim not or scarcely extended, the lower part broadly rounded but often flat-based, the surface lifting and becoming scaly, the valves very woody, raised only so as to form a low, rather lobed, dome depressed in the centre, after opening the surface lifting and the valves often a little more raised, usually ultimately becoming broader than the base. *Mature seeds* c. 2.5 mm long, narrowly linear-cuneiform, curved, striate. Main flowering period: Oct.-Jan.

DISTRIBUTION: Widespread in Tasmania, and, on mainland Australia, from southeastern South Australia to southern and eastern Victoria and extending as scattered populations to the Central Tablelands of New South Wales (Map 9). In sandy swamps and along watercourses.

SELECTED SPECIMENS: NEW SOUTH WALES: South Coast: Towamba, *Thompson 4250*, 3.1982 (NSW). Central Tablelands: 1 mile [1.6 km] N. of Taralga, *Constable NSW 55267*, 1.1961 (NSW). Southern Tablelands: Tidbinbilla Fauna [Nature] Reserve, A.C.T., *Gray 5532*, 9.1964 (CANB), *Thompson 4167*, 11.1984 (NSW). VICTORIA: East Gippsland: Reedy Creek, *Wakefield 4219*, 10.1948 (MEL, NSW), *Haegi 1684*, 2.1979 (NSW), *Thompson 4232*, 3.1982 (NSW). Western Highlands: Victoria Valley, beside Glenelg R. at Serra road crossing, Grampians, *Corrick 8455, 8456*, 11.1982 (MEL, NSW). SOUTH AUSTRALIA: Upper Southeast: 2 km NE. of Tooperang P.O., *Haegi 551*, 10.1974 (AD, NSW). TASMANIA: Road from George Town, *Gunn 809/1842*, 12.1841 (NSW); Frenchman's Cap track (at Franklin R.), *Canning 2093*, 1.1969 (CBG, NSW); Birch's Inlet, Macquarie Harbour, *Milligan 713*, 11.1846 (HO); W. edge of Platypus Tarn, Mt Field National Park, *Short 1826*, 1.1983 (MEL, NSW); S. Esk R., near Evandale, *Buchanan 3578*, 5.1984 (HO).

Many specimens from western Victoria lack the characteristic grey leaf-pubesence. It has not been possible to separate these as a distinct taxon; they appear to indicate the influence of genes of another species (see p. 338). A green-leaved form has been treated as a distinct variety by Miquel (1859).

68. *L. arachnoides* Gaertner, Fruct. Sem. Pl. 1: 175, t. 35 (1788).

TYPE: The illustration in the above publication, based on a specimen in the Banksian herbarium (BM).

SYNONYMY: *L. arachnoideum* Smith, Trans. Linn. London Soc. 3: 263 (1797), nom. illegit. **TYPE:** as above.

L. baccatum Smith, op. cit. 264. **TYPE:** NEW SOUTH WALES: Port Jackson (according to Smith in Rees Cycl., sent to Kew Gardens by Sir Joseph Banks in 1790) (?LINN, n.v.).

L. juniperifolium Cav., Icon. 4: 18, t. 331 (1797). **TYPE:** NEW SOUTH WALES: "a portu" Botany Bay (MA, n.v.).

L. triloculare Vent., Jard. Malm.: 88, t. 84 (1804–1805). **TYPE:** a garden plant "originaire de la Nouvelle Hollande".

Much-branched shrub, often almost prostrate but frequently erect and occasionally reaching more than 2 m in height, the bark rough and peeling in flaky layers; the younger stems stout, with long, spreading hairs over a persistent pubescence of usually very short, irregular, crisped hairs, without a flange but enlarged at each node, and with branching at c. 60°–90°. *Leaves* at first narrowly divergent, not spreading from the base but the whole often recurved so as

to appear so, usually 10–20 mm long and very variable (often regionally) in width from less than 1 to more than 3 mm, elliptical to lanceolate or oblanceolate, glabrous or variously partially pubescent, thick, especially near the apex, the margins often minutely tuberculate, incurved, often strongly, and frequently infolded near the apex, the whole with a tendency to twist (spirally), the apex tapering and pungent-pointed, the base tapering, usually expanding again to a very short, broad somewhat triquetrous petiole. *Flowers* white, c. 10 mm in diameter, single on modified shoots at the ends of crowded, short, leafy, axillary branches, occasionally with the leaves subtending the shoots modified, the new growth dense, from many short branch-ends away from the flowering region before flowering, and with some development coming later from flowering shoots. *Bracts* almost spherical, stiff, and pale yellow- or red-brown, the outer often broad-based and pungent, the inner and bracteoles large and concave, allowing the pointed sepal-tips to extend beyond, and tending to remain about the open flower. *Hypanthium* usually pubescent with dense spreading hairs, occasionally the pubescence appressed or sparse, c. 2 mm long, the upper part somewhat expanded, usually tapering rather evenly to above a very short pedicel, the top of the ovary glabrous. *Sepals* persistent, c. 2 mm long, deltoid and somewhat hooded, appressed-pubescent but often also with many spreading hairs. *Petals* c. 4 mm long. *Stamens* in bundles of (3–)5–7, c. 2 mm long, the anther-cells 0.4–0.6 mm long, parallel, thickened but opening wide with a broader deeper outer part, variable but usually not much recurved or folded. *Style* not inset, very stout-based and stout with a medium-sized stigma. *Ovary* (3–) 4–5-locular, each loculus with c. 30–40 ovules in c. 6 rows on a close-set almost inset, shallow placenta. *Fruit* often long-persistent, from less than 5 to more than 8 mm in diameter, the rim somewhat extended and woody, the lower part almost hemispherical with the pubescent surface lifting and ultimately the surface flaky, the valves, before opening, only slightly exerted as a low dome depressed in the centre with the surface lifting and often tearing from the style-base, after opening usually not much further raised or much spreading. *Mature seeds* c. 1.5–2 mm long, linear-cuneiform, striate. Main flowering period: Nov.–Jan.

DISTRIBUTION: From Stanthorpe, southeastern Queensland, to the Tinderry Range of southeastern New South Wales (Map 9). Usually in moist heath or forest, in shallow soils especially on sandstones and granite.

SELECTED SPECIMENS: QUEENSLAND: Darling Downs: Stanthorpe, *Boorman NSW 154781*, 11.1904 (NSW). NEW SOUTH WALES: North Coast: Nابیac aerodrome, *Burgess 117*, 3.1962 (NSW). Central Coast: Port Jackson, *White, herb. Smith 878.18*, 1795 (photo NSW); Maddens Plains, 2 km NE. of Sublime Point, *Coveny 11119 & Taylor*, 6.1982 (NSW). South Coast: Pigeon House Range, *Burgess B162*, 11.1972 (CBG, NSW). Northern Tablelands: Torrington, *Cabbage 1637*, 7.1907 (NSW). Central Tablelands: Mt Victoria-Bell road, *Constable NSW 11118*, 3.1950 (NSW). Southern Tablelands: Tinderry Range, c.30 miles [48 km] S. of Queanbeyan, *Pullen 4424*, 12.1971 (CANB, NSW). North Western Slopes: Ponds Creek, Tingha, *Cabbage 932*, 10.1903 (NSW). Central Western Slopes: Lees Pinch, Wollar-Merriwa road, *Johnson NSW 17636*, 9.1951 (NSW).

69. *L. thompsonii* J. Thompson sp. nov.

Frutex usque ad 3 m vel altior. Folia late elliptica ad ovata, 1–1.5 cm longa. Flores c. 15 mm diametro, sepalis pubescentibus persistentibus. Ovarium 5-loculare. Fructus 9–12 mm diametro persistentes.

HOLOTYPE: NEW SOUTH WALES: Clyde Mt, near Braidwood, J.L. Boorman NSW 154782, 12.1915 (NSW).

Tall usually erect shrub 1 to more than 2 m tall with rather fibrous and flaky rough bark; the younger stems stout, with a long fine spreading pubescence over a dense short irregular pubescence, with at least the latter persisting, without a flange but somewhat thicker below each node, and with branching at c. 30°. *Leaves* rather dense and mostly divergent, usually 10–15 mm long and 4–6 mm wide, broad-elliptical to obovate, thick, especially near the apex, and tending to incurve there, but otherwise flat or with the margins tending to recurve, both surfaces tardily glabrescent but hairs often persisting on the margins, the apex broadly acuminate with a broad pungent tip, the base narrowing to a short petiole often thickened behind at the base and frequently laterally enlarged there. *Flowers* white, c. 15 mm in diameter, single on modified shoots terminating leafless or leafy branches, occasionally with the leaves subtending the shoots modified, the new growth extending densely both from branch-ends and from flowering shoots after flowering. *Bracts* almost spherical, stiff and yellow-to red-brown, the outer often broad-based and acuminate, the inner longest and concave, the bracteoles a little smaller, allowing the rather obtuse sepal-tips to protrude; all tending to remain about the opened flower. *Hypanthium* with a dense, long, fine pubescence, c. 4 mm long, the upper part somewhat spreading, the lower rather rounded above, or broadly tapering to, a negligible pedicel, the top of the ovary glabrous. *Sepals* persistent, c. 3 mm long, broadly ovate or almost hemispherical, with a rounded, rather hooded apex and with very dense long spreading hairs. *Petals* c. 4–6 mm long. *Stamens* in bundles of c. 7–9, c. 2–3 mm long, the anther-cells 0.5–0.7 mm long, parallel, thickened, with the outer part wide and deep, and somewhat recurved and folded back. *Style* inset, very broad-based, tapering to behind a medium-sized stigma. *Ovary* (4–) 5-celled, each loculus with c. 50 ovules in c. 6 rows on a large, broad, close, somewhat inset placenta. *Fruit* persistent, 9–10 mm in diameter, scarcely extended at the rim, the base rather shallowly rounded, the pubescent surface lifting, later flaky, the valves before opening only slightly exerted as a shallow dome with a depressed centre, later spreading and ultimately equal to or somewhat wider than the rim and often equalling the depth of the base. *Mature seeds* c. 2.5 mm long, irregularly linear-cuneiform, often curved, striate. Main flowering: probably Dec. (–Mar.).

DISTRIBUTION: Known only from the Clyde Mountain district of southeastern New South Wales (Map 9). In wet places, in forest.

SELECTED SPECIMENS: NEW SOUTH WALES: Southern Tablelands: near Monga, Thompson 4170 & Thompson, 11.1982 (NSW); Monga, Baeuerlen NSW 154783, 12.1898 (NSW).

This species is named for M.M.H. Thompson, my husband, whose assistance in the collection and field study of this and many other species has helped to enlarge understanding of this genus.

70. *L. glabrescens* Wakef., Victorian Naturalist 72: 43 (1955) quoad Typum.

TYPE: VICTORIA: Reedy Creek, Tamboon Road, Cann River valley, 20.1.1955, N.A. Wakefield, No. 4806, (MEL, NSW).

Tall shrub 1.5–4 m or more in height with firm bark; the younger stems rather stout, with a dense pubescence of very short crisped hairs and scattered long fine hairs, the former persisting but sometimes becoming sparse, without a flange but becoming thicker below each node, and with branching at 30°–45°. *Leaves* rather narrowly divergent, at least at first, and dense, 5 to more than

10 mm long and mostly 1–3 mm wide, elliptical to linear, rather thick and in general flat, but often tending to incurve towards the apex or recurve at the margins, ultimately glabrous but with hairs tending to persist on the margins, the apex acute to acuminate and pungent-pointed, the base tapering to, or slightly rounded above, a broad-based, very short petiole, often thickened behind. *Flowers* white, c. 12 mm in diameter, single on modified shoots, on short few-leaved branches, with the subtending leaves tending to be modified, the new growth from branch-ends and, often quite vigorously, from flowering shoots after flowering. *Bracts* broad, often stiff, and yellow- to red-brown, the outer often broad-based and pungent, the inner and bracteoles very broad, very broadly obtuse and concave with the bracteoles tending to be somewhat smaller, enclosing only the young bud with the broad calyx-top soon exposed, but tending to be retained about the open flower. *Hypanthium* densely long-villous with rather crimped hairs, c. 3 mm long, the upper part not much expanded, the lower shallowly rounded, the top of the ovary glabrous. *Sepals* persistent, c. 2 mm long, densely villous, very short and broad, almost hemispherical, very broadly obtuse and rather hooded. *Petals* c. 3–5 mm long. *Stamens* in bundles of c. 7, c. 2.5–3 mm long, the anther-cells c. 0.5–0.6 mm long, parallel, thickened, with the outer part deep, and tending to recurve and fold back. *Style* well inset, very broad-based, and tapering to a rather small stigma. *Ovary* 5-locular, each loculus with c. 30 ovules in 6 rows on an extended and narrow-topped, rather flat-surfaced placenta. *Fruit* persistent, some times quite long-persistent but not enlarging, c. 5–7 mm in diameter, widest at the scarcely extended rim, the lower part shallow and broadly rounded (the narrow base scarcely at all visible), sometimes somewhat lobed when young, the surface lifting, ultimately scaly, the valves woody, at first exerted as a rather low lobed dome with a central depression and later with the surface tending to lift, and spreading but usually not exceeding the rim so the fruit is relatively shallow and rather flat-topped. *Mature seeds* c. 2 mm long linear-cuneiform, somewhat sigmoid or curved, striate. Main flowering period: Dec.-Jan.

DISTRIBUTION: In the East Gippsland district of Victoria (Map 9). In sandy swampy heath or on creek banks.

SELECTED SPECIMENS: VICTORIA: East Gippsland: Reedy Creek, E. of Cann River, Wakefield 2874, 12.1948 (NSW), 4220, 11.1948 (NSW), Haegi 1686, 2.1979 (NSW), Thompson 4231, 3.1982 (NSW); Dinner Creek, Tamboon road, Melville 2876 et al., 1.1953 (NSW); 4 km from Cape Conran on Conran-Cabbage Tree road, Thompson 4225, 3.1982 (NSW); 2 km from Cape Conran on Conran-Cabbage Tree road, Thompson 4224, 3.1982 (NSW).

Specimens from other areas included by Wakefield in his concept of *L. glabrescens* are not conspecific. These are (at least for the most part) forms of *L. lanigerum*.

71. *L. spectabile* J. Thompson sp. nov.

Frutex usque ad 3 m altus. Folia anguste elliptica, 2–3.5 cm longa. Flores c. 20 mm diametro sanguinei, sepalis sericeis persistentibus. Ovarium 4–5-loculare. Fructus 9–12 mm diametro persistentes.

HOLOTYPE: NEW SOUTH WALES: Colo River gorge below Boorai ridge, 12.7 mls (20.4 km) E. along Culoul Range road off Windsor-Singleton road [NW. of Windsor], R. Coveny 9125 & P. Hind, 12.ii.1977 (NSW).

Shrub to 3 m tall with close firm and ultimately corrugated bark; the younger stems with long, fine, antrorse hairs and shorter curved hairs and with short

crisped and irregular hairs persisting, scarcely or imperceptibly flanged but thickened below each node, and with branching usually at c. 30° or even less. *Leaves* erect or very narrowly divergent at least at first, most from 20–35 mm long and mostly 3–5 mm wide, narrowly elliptical, rather firm in texture, with the surface often dull, usually almost flat, occasionally incurved in cross-section, ultimately almost glabrous but with hairs tending to persist at the base, tapering to a long-acute or -acuminate, slightly infolded and shortly, stiffly, pointed apex, the base tapering to a short petiole sometimes thickened at the back. *Flowers* a rather dark red, c. 20 mm in diameter, single on modified shoots on several-leaved leafy side-branches, the new growth extending from beyond the flowers after flowering. *Bracts* broad, concave and light- to red-brown, the innermost and bracteoles more scarious; the bracteoles not shorter but folded over the pointed sepals; all shed before the flower opens. *Hypanthium* densely covered with long, rather loosely appressed, silky hairs, c. 4–5 mm long, the upper part spreading widely, the lower broadly tapering to an extremely short to negligible pedicel, the top of the ovary glabrous. *Sepals* persistent, c. 4 mm long, ovate-oblong, obtuse and rather hooded, broad-based and rather pale, with a long, appressed, silky pubescence. *Petals* c. 5–7 mm long. *Stamens* in bundles of c. 9, 5–7 mm long, the filaments occasionally with scattered spreading hairs, the anther-cells 1.0–1.2 mm long, parallel, very much thickened and opening wide, with the outer part rather deep, not much recurved but to some extent folded back. Style not inset, stout-based and rather stout, with the stigma small (in relation to the style); frequently undeveloped. *Ovary* 4–5-locular, each loculus with c. 80 ovules in 8 rows on a large, close, high placenta; sometimes absent. *Fruit* persistent but not enlarging, c. 9–12 mm in diameter, widest at the distinct but not woody rim, below the lower part hemispherical, with or without an almost negligible stalk, the valves very woody, before opening much exerted to form a tall often rather narrowly rounded dome minutely dished in the centre but raised to the high style-base, on opening tearing from the style and spreading to the width of the rim or somewhat beyond, the fruit usually appearing to be deeper than wide. *Mature seeds* c. 6 mm long, linear-cuneiform, long-sigmoid, striate. Main flowering period: Nov.

DISTRIBUTION: Found only along the Colo River in central eastern New South Wales (Map 9). Among sandstone boulders on the river bank.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Colo Gorge, c. 1 km upstream from Boorai Creek junction, *Haegi 1604 & Hind*, 1.1979 (NSW); c. 2 miles [3.2 km] up the Colo R., *Sanders NSW 153050*, 11.1976 (NSW); lower Colo R. c. 4 miles [6.4 km] above Lower Portland, *Cooper NSW 153049*, 11.1957 (NSW).

This species has been named for its large red flowers. It is closely related to *L. sphaerocarpum*.

72. *L. macrocarpum* (Maiden & Betche) J. Thompson comb. nov.

BASIONYM: *Leptospermum lanigerum* (Sol. ex Aiton) Smith var. *macrocarpum* Maiden & Betche, Proc. Linn. Soc. New South Wales 23: 12 (1898).

LECTOTYPE, here chosen: NEW SOUTH WALES: Mt. Tomah, *J. Gregson NSW 154788*, 11.1897 (NSW). There is, in NSW, only one Gregson specimen from Mt Tomah, but two specimens from Mt Wilson (dated 11.1897 and 12.1897) appear to have been used in drawing up the protologue.

Shrub, low-growing or to 2 m in height, spreading and diffuse or, less frequently, erect and compact, the bark close, densely layered and becoming

gnarled; the younger stems stout with a dense short crisped pubescence and a scarcely perceptible flange, but much thickened below the nodes, and often branching at 60° or more. *Leaves* erect, spreading or even deflexed, from less than 10 to 20 mm or more long and mostly 5–10 mm wide, usually broadly elliptical but often wider near the apex, firm, with the surface rather dull and usually flat, ultimately glabrous but with hairs tending to remain longer on the margins and persist at the base, the apex obtuse or acute, often infolded near a short stiff point, the base usually tapering but occasionally almost cordate above a distinct petiole. *Flowers* greenish white, pink or dark red, 15–30 mm in diameter, single on modified shoots on short leafy side-branches, the new growth after reddish, vigorous from branch-ends beyond the flowering region during flowering and less so from the flowering shoots after flowering. *Bracts* very broad, large, stiff, red-brown and concave, the inner, and somewhat smaller bracteoles, very broadly obtuse, about the broad-topped bud but shed before the flower opens. *Hypanthium* usually densely covered with long silky hairs, the hairs occasionally shorter and more sparse on the upper part, 4–8 mm long, the upper part widely expanded, the lower tapering to a broad base, the top of the ovary glabrous. *Sepals* persistent, c. 7–8 mm long, almost orbicular, to broadly ovate, broadly obtuse, broad-based and densely covered with a long silky pubescence. *Petals* c. 4–8 mm long. *Stamens* in bundles of 9–11, 6–9 mm long, the filaments somewhat joined at the base, the anther-cells c. 1.0–1.2 mm long, parallel, recurved and somewhat folded back, very much thickened with the outer part deep, but opening wide. *Style* not inset, broad-based and stout, with a rather small stigma; frequently absent. *Ovary* (4–) 5-locular, each loculus with c. 100–200 ovules in 8–12 or more rows on a large, rather shallow, almost inset, high placenta; sometimes absent. *Fruit* long-persistent but not enlarging, often 15–20 mm in diameter, widest at the broad, rather woody rim, the lower part broadly rounded with the base sometimes almost flat, the valves very woody, well exerted, at first forming a wide dome sometimes rather flat-topped or almost dished but raised in the centre to the style-base, on opening tearing from the style base and spreading but usually not wider than the rim, the fruit usually appearing much wider than deep. *Mature seeds* c. 5 mm long, narrowly linear-cuneiform, curved, striate. Main flowering period: Oct.-Dec.

DISTRIBUTION: Restricted to a small area in the Blue Mountains, New South Wales (Map 9). Usually on rocky exposed or rather dry sites on sandstone.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: above Colo R. gorge on Boorai ridge, *Coveny 9117 & Hind*, 2.1977 (NSW); Woodford, *Bowden NSW 154786*, 10.1950 (NSW). Central Tablelands: Mt Victoria on the Victoria Falls road, *Coveny 4146*, 4.1972 (NSW).

73. *L. sphaerocarpum* Cheel, J. & Proc. Roy. Soc. New South Wales 65: 204 (1932).

LECTOTYPE, here chosen: NEW SOUTH WALES: at foot of range about 8 miles [13 km] from Rylstone, *E. Cheel NSW 143045*, 9.10.1931 (NSW).

Shrub to 2 m in height, usually erect, rarely spreading, the bark close and firm; the younger stems rather stout, usually with a dense short pubescence and often with a few to numerous, long, ascending hairs, the longer hairs rarely persisting, without a flange but thickened below each node, and branching at c. 45°. *Leaves* at first almost erect, later divergent, mostly 5–20 mm long and 2–5 mm wide, broadly to narrowly elliptical, rather thick, with the surface often dull, flat or somewhat re- or incurved in cross-section, ultimately almost glabrous but with hairs tending to persist at the base, the apex tapering to an acute or

long-acute, slightly infolded, pungent point, the base broadly or narrowly tapered to a short, broad and broader-based petiole with a thickening behind. *Flowers* a rather greenish white or pink, (10-) 15-20 mm in diameter, single on modified shoots at the ends of leafy side-branches, the new growth extending from beyond the flowers, after flowering. *Bracts* broad, stiff, concave and pale- or red-brown, the inner and bracteoles more scarious, the bracteoles not, or scarcely, smaller but allowing the broadly acute bud-tip to protrude, all shed well before the flower opens. *Hypanthium* with a dense silky pubescence or glabrous apart from a few hairs at the base and top, dark, with rather obvious glands, 3.5-5 mm long, the upper part expanded widely and all tapering to a base rounded above a minute pedicel, the top of the ovary glabrous. *Sepals* rather persistent, 3.5-5 mm long, usually broadly ovate, obtuse and hooded, with a broad base, scarious and relatively pale, and silky-pubescent or glabrous apart from the apex and margins. *Petals* c. 5-7 mm long. *Stamens* in bundles of c. 9, 4-6 mm long, the anther-cells c. 0.7-1.0 mm long, parallel, thickened and deep especially in the outer part, and opening wide, recurved but not folded back. *Style* not or scarcely inset, stout-based and rather stout, with the stigma small in relation to the style; often undeveloped. *Ovary* 3-5-locular, each loculus with c. 40 ovules in c. 6 rows on a broad, short, close, sometimes extended, rather high placenta; sometimes absent. *Fruit* persistent but not enlarging, usually 7-10 mm in diameter, with a distinct but not woody rim, the lower part almost hemispherical, sometimes above a very short stalk, the valves very woody and much exserted, forming a tall rounded or rather flat-topped dome, after opening, breaking away from the style-base, and spreading, often as wide as the rim, the fruit usually appearing to be as deep or deeper than wide. *Mature seeds* 4-6 mm long, usually irregularly narrowly linear-cuneiform (bent at one end), striate. Main flowering period: Oct.-Nov.

DISTRIBUTION: Extending from the Warrumbungle Ranges to the Central Tablelands of New South Wales, and on adjacent dry parts of the Central Coast region (Map 9). In light soils, especially on sandstone, in heath or sclerophyll forest on ridges or escarpments.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Yango track, near Wollombi, *Story* 6656, 9.1959 (NSW). Central Tablelands: Khyber Pass, c. 30 km E. of Kandos, *Jackson* 2197, 10.1972 (AD, NSW); Bell-Mt Wilson road, *Garden NSW* 153048, 8.1950 (NSW). North Western Slopes: Warrumbungle Ranges, *Forsyth NSW* 153047, 10.1899 (NSW), *NSW* 143046, 10.1901 (NSW). Central Western Slopes: Currant Mountain Gap, 24 km E. of Rylstone, *Coveny* 9552, 9.1977 (NSW).

74. *L. riparium* D. Morris in D. Morris & W.M. Curtis, Rec. Queen Victoria Mus. 50: 2 (1974).

HOLOTYPE: TASMANIA: west side of bridge over Huon River, Tahune Forest Park, *D.I. Morris*, 7.i.1974 (HO). **ISOTYPES:** HO, K, NSW.

Tall straggling shrub 3 m or more in height with flaking bark; the younger stems slender but relatively broad-based, with long fine hairs and a short close irregularly spreading pubescence, the latter tending to persist, with an inconspicuous but thick, flange, and branching at 45°-60°. *Leaves* divergent to spreading or even deflexed, (5-) 10-25 mm long and mostly 2-4 mm wide, most narrowly oblanceolate and somewhat falcate, mostly glabrous but with pubescence often persisting on margins and at the base, firm and almost flat but slightly infolded near the tip and sometimes with the margins tending to recurve, the apex

acuminately or acutely tapering to a rather recurved point, the base tapering to a broad, relatively thin and often somewhat twisted petiole. *Flowers* probably always white, 15–20 mm in diameter, single on modified shoots at the ends of leafy branches with the petioles of subtending leaves often elongated, the new growth reddish and extending from flowering shoots after flowering. *Bracts* pale- or reddish-brown, stiff and broad, the inner and bracteoles long but allowing the very narrow tip of the bud to protrude, all shed before the flower opens. *Hypanthium* with a dense short pubescence, c. 4 mm long, the upper part very widely expanded, the lower rather shallowly rounded above a narrow, tapering, conspicuously fluted pedicel of variable length (c. 0–2 mm), the top of the ovary glabrous. *Sepals* persistent, 4–6 mm long, long-deltoid, with a long silky pubescence, at least for the most part, the margins pale and scarious, and inrolled in the upper part with the tip infolded. *Petals* 8–9 mm long. *Stamens* in bundles of c. 7, c. 4 mm long, the anther-cells 0.5–0.7 mm long, parallel, recurved and folded back, the outer part deep but all much thickened and opening wide. *Style* inset, very slender, but rather broad-based, with a small stigma. *Ovary* 5-locular, each loculus with c. 80 ovules in c. 6 rows on a large, close, almost inset placenta. *Fruit* persistent, 6–8 mm in diameter, the rim not extended, the lower part rather turbinate, usually above a short stalk, the surface lifting and becoming scaly, the valves very woody, raised to form a broad, shallow dome, on opening not spreading wider than the rim. *Mature seeds* not seen. Main flowering period: Jan.

DISTRIBUTION: In the mountains of western Tasmania (Map 9). On the banks of swift-flowing rivers in rainforest.

SELECTED SPECIMENS: TASMANIA: Pieman R. Bridge, *Davies & Davies NSW 134555*, 1.1937 (NSW); Franklin R., *Gunn 1962, NSW 134554*, 2.1845 (NSW); Gordon R., *Davies & Davies, Rodway 2465*, 1.1937 (NSW), *L. Rodway 2694*, 12.1892 (NSW).

75. *L. nitidum* Hook. f., *Fl. Tasman.* 1: 139 (1856).

SYNTYPES: TASMANIA: Rocky Cape, *Gunn [813/1842, 29.12.1837]*, (K, n.v.; dupl. NSW); heathy plains between Macquarie Harbour and Lake St Clair, *Gunn* (K, n.v.). There are specimens in NSW, 'heathy hills, Cape Sorrel, Macquarie Harbour, *J. Milligan*] 366, *herb. Gunn 813/1842, 3.5.1842*' and 'heathy and peaty plains, Macquarie Harbour, *Gunn 813*, Nov. 1846', and in HO, 'Rocky Cape, *Gunn 813/1842, 4.10.1838*' and 'Detention Corner, Macquarie Harbour, *Gunn 813, 10.2.1845*'.

SYNONYMY: *L. flavescens* var. *nitidum* (Hook. f.) Rodway, *Tasman. Fl.*: 53 (1903). *L. pubescens* var. *nitidum* (Hook. f.) Domin, *Biblioth. Bot.* 89: 453 (1928).

Compact shrub often 2 m tall with scaly layered bark; the stems stout, with a dense, long, fine, antrorse pubescence soon giving way to short close hairs, without a flange but with a narrow ridge subtending each leaf-base, and branching densely at c. 60° but curving so as to appear to be at a narrower angle. *Leaves* aromatic, dense, erect or narrowly divergent, usually 8–20 mm long and 3–6 mm wide, elliptical, mostly glabrous on both surfaces but often with pubescent margins, flat or with a slight tendency to recurve, usually glossy, the texture rather thick especially near the apex, the apex broad-acute to -acuminate, somewhat infolded or curved, with a short, usually pungent, point, the base tapering to or rounded above a short broad-based petiole. *Flowers* white, usually c. 15 mm in diameter, single on modified shoots at the ends of dense leafy side-branches whose upper leaves are often reduced in size, and with the new growth extending beyond the flowers after flowering. *Bracts* stiff, golden brown, concave, the inner longest with the bracteoles fractionally shorter, all enclosing only the young bud but some tending to be caught among

the flowers. *Hypanthium* densely long-pubescent or occasionally with fewer or short hairs or almost glabrous, 4–6 mm long, the upper part expanded, the lower tapering to or rounded above a short rather fluted pedicel, the top of the ovary glabrous. *Sepals* persistent, often 5–6 mm long, very long-deltoid, silky-pubescent with pale margins and an inrolled and rather folded minutely hooded tip. *Petals* c. 6 mm long. *Stamens* in bundles of c. 7, 2.5–3 mm long, the anther-cells 0.5–0.8 mm long, parallel, much-thickened but wide open with the outer part deeper, and somewhat recurved and folded. *Style* deeply inset, and rather slender with a small style. *Ovary* 5-locular, each loculus with c. 60 ovules in c. 6 rows on a large, rather narrow-topped, rather inset, placenta. *Fruit* long-persistent, usually 6–10 mm in diameter, the rim woody but very narrow, the lower part usually rather straight-sided, the base broadly rounded or flat, the surface lifting and flaking, later scaly, the very woody valves scarcely exerted, and usually on opening little further raised and scarcely extended. *Mature seeds* c. 2.5 mm long, narrowly linear-cuneiform, curved, striate. Main flowering period: Jan.

DISTRIBUTION: Widespread in Tasmania, including Cape Barren Island (Map 9). In cold moist heathy places, often on granite.

SELECTED SPECIMENS: TASMANIA: c. 3 miles [5 km] from Savage River, towards Waratah, *Canning* 1966, 1.1969 (CBG, NSW); Strahan, *Davis & Davis, Rodway* 2484, 1.1937 (HO, NSW), *Rodway* 1530, 10.1933 (NSW), *Garden* NSW 19392, 19393, 1.1949 (NSW); junction of Scotts Peak road and Condominium Creek, South West National Park, *Short* 1802, 1.1983 (MEL, NSW); Lake Margaret, *Garden* NSW 19394, 1.1949 (HO, NSW).

76. *L. petraeum* J. Thompson sp. nov.

Frutex usque ad 3 m altus. Folia late elliptica, c. 1.5 cm longa, apicibus pungentibus. Flores sepalis longideltoideis sericeis persistentibus. Ovarium 5-loculare. Fructus 7–8 mm diametro persistentes.

HOLOTYPE: NEW SOUTH WALES: Rocky Top, Kanangra, *J. Thompson* 4303, 23.8.1982 (NSW).

Spreading rigid shrub to 3 m tall, with bark close on small branches but later flaking in strips, the younger stems very stout, with a short pubescence and a flange seen only as a thickening extending below the leaf-base, and with branching at 45°–60° or more but later curving so as to appear at a narrower angle. *Leaves* rather aromatic, mostly narrowly divergent, variable in size but usually c. 15 mm long and 5–6 mm wide, rather broadly elliptical, glabrescent with both surfaces soon glabrous and glossy but hairs persisting on margins and the petiole, the texture rather thick, the surface often tending to incurve or infold especially near the apex but older leaves flat or even slightly recurved in cross-section, the upper part tapering to an acute or acuminate, pungent-pointed apex, the base rounded above a distinct somewhat thick-based petiole. *Flowers* white, c. 22 mm in diameter, single on modified shoots at the ends of short leafy side-branches, the subtending leaves often somewhat modified, the new growth developing from the flowering shoot after flowering. *Bracts* and bracteoles similar, broad, stiffly scarious and yellowish-brown. *Hypanthium* glabrous or with a short dense pubescence, 4 mm long, the upper part much expanded, the lower rounded above a stout, short, fluted pedicel, the top of the ovary glabrous. *Sepals* persistent, c. 4–6 mm long, long-deltoid, glabrous or with a close silky pubescence on the lower part, and, usually, long hairs on the upper, inrolled or folded with the tip minutely hooded. *Petals* c. 7 mm long. *Stamens* in bundles of 7, c. 2.5–3 mm long, the anther-cells c. 0.7 mm long,

somewhat recurved and folded, wide open and thickened, the outer part deep. *Style* inset, slender and tapered, with a small stigma. *Ovary* 5-locular, each loculus with c. 40 ovules in c. 6 rows on a large, close-set placenta. *Fruit* long-persistent, c. 7–8 mm in diameter, the rim not much extended, the lower part rather broadly rounded with the surface lifting, later flat-based and scaly, the valves very woody, exerted at first only as a low dome but on opening the surface lifting and the valves rising and spreading so as to be about equal to the base in depth and somewhat broader than the rim. *Mature seeds* c. 2 mm long, linear-cuneiform, striate. Main flowering period: Uncertain; one specimen Nov., one April, one in young fruit Oct.

DISTRIBUTION: known only from a population on an exposed granite outcrop and an old herbarium specimen without field notes, both from the Central Tablelands of New South Wales (Map 9). In rock crevices.

SPECIMENS EXAMINED: NEW SOUTH WALES: Central Tablelands: Rocky Top, Kanangra, *Johnson NSW 154790*, 10.1948 (NSW), *Garden NSW 154789*, 4.1956 (NSW); Blackheath, *Close NSW 154805*, 11.1923 (NSW).

This species is named for its habitat.

77. *L. turbinatum* J. Thompson sp. nov.

Frutex 1–2 m altus. Folia obovata oblanceolata vel elliptica pungentia, 1–2 cm vel longiora. Flores c. 25 mm diametro, sepalis sericeis, longideltoideis persistentibus. Ovarium (4–)5(–6)-loculare. Fructus 7–11 mm diametro turbinati persistentes.

HOLOTYPE: VICTORIA: on steep slopes and sandstone rocks of Mackay's Peak, Serra Range, near Hall's Gap, Grampians, *R. Melville 1847*, *P. Morris*, *C. D'Alton & R. Warry*, 30.x.1952 (NSW).

Spreading shrub usually 1–2 m in height with (as seen on specimens) close, firm bark; the younger stems rather stout with a short close pubescence, without a flange but with a narrow ridge subtending each leaf-base, the branching rather variable but usually at 45°–60°. *Leaves* aromatic, mostly rather narrowly divergent, 10–20 or more mm long and usually 4–8 mm wide; somewhat smaller near the flowers, elliptical to obovate or oblanceolate, ultimately glabrous and glossy but the fine spreading pubescence of young leaves rather persistent, thick in texture and flat or minutely infolded near the tip, the apex acuminate and pungent with a rather stout point, the base tapering gradually or more suddenly to a distinct tapering petiole. *Flowers* white, c. 25 mm in diameter, single on modified shoots terminating adjacent leafy side-branches, the new growth extending from beyond the flowers after flowering. *Bracts* very broad, pale yellowish-brown and stiff, the inner and bracteoles longest (the latter somewhat shorter than the final bract) tightly rolled around the young bud, but allowing the pointed bud to protrude, and sometimes held about the opening flower. *Hypanthium* with a long dense silky pubescence, c. 5 mm long the upper part widely expanded, the lower somewhat tapering and fluted but rounded at the base with a minimal pedicel, the top of the ovary glabrous. *Sepals* persistent, 5–7 mm long, long-deltoid, with a long, dense, silky pubescence, the tip infolded and minutely hooded. *Petals* c. 12 mm long. *Stamens* in bundles of 7–9, c. 5 mm long, the anther-cells c. 0.8 mm long, parallel, much-thickened but wide open and with the outer part deep, recurved and somewhat folded back. *Style* rather shallowly inset, moderately stout and tapering, with the stigma small in relation to the style. *Ovary* (4–) 5 (–6)-locular, each loculus with c. 80 ovules in c. 8 rows on a rather small, high, inset, placenta with the top

somewhat extended. *Fruit* persistent, c. 7–11 mm in diameter, the rim rather broad and woody, the lower part usually rounded and eventually tapering to a narrow base, the surface lifting, later firm and gnarled, the valves very woody, exerted to a rather variable extent, forming a broad- or narrow-topped dome, on opening with the surface lifting, the valves usually failing to extend to any extent. *Mature seeds*, c. 4 mm long, irregularly narrowly linear-cuneiform, sigmoid, striate. Main flowering period: Nov.

DISTRIBUTION: Limited to the Grampians and adjacent ranges in western Victoria (Map 9). In sandy soil on rocky sandstone slopes.

SELECTED SPECIMENS: VICTORIA: Western Highlands: Mt William, *Phillips* 586, 11.1971 (CBG, NSW); W. slope of Boronia Peak, *Muir* 822, 9.1959 (MEL, NSW).

This species is named for the shape of its fruit, by which it can be distinguished from *L. nitidum* with which it has been confused.

78. *L. crassifolium* J. Thompson sp. nov.

Frutex 1–2 m altus. Folia crassa nitida, usque ad 7 mm longa. Flores c. 18 mm diametro, sepalis longideltoideis sericeis pubescentibus. Ovarium (4–)5-loculare. Fructus 8–10 mm diametro longipersistentes.

HOLOTYPE: NEW SOUTH WALES: N. side of Mt Corang, northern Budawang Range, c. 40 km NE. of Braidwood, *R. Pullen* 4972 & *J. Story*, 26 Sept. 1973 (NSW). **ISOTYPE:** CANB.

Shrub 1–2 m in height with (as seen on specimens) close bark; the younger stems rather stout with a minute close pubescence, without a flange but thickened around the leaf-bases, branching at c. 60° but often soon curving. *Leaves* somewhat aromatic, dense, and rather erect at first, later diverging and usually with the upper part recurving, mostly 7 mm or less in length and 3–4 mm wide, broadly elliptical, very thick in texture, incurved in cross-section and often infolded near the apex, glabrous and very glossy with prominent glands on the lower surface, the margins often minutely pubescent, the apex broadly acute, usually with a stout blunt point, the base broad above a distinct often broad-based petiole. *Flowers* white, c. 18 mm in diameter, single on modified shoots terminating leafy side-branches, the new growth extending from branch-ends and from beyond the flowers after flowering. *Bracts* large, very broad and concave, almost spherical, golden brown and rather thin, stiff but translucent, the inner and bracteoles longer but enabling the long-pointed sepals to protrude, many tending to persist about the open flower. *Hypanthium* glabrous apart from a minute pubescence on the upper parts and rather dark, c. 5 mm long, the upper part not much expanded, the lower rather straight-sided and rounded above a fluted pedicel, the top of the ovary glabrous. *Sepals* persistent, c. 5 mm long, long-deltoid, with a thin silky pubescence, the margins pale, the upper part infolded and the tip hooded. *Petals* c. 7 mm long. *Stamens* in bundles of 5–7, c. 4 mm long, the anther-cells 0.6–0.7 mm long, somewhat recurved and folded, much-thickened and opening wide but deep in the outer part. *Style* inset, evenly slender or with a very short broad base, the stigma rather small. *Ovary* (4–) 5-locular, each loculus with c. 80 ovules in (6–) 8-rows on a large, rather shallow and close-set placenta. *Fruit* long-persistent with the base becoming very broad, mostly 8–10 mm in diameter, the rim woody but not much expanded, the lower part rather straight-sided or rounded above a broad base, the surface lifting as a very thin layer, the valves very woody, exerted to form only a very low dome with a small central depression, after opening the surface lifting, and the valves raised and spreading to some extent

so as to be less wide than the rim and usually about half the depth of the base. *Mature seeds* c. 2.5 mm long, linear-cuneiform, striate. Main flowering period: Feb. and perhaps later.

DISTRIBUTION: On peaks of the Budawang Range in southeastern New South Wales (Map 9). In moist peaty sand and rock crevices, on sandstone

SELECTED SPECIMENS: NEW SOUTH WALES: Southern Tablelands: S. end of Quilties Mountain, *D. Black NSW 154791*, 11.1981 (NSW); Corang Trigonometrical Station, *Olsen 953*, 2.1969 (NSW). This species is named for its leaf-texture.

79. *L. epacridoideum* *Cheel, J. & Proc. Roy. Soc. New South Wales 53: 121 (1919)* (as *L. epacridoideum*, an error resulting from the wrong use of a connecting vowel).

LECTOTYPE, here chosen: NEW SOUTH WALES: Jervis Bay, *Dr. F.A. Rodway NSW 154792*, 2.1916 (NSW).

Erect rather rigid bushy shrub, usually more than 2 m in height, with close firm bark, corrugated towards the base of the plant; the younger stems very stout, with a very minute, often rather retrorse pubescence that persists onto older growth, with no flange and scarcely raised below the nodes, often branching at 60° but frequently soon becoming more erect. *Leaves* somewhat aromatic, dense and erect or narrowly divergent with the lamina tending to recurve, 2–3 mm long and c. 2 mm wide, broadly elliptical to almost orbicular, incurved in cross-section and very thick in texture, especially in the upper part, glabrous and very glossy, with prominent glands on the lower surface the apex rounded, often with a thickened umbo behind, the base broad above a distinct short, broad and very thick-based petiole. *Flowers* white or pink, c. 10 mm in diameter, single on modified shoots on short or long leafy side-branches, the new growth from branch ends and beyond flowers after flowering. *Bracts* large, very broad, almost spherical and concave, stiff but not very thick, golden- to red-brown, the longer inner ones and even slightly longer bracteoles enclosing the narrow young bud but soon allowing the long sepal-tips to protrude, tending to persist about the flower. *Hypanthium* glabrous, and dark with obvious glands, or occasionally with a minute pubescence at the top, c. 3 mm long, the upper part a little expanded, the lower almost hemispherical, the top of the ovary glabrous. *Sepals* persistent, c. 3.5 mm long, long-deltoid, minutely pubescent especially near the apex and on the pale margins, the margins infolded and the apex minutely hooded. *Petals* c. 5 mm long. *Stamens* in bundles of c. 5(–7), c. 2.5 mm long, the anther-cells c. 0.5 mm long, parallel, very much thickened and wide open but deep in the outer part, recurved and folded back. *Style* inset, rather slender, with a stigma of medium size. *Ovary* 5–(–6) locular, each loculus with c. 60 ovules in 6 rows on a large, close-set placenta. *Fruit* long-persistent and becoming broad-based, up to 8 mm in diameter, the rim woody but scarcely extended, the lower part usually almost hemispherical, the surface lifting in a thin layer and becoming gnarled, the valves very woody, exerted only as a low dome before opening, and the opening reluctant or restricted, occasionally the valves lifting and spreading to some extent. *Mature seeds* c. 2 mm long, linear-cuneiform, striate. Main flowering period: Feb.-Mar.

DISTRIBUTION: Almost confined to the Jervis Bay area of southeastern New South Wales (Map 9). In poor sandy, often moist heath and dry sclerophyll forest, on sandstone. Recent study of the area has failed to confirm the Central Coast record.

SELECTED SPECIMENS: NEW SOUTH WALES: Central Coast: Austinmer, *G. Rodway* NSW 154793, 7.1933 (NSW). South Coast: Flat Rock Creek, on Yalwal road, *Coveny* 10975 & *James*, 9.1981 (NSW); Sassafras-Tomerong road, c. 1.6 km from Nowra turn-off, *Blaxell* 1241 & *Benson*, 2.1974 (NSW); Jervis Bay, *Gaub* 5608, 2.1953 (CBG, NSW).

Unidentified taxa

L. pubescens Lam., *Encycl.* 3: 466 (1791). Described from living material said to have come from New Zealand but, from the description, probably *L. lanigerum* (publ. 1789) from Tasmania.

L. recurvifolium Salisb., *Prodr.*: 350 (1796). Based on a 1791–1792 collection by D. Burton from Port Jackson. From the description probably *L. arachnoides* (publ. 1788) but perhaps *L. squarrosum* (publ. 1788).

L. multiflorum Cav., *Icon.* 4.: 17, t. 331 (1797). A mixed concept (“prope Paramata et Jackson”), with elements of *L. polygalifolium* (publ. 1796) and *L. juniperinum* (publ. 1797).

L. stellatum Cav., *op. cit.* 4: 16, t. 330. A mixed concept with elements of *L. polygalifolium* (publ. 1796) and *L. trinervium* (publ. 1790).

L. pungens Dum.-Cours., *op. cit.*: 385. A name of uncertain application described from living material grown from seed sent under this name “par M. Banks”.

L. villosum Fischer, *Cat. Jard. Gorenki*, ed. 2: 63 (1812). Publication not seen but species based on material of a garden plant grown in Moscow.

L. tuberculatum Poir. in Lam., *Encycl.*, *Suppl.* 3: 338 (1813). Based on a specimen collected by Labillardière (herb. Desf., FI, n.v.). Usually assumed to be *L. lanigerum* (publ. 1789). The FI specimen has not been found (Guymer, pers. comm.).

*L. rubricaul*e Cels ex Link, *Enum. Hort. Berol. Alt.* 2: 25 (1822). Described from a garden plant of Australian origin. From the description perhaps *L. squarrosum* (publ. 1788).

L. cuneatum Hoffsgg., *Verz. Pfl.-Kult.*: 72, 175 (1824). Described from material from a Dresden or Rammerau garden plant; probably a form of *L. lanigerum* (publ. 1789).

L. microphyllum Hoffsgg., *loc. cit.* Described from material from a Dresden or Rammerau garden plant.

L. thymifolium Hoffsgg., *op. cit.*: 72, 176. Described from material of a Dresden or Rammerau garden plant.

L. obliquum Colla, *Hortus Ripul.*, *App.* 2: 351 (1826). Described from a cultivated plant without flowers.

L. scoparium var. *rubricaul*e (Cels ex Link) DC., *op. cit.*: 227. See *L. rubricaul*e Cels ex Link (1822).

L. tuberculatum var. *subenerve* DC., *op. cit.*: 227. A brief description based on a dried specimen without provenance that has not been found in De Candolle’s herbarium (G-DC, NSW microfiche).

L. buxifolium Dehnh., *Cat. Horti Camald.* 1: 172 (1829). Publication not found but species, if valid, described from cultivated material. The name is certainly published in ed. 2, 1: 172 (1839), and there an origin in Tasmania is suggested.

- S. Schauer, in 1841, considered this to be *L. grandiflorum* (publ. 1821).
- L. tortuosum* Dehnh., op. cit. 1: 171. See above but of different origin.
- L. buxifolium* Otto & A. Dietr., Allg. Gartenzeitung 1: 186 (1833) non Dehnh. (1829). There are probably no extant specimens of species described in this series of papers. They were based on living material and any specimens would have been in B.
- L. acutifolium* Otto & A. Dietr., op. cit. 9: 225 (1841).
- L. ciliolatum* Otto & A. Dietr., op. cit. 9: 241 (1841).
- L. villosum* Otto & A. Dietr., op. cit. 9: 242 (1841), non Fischer (1812).
- L. acerosum* Schauer ex Otto & A. Dietr., op. cit. 9: 250 (1841).
- L. cupressinum* Otto & A. Dietr., op. cit. 9: 250 (1841).
- L. cuneiforme* Otto & A. Dietr., op. cit. 9: 251 (1841).
- L. pungens* Otto & A. Dietr., op. cit. 9: 260 (1841), non Dum.-Cours. (1811).
- L. candollei* S. Schauer, Linnaea 15: 440, 441 (1841). Based on material (without number) collected by A. Cunningham, in 1825, in inland New South Wales. Schauer confused *Leptospermum* taxa, and cited Cunningham's specimens (often without number) by manuscript herbarium names in synonymy of many species.
- L. grandifolium* var. *angustum* S. Schauer, op. cit.: 413. Based on a Murrey specimen (without number) from Moreton Bay, n.v.; probably, from the locality, a form of *L. trinervium*.
- L. grandifolium* var. *argyreum* S. Schauer, op. cit.: 413. Based on an A. Cunningham specimen (without number) from Tasmania, collected in 1819, n.v. but likely to be a form of *L. lanigerum*.
- L. grandifolium* var. *vestitum* S. Schauer, op. cit.: 413. Based on an A. Cunningham specimen collected in New South Wales in 1822, n.v., and not identifiable without number.
- L. lanigerum* var. *concolor* S. Schauer, op. cit.: 415. From "Nova Hollandia orientale". This would be either *L. lanigerum* sens. str., *L. trinervium* or (most likely) *L. grandifolium*. Schauer confused these species.
- L. lanigerum* var. *discolor* S. Schauer, op. cit.: 415. From "Nova Hollandia orientale". This is likely to be a form of *L. grandifolium*.
- L. oxycedrus* S. Schauer (as L. Schauer), op. cit.: 432. From "Hollandia orientale", but the description was based on a cultivated plant, perhaps but not certainly *L. squarrosus* (publ. 1788).
- L. scoparium* var. *confertifolium* S. Schauer, op. cit.: 425. From the specimens cited, a mixed and unidentifiable concept.
- L. tonsum* S. Schauer, op. cit.: 422. From "Nova Hollandia"; a plant seen cultivated with reference also to a specimen in Willdenow's herbarium, n. 9458, "without flowers".
- L. pilosum* Schauer in Walp., Rep., Suppl. 1: 923 (1843). Based on a specimen from Tasmania, A. Cunningham 84, that Bentham failed to find in Cunningham's herbarium. J. D. Hooker in 1856, in describing *L. nitidum*, suggested that this may be conspecific, but the description of the calyx suggests otherwise. Current searching has not located this specimen.

L. bullatum Loud., Hort. Brit., Suppl. 3: 576 (1850) nom. nud.

L. pubescens var. *commune* Domin, Biblioth. Bot. 89: 453 (1928). Domin was referring here to, and cites in synonymy, *L. pubescens* Lam. (1791) sens. str.

L. pubescens var. *tonsum* (S. Schauer) Domin, op. cit.: 453. See S. Schauer (1841).

Excluded taxa

L. ciliatum Forst. & Forst. f., Char. Gen.: 72 (1776) = *Purpureostemon ciliatus*.

L. collinum Forst. & Forst. f., loc. cit. = *Metrosideros collina*.

L. leucadendron (L.) Forst. & Forst. f., loc. cit. = *Melaleuca leucadendra*.

L. perforatum Forst. & Forst. f., loc. cit. = *Metrosideros perforata*.

L. scandens Forst. & Forst. f., loc. cit. = *Metrosideros scandens*.

L. virgatum Forst. & Forst. f., loc. cit. = *Baeckea virgata*.

L. umbellatum Gaertner, Fruct. Sem. Pl.: 174, t. 30 (1788) = *Eucalyptus umbellata*.

L. salicifolium Lam., Encycl. 3: 467 (1791) = a plant with opposite leaves, from Java.

L. ambiguum Smith, Trans. Linn. Soc. London 3: 264 (1797) = *Kunzea ambigua*.

L. imbricatum Smith, Trans. Linn. Soc. London 6: 300 (1802) = *Baeckea imbricata*.

L. marginatum Labill., Nov. Holl. Pl. 2: 10, t. 148 (1806) = *Agonis marginata*.

L. brevifolium Rudge, Trans. Linn. Soc. London 8: 169 (1807) = *Baeckea brevifolia*.

L. resiniferum Bertol., Amoen. Ital.: 29 (1819) = *Agonis flexuosa*.

L. glomeratum Wendl. f., Flora 2: 678 (1819) = *Agonis flexuosa*.

L. flexuosum Link, Enum. Hort. Berol. Alt. 2: 26 (1822) = *Agonis flexuosa*.

L. celsianum Ten., Ind. Sem. Hort. Neap.: 11, n. 13 (1823), (according to Steudel, Nomencl. Bot., ed. 2: 31 (1840)) = *Metrosideros* sp.

L. parvulum Labill., Sert. Austro-caledon. (1823): 62, t. 61 = *Baeckea parvula*.

L. pinifolium Labill., op. cit.: 63, t. 62 = *Baeckea pinifolia*.

L. dubium Sprengel, Syst. Veg. 2: 492 (1825) = ? *Astartea* sp.

L. linearifolium DC., Prodr. 3: 227 (1828) = *Agonis linearifolia*.

L. scabrum (Thunb.) Wallich, Cat. n. 3650 (1831) = *Deutzia scabra*.

L. stamineum (R.Br.) Wallich, op. cit. n. 3651 = *Deutzia staminea*.

L. ericoides A. Rich., Voy. Astr. 1: 338 (1832) = *Kunzea ericoides*.

L. buxifolium Otto & A. Dietr., Allg. Gartenzeitung 1: 186 (1833), non Dehnh. (1829) = a plant with crenate leaves.

L. angustifolium Endl. in Endl. & al., Enum. Pl.: 50 (1837) = *Hypocalymma angustifolium*.

- L. ellipticum* Endl., op. cit. = *Pericalymma ellipticum*.
L. robustum Endl., op. cit.: 50 = *Hypocalymma robustum*.
L. hypericifolium Otto & A. Dietr., Allg. Gartenzeitung 9: 243 (1841) = *Agonia* sp. (?*theiformis*).
L. styphelioides S. Schauer., Linnaea 15: 423 (1841) = *Melaleuca styphelioides*.
L. crassipes Lehm., Sem. Hort. Bot. Hamburg (1842) = *Pericalymma ellipticum*.
L. splendens Schauer, in Walp., Rep., Suppl. 1: 923 (1843) = a plant with axillary subracemose flowers.
L. laricifolium Cunn. ex. Schauer, op. cit.: 922 = *Astartea fascicularis*.
L. longifolium? Cunn. in R. Heward, J. Bot. 4: 243 (1841). A scarcely valid description of a southern Australian plant, possibly *Agonia flexuosa*.
L. fabricia Benth., Fl. Austral. 3: 102 (1867) = *Neofabricia myrtifolia*.
L. firmum (Schauer) Benth., op. cit.: 104 = *Homalospermum firmum*.
L. floridum (Schauer) Benth., op. cit.: 110 = *Pericalymma ellipticum*.
L. sinclairii Kirk, Stud. Fl. New Zealand: 158 (1899) = *Kunzea ericoides*.
L. javanicum var. *papuana* F. Muell., Descr. Notes Papuan Pl.: 59 (1890) = a plant with flowers in terminal clusters.
L. benningsenianum Volk. in Engl., Bot. Jahrb. Syst. 31: 470 (1902) = *Myrtella benningseniana*.
L. mjoebergii Cheel, J. & Proc. Roy. Soc. New South Wales 53: 120 (1919) = *Neofabricia mjoebergii*.
L. phylcooides (as *phylcoideum*) Cheel, op. cit. 76: 231 (1943) = *Kunzea ericoides*.

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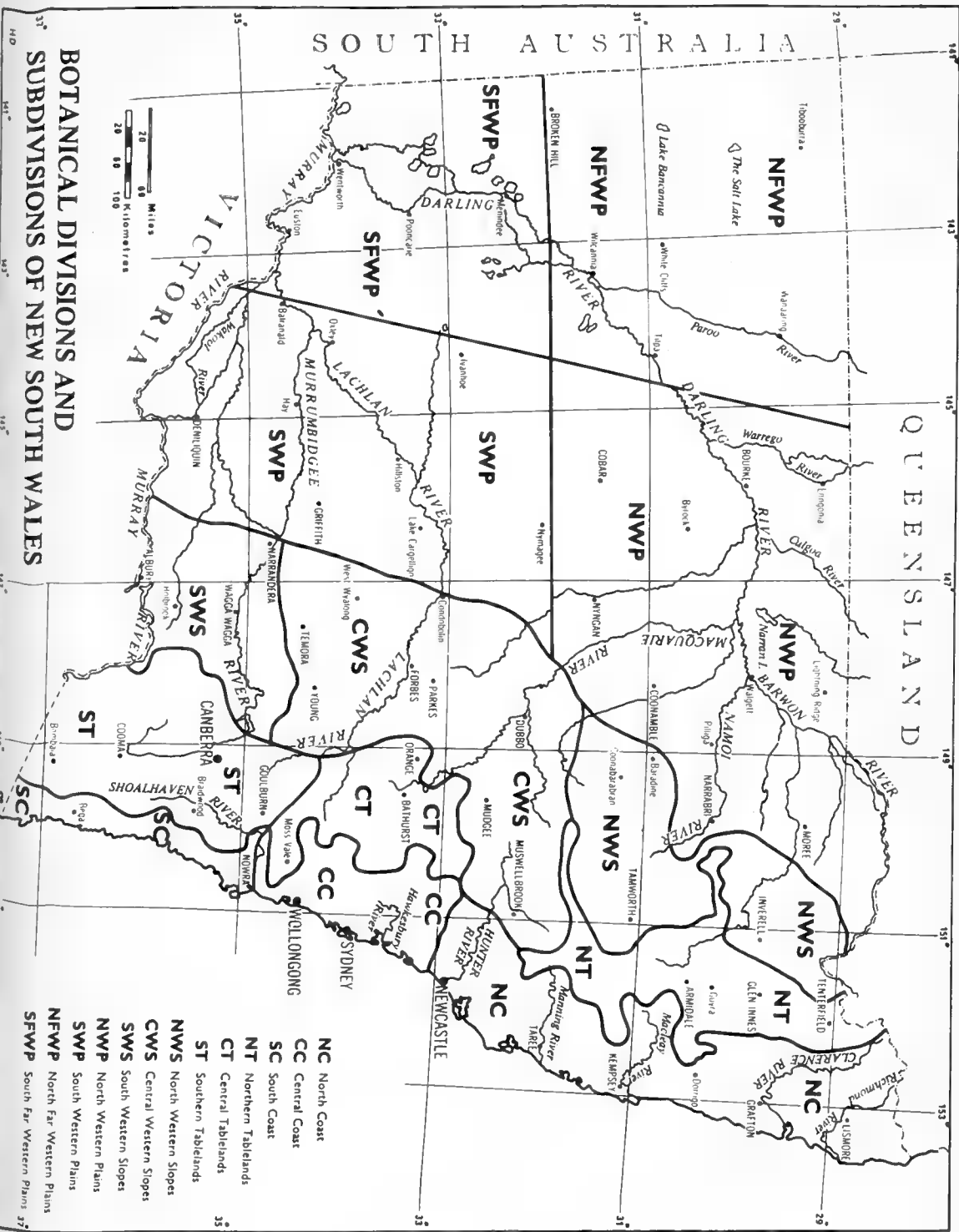
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For explanation and description of the Botanical Divisions and Subdivisions of New South Wales see R.H. Anderson (1961) Introduction. *Contr. New South Wales Natl Herb., Flora New South Wales* Nos. 1-18: 1-15.

A revision of the genus *Xanthostemon* (Myrtaceae) in Australia

Peter G. Wilson

Abstract

Wilson, Peter G. (National Herbarium of N.S.W., Royal Botanic Gardens, Sydney 2000) 1990. A review of the genus *Xanthostemon* (Myrtaceae) in Australia. *Telopea* 3(4): 451-476. — The Australian species of *Xanthostemon* are examined in the light of morphological and anatomical evidence and their relationships are discussed. Thirteen species are recognised, three of them new: *X. formosus*, *X. xerophilus* and *X. graniticus*. Also, the new combinations *X. petiolatus* (based on *Nania petiolata* Valetton) and *X. verus* (based on *Metrosideros vera* Roxb.) are made for two Malesian species.

Introduction

Xanthostemon is a genus of at least 45 species, most of which are arborescent, with a range extending from the Philippines to the Solomon Islands, New Caledonia and Australia. In Australia, the distribution is predominantly tropical with the only extratropical species, *X. oppositifolius*, occurring not far north of Brisbane.

When Ferdinand Mueller described the genus in 1857 with one species, *X. paradoxus*, he stated that it was close to the genus *Metrosideros* but was presumably convinced of the distinctness of the taxon by its golden-yellow stamens and its almost superior capsule. In the first volume of his 'Fragmenta' (1858: 80) he added a new species, *X. eucalyptoides*, and particularly indicated three character-states that distinguished *Xanthostemon* from *Metrosideros*, viz., capsule hardly adnate to the calyx tube, endocarp becoming free, and seeds flattened. However, in a later part of the same publication (1858: 243) he reduced the genus to subgeneric status under *Metrosideros*, influenced by the affinity of his two species to *Metrosideros ciliata* (now usually considered to constitute the monotypic genus *Purpureostemon* Gugerli).

Bentham (1865, 1867) reinstated the genus *Xanthostemon* for species with alternate leaves, e.g. *X. paradoxus*, but left species with opposite leaves, e.g. *X. eucalyptoides*, in *Metrosideros*. Gugerli (1940), in his monograph of the genus *Xanthostemon*, follows Bentham in excluding those species with strictly opposite leaves, except for *X. oppositifolius* which F.M. Bailey had placed in *Xanthostemon* rather than *Metrosideros* because the fruits were quite similar to those of *X. chrysanthus*. In this case, Gugerli's reasoning was based on his interpretation of leaf arrangement which he described as 'folia subopposita vel leviter alterna'. Although he excluded them from his taxonomic treatment, Gugerli did give some consideration to the opposite-leaved species which he considered under *Metrosideros* sect. *Nania*, and concluded that the latter taxon could be combined with ('zurückgeführt') *Xanthostemon*. While his monograph was in preparation, Gugerli (1939) described a new genus, *Purpureostemon*, distinct from *Xanthostemon* in four characters, viz., quincuncial (vs. imbricate) aestivation of the corolla, extent of fruit dehiscence, reduced size of the embryo (associated with the winged seed) and placenta angle (oblique rather than horizontal).

Merrill (1952: 156), in a discussion of *X. crenulatus* C. White, a species with opposite leaves, considered that it might be better placed in the genus *Nani* Adanson (*Nania* Miq.) which had long been considered a synonym of *Metrosideros* but which Valetton (1901: 65) accepted (as *Nania*) as generically distinct from *Metrosideros* on the basis of the more or less superior fruits and the different seeds and placenta. However, although Merrill seemed to be in favour of placing opposite-leaved species in *Nani* he did not transfer *X. crenulatus* to that genus.

Dawson (1972a) compares the four genera *Xanthostemon*, *Nani*, *Pleurocalyptus* and *Purpureostemon*, and concludes that none of them have any close affinity with *Metrosideros*. The four genera have a large number of character-states in common and differ from each other in only a few respects, and so Dawson raises the possibility that a detailed revision would lead to these genera being merged. Briggs and Johnson (1979) present an informal classification of the genera of the Myrtaceae into alliances, suballiances and infra-alliances and within this scheme they place the genera *Xanthostemon* (including *Nani*), *Purpureostemon* and *Pleurocalyptus* in the *Xanthostemon* suballiance, which is part of the *Metrosideros* alliance. If all four genera are combined, or if *Nani* alone is merged into *Xanthostemon*, the name *Nani* Adanson has priority but Wilson and Dawson (1981) have proposed that *Xanthostemon* be conserved against it.

Discussion of Characters

Phyllotaxis

In the Myrtaceae, the phyllotaxis is generally opposite and decussate or alternate, i.e. disperse in the terminology of Briggs and Johnson (1979), in both juvenile and mature plants. The best known exception to this is the condition found in most species of *Eucalyptus* sens. lat., where the juvenile foliage is opposite and decussate with the adult foliage becoming alternate by the separation of the pairs of leaves through expansion of the intranode, i.e. disjunct opposite in the terminology of Briggs and Johnson (1979). Another example is the genus *Lophostemon* which also has opposite leaves in the juvenile stage and alternate (disjunct opposite) leaves in the adult; the latter is most noticeable in young plants when the phyllotaxis first changes, but it is obscured in the more mature plant by the aggregation of almost all the true leaves into a pseudoverticil at the tip of the seasonal growth unit (Wilson & Waterhouse 1982). In *Lindsayomyrtus* it has been reported (Hyland & van Steenis 1973) that the first leaves in the seedling are opposite but that the phyllotaxis very soon becomes disperse, and a similar occurrence has been observed in *Welchiodendron* seedlings (Wilson & Waterhouse 1982). This ontogenetic sequence also occurs in at least some *Melaleuca* species and in *Leptospermum* (J. Thompson, pers. comm.) and may be more widespread in the family than the literature would indicate.

In *Xanthostemon*, however, a further exception is found in three of the species with opposite adult leaves, viz., *X. eucalyptoides*, *X. umbrosus* and *X. xerophilus*. When seed of these species was germinated, the seedlings were found to bear alternate leaves for at least the first season's growth. However, the phyllotaxis was not identical; in *X. xerophilus* it was distinctly disperse but in *X. eucalyptoides* it appeared to be disjunct opposite. Disperse phyllotaxis

succeeded by opposite has recently been reported for the newly described genus *Barongia* (Wilson & Hyland 1988) which does not, however, appear to have close affinities with *Xanthostemon*.

A variation of this has been observed in *X. whitei*; this species has predominantly disperse leaves but produces occasional branchlets bearing opposite leaves. Another species, *X. verticillatus*, has its leaves in apparent whorls of (3-)4(-5) at each node, a unique phenomenon in the genus. In the related genus *Purpureostemon*, which has alternate (? disjunct opposite) leaves, it has been observed (J.W. Dawson, pers. comm.) that the seedlings of the single species, *P. ciliatus*, bear opposite leaves.

Inflorescence

A range of inflorescence types is found in the genus. Briggs and Johnson (1979) record the occurrence of monads, triads, botryoids, metabotryoids and panicles; metaxymonads were said to occur rarely. All these inflorescence types have been observed in Australian species during the present study, as well as occasional metaxyttriads. Briggs and Johnson also comment that branching in the larger unit inflorescences is often subopposite or irregular and that recaulescence (adnation of a bract ("pherophyll") to the axis it is subtending) is common. All inflorescences in *Xanthostemon* are axillary, although certain species have pseudoterminal inflorescences consisting of aggregations of lateral monads, triads or botryoids, subtended by reduced phyllomes, that occur at the apex of a stem.

Hypanthium and Perianth

The perianth in *Xanthostemon* is perigynous, the sepals and petals being borne on the rim of a dished hypanthium. The hypanthium varies in shape from broad and shallow to relatively deep and cylindrical. In the latter case, the rim of the hypanthium much exceeds the ovary summit while in the former it is below or barely exceeds the ovary summit. The variations in this character were used by Gugerli (1940) as the basis for a number of the sections that he described. In at least three species (two from Australia and one from the Philippines), the broad hypanthium has concave depressions opposite the petals; this feature was the basis of Gugerli's Section *Vesicaria*. Two of these species, *X. youngii* from Queensland and *X. speciosus* from the western Philippines (Calamian-Palawan group), have red flowers. This character may be associated with bird pollination; however, there are no published observations on the pollination biology of any member of the genus.

The petals are always free and may be red, yellow or cream to white in colour. There are at least four species with deep red petals and stamens but these do not seem to have arisen in the same evolutionary line as the red-flowered *Purpureostemon ciliatus*, and may not themselves represent a monophyletic group. A number of other species, from New Caledonia, have petals that are reddish orange to red but the filaments of the stamens are not necessarily the same colour.

The sepals are free and persistent; however, in the related New Caledonian endemic genus *Pleurocalyptus* the calyx is fused to form a calyptra which tears irregularly at anthesis to reveal the petals and stamens. The single species of

this genus has very close affinities with one particular group of New Caledonian species of *Xanthostemon* (Gugerli's Sect. *Bullata*) and does not warrant generic status solely on the basis of this one character-state (Wilson 1987).

Androecium

The stamens are numerous, mostly the same colour as the petals and arranged in one to several rows. They are relatively long (at least twice as long as the petals in most cases) and are usually the most prominent feature of the flower. Bentham (1867), in his description of the genus, says "stamens indefinite, free or slightly united at the base" but there is no evidence of regular fusion in any species that I have examined, although occasionally two filaments are connate giving the impression of a single stamen with two anthers. In some species there are small gaps in the ring of stamens opposite the centre of each sepal; in other cases the stamens are in two rows in front of a petal but in a single row elsewhere.

The exact nature of the androecium of *Xanthostemon* will only be determined through developmental studies. Payer (1857) was the first to investigate floral organogenesis in the Myrtaceae and described the development of the corolla primordia followed by the differentiation of each of these into a petal and a staminal primordium from which the individual stamens developed centripetally; his work implied that the family is basically obhapplostemonous. However, Johnson and Briggs (1985: 739) argue that the family is basically obdiplostemonous and give a range of examples to support this view.

In the original description of the genus, Mueller stated that the anthers were basifixed. However, Gugerli (1940:33) and Dawson (1972a, fig. 8) have shown that the anthers are, in fact, dorsifixed; the point of attachment of the filament is under a flap of the connective so that it can give the superficial impression that the anthers are basifixed. This mode of attachment is distinctive and is consistently present in *Xanthostemon*, *Pleurocalyptus* and *Purpureostemon* (Dawson 1972a). There seems to be a similar structure occurring in some species of *Metrosideros* sens. lat. (see, e.g., Dawson 1972b).

Another distinctive feature of the anther in *Xanthostemon* is the nature of the oil glands in the connective. The Myrtaceous anther typically has a conspicuous oil gland towards the apex of the connective, but in *Xanthostemon* this single large gland is often accompanied by a number of smaller glands elsewhere in the connective. This was noted by Dawson (1972a) in all the genera of the *Xanthostemon* group and has been observed in the present study in at least six species, *X. paradoxus*, *X. chrysanthus*, *X. whitei*, *X. umbrosus*, *X. psidioides* and *X. graniticus*; the extra glands may be present in other Australian species but are sometimes difficult to detect. Some species of *Metrosideros* sens. lat. also have such additional glands in the connective (Dawson 1970a,b, 1972b).

Ovary and Fruit

The ovary in *Xanthostemon* is often almost superior, although the base is always broadly attached, and it is this character-state, coupled with the subsequent fruit development, that gives the genus its distinctive appearance. The sides of the ovary are free from the hypanthium rather than adhering to it as in most other Myrtaceous genera with the exception of *Ristantia* and, perhaps, a

few other genera. The style is terminal on the ovary or, more usually, set into a slight depression in the summit; the stigma is flat or convex and is as wide as or narrower than the style.

The placentas in most species are rod-like and project into the loculi from the axis at various angles. The only exception to this is in the two closely related species *X. crenulatus* and *X. eucalyptoides* where the ovules are attached to the axis above a very slight protrusion (Fig. 1a). The placentas in these two species have been erroneously thought to be erect and, therefore, the species have been assumed to be part of the same taxon as the type of the genus *Nani* Adanson (Dawson 1972a) which is not here considered to be sufficiently distinct from *Xanthostemon* to warrant separate generic status. The condition described for *Nani* by Dawson (1972a) of placentas obliquely inserted towards the base of the axis and more or less erect, is, however, present in the two Australian endemic species *X. psidioides* and *X. graniticus* (Fig. 1b). In *X. umbrosus* and at least one species from New Guinea the placentas arise from the axis and project obliquely into the upper part of the loculus (Fig. 1c), while in the bulk of the species in the genus the placentas project horizontally into the centre of the loculus (Fig. 1d). In *Purpureostemon* the placenta is oblique but arises from the base of the axis and projects into the centre of the loculus (see Gugerli 1939: Fig. 2).

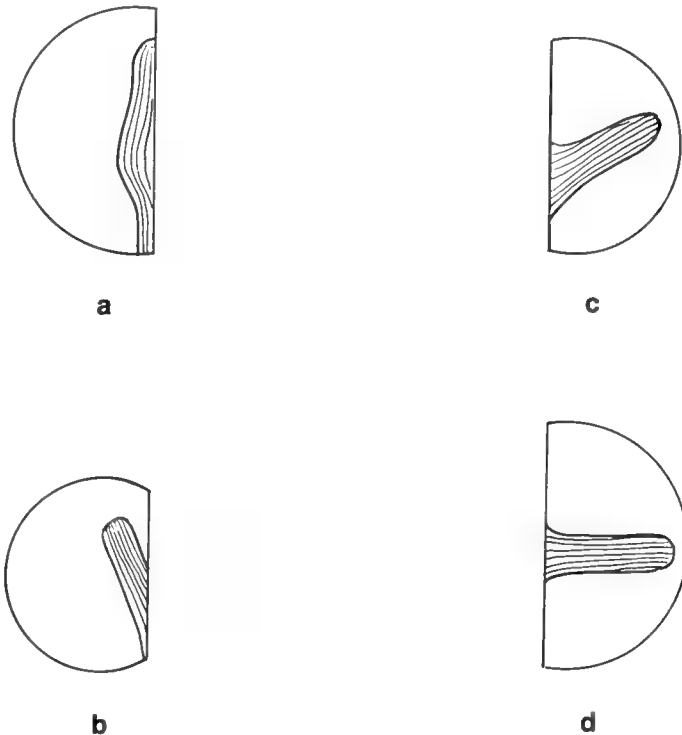


Fig. 1. Diagrammatic representation of the various placenta types found in *Xanthostemon* (see text for details).

The ovules are hemitropous (Dawson 1972a), bilaterally flattened and accumbent to the axis or the placenta. In the species with horizontal placentas the ovules form a complete ring around the placenta whereas in the species with oblique placentas the ring is almost complete, being interrupted at the top by the axis. In *X. crenulatus/eucalyptoides* and *X. psidioides/granicus* the attachment of the ovules is such that they are borne in an arc. In *Purpureostemon* the different configuration of the placenta with respect to the loculus allows the placenta to bear a complete ring of ovules (Dawson 1972a).

As the ovary develops into the fruit, the free part expands at a much faster rate than the fruiting hypanthium so that, finally, the fruit is strongly exerted from the hypanthium. In a fruit that develops from a flower with a shallow hypanthium, the fruiting hypanthium does not enclose the base of the fruit while a cupular hypanthium will often partly enclose the base of the fruit.

Seed and Embryo

The fertile seeds of *Xanthostemon* species are bilaterally flattened and deltoid to semicircular in outline. The embryo usually fills the seed but in two species, *X. eucalyptoides* and *X. crenulatus*, the embryo is confined to one end of the seed, the other being a somewhat membranous wing. Dawson (1972a: Fig. 61) shows a winged seed in *Purpureostemon* but a closer examination of this wing reveals that it is not homologous with the wing in the two species of *Xanthostemon*; in *Purpureostemon* the major wing development is between the raphe and the embryo while in *X. eucalyptoides* and *X. crenulatus*, it is distal to the raphe. Winged seeds in *Xanthostemon* are more or less the same size as unwinged seeds but the embryo in the winged seeds is relatively small and consequently they weigh much less. For example, the average weight of the unwinged seed of *X. chrysanthus* is 3.2 mg while the average weight of the (fertile) winged seed of *X. eucalyptoides* is only 1.3 mg.

The embryo of members of the *Xanthostemon* suballiance is very distinctive. The cotyledons are relatively broad (when compared, for example, with *Metrosideros*) and flat and lie face-to-face; the hypocotyl is bent more or less at right angles to the cotyledons and is accumbent (i.e. lying along the margins of the cotyledons). No other genus of the Myrtaceae is known to have the same embryo type.

Palynology

The study by Pike (1956) of Myrtaceous pollen included three species of *Xanthostemon*, viz., *X. crenulatus*, *X. paradoxus* and *X. verdugonianus*, but apart from a general description of the grains in tabular form and a line drawing of a pollen grain of *X. crenulatus*, the only comment on the genus related to the occurrence of syncolpate or parasyncolpate grains. The more recent study by Gadek and Martin (1981) also included only three species, *X. crenulatus*, *X. chrysanthus* and *X. psidioides*, but the increased resolution of the S.E.M. has enabled a more precise description of the surface pattern of two of the grains as 'microfossulate'. These authors characterise the genus by this type of sculpture as well as by the presence of arcuate colpi and predominantly parasyncolpate grains. However, in a genus of over 40 species, this sample is far too small for any definite conclusions to be reached. The morphological diversity of the genus, and its wide geographic range, would make it a fruitful area

for a more detailed investigation. A recent survey of Myrtalean pollen (Patel et al. 1985) did not include any species of *Xanthostemon*.

Vegetative Anatomy

Earlier studies of anatomy have indicated some characters that may be useful in the taxonomy of *Xanthostemon* as well as in distinguishing that genus from other genera. The study by Ingle and Dadswell (1953) showed that it is not always possible to distinguish genera from each other on the basis of wood anatomy: from their key, *Xanthostemon* would appear to be indistinguishable from *Callistemon*, *Calothamnus*, *Lysicarpus*, *Melaleuca*, *Syncarpia*, and *Tristania* sens. lat. On the other hand, bark anatomy appears to be of considerably more value in characterising genera. Bamber (1962) found, from a survey of four species in the genus, that *Xanthostemon* is distinctive in having the following combination of character-states: alternating layers of sclerosed and suberized cells in the phellem, silica deposits in the ray parenchyma cells (except in the New Caledonian *X. aurantiacus*), fibre-sclereids, and oil glands usually present. On the basis of bark anatomy, Bamber was able to determine that a specimen sent to him labelled "*Metrosideros* sp." was probably a species of *Xanthostemon*. During the present study, observation has recorded oil glands in the bark of *X. eucalyptoides* and *X. graniticus*.

Gugerli (1940) studied vegetative anatomy in his monograph of the genus but this aspect of his work has rarely been referred to. For example, he had already noted (p. 27) that there were alternate rows of sclerosed and suberized tissue in the periderm and that sclereids were found almost always and oil glands less frequently. His findings on leaf anatomy are also quite important. He records the presence of a hypodermis in every one of the 38 species that he examined and this ranged from a single, discontinuous layer in the Australian species *X. oppositifolius* to a very substantial layer five cells deep, occupying almost half the leaf thickness, in the New Caledonian species *X. grandiflorus*.

In the present study, the leaf anatomy of 12 species (10 from Australia, 2 from New Guinea) was examined and a hypodermis was found to be always present; this varies from being a single, discontinuous layer to a layer three cells thick that takes up 5–18% of the leaf thickness. Another notable anatomical feature observed was the nature of the support tissue associated with the secondary leaf traces; in every species examined there is an adaxial column of sclerenchyma reaching through the palisade mesophyll up to or almost to the hypodermis while on the abaxial side there is usually a smaller group of sclerenchyma cells and, below that, a short column of lightly thickened collenchyma reaching to the lower epidermis. There appears to be a correlation between the degree of sclerophylly, as shown anatomically by the amount of sclerenchyma and the thickness of the hypodermis, and the usual habitat of the species; those from woodlands on poorer soils, e.g. *X. paradoxus* and *X. xerophilus*, are more sclerophyllous than those from moist riparian or rainforest situations, e.g. *X. chrysanthus* and *X. whitei*.

Gugerli (1940) reported the occurrence of sclereids or idioblasts in the mid-veins of many species but not in any of the four Australian species that he studied: in the present investigation only one species, the extra-Australian *X. novoguineensis*, displayed this character-state. Gugerli also noted various kinds of sclereids in the pith of young stems; in this study small groups of sclereids were found to be commonly present in the pith but large, angular sclereids were

observed only in the pith of *X. novoguineensis*. Gugerli did not remark on the presence of oil glands in the medulla of the petiole or in the pith; in this study oil glands were observed in the medulla of the petiole in seven species, and an examination of the stem revealed oil glands in the pith in each of these species and also in four other species that had not shown oil glands in their petioles. It seems likely that oil glands occur in all species but may be infrequent in some and thus overlooked.

Oil glands in the leaf lamina were in the size range 55–120 µm in diameter which is almost identical to that recorded by Gugerli for the four Australian species he examined, although the usual range for the extra-Australian species he studied was 100–220 µm. In only one species, *X. psidioides*, were the oil glands consistently located below the palisade in the leaf and this accounts for the difficulty in observing oil glands in fresh leaves of this species.

Discussion of relationships

The species of *Xanthostemon*, as accepted here, fall into a number of distinct groups. The first of these is the group containing *X. eucalyptoides* and *X. crenulatus*; Dawson (1972a) has suggested, following a number of earlier authors, that these two species are closely related to the type species of the genus *Nani* Adanson. These two species are each other's closest relatives as shown by their shared, unique derived character-states (synapomorphies), particularly the narrow perianth segments, the placentation and the winged seeds; there are no obvious synapomorphies linking them to *Nani*.

A second distinctive group of species is made up of *X. psidioides* and *X. graniticus*. The fruits of these two species are superficially similar to that illustrated by Dawson (1972a) for the type species of the genus *Nani*, but there are some differences between these species and *Nani*. In *Nani* the leaves are regularly opposite and mesophyllous while in *X. psidioides* and *X. graniticus* they are alternate and stiffly coriaceous. These differences in leaf arrangement are not necessarily significant since phyllotaxis seems to have become fixed as either opposite or alternate a number of times in the genus (Wilson, unpublished analysis).

A third group of species consists of *X. youngii* and *X. speciosus* Merr. from the Philippines which both have red flowers and vesiculate hypanthium; *X. formosus* shares the vesiculate hypanthium of these species but lacks the derived character-state 'red flowers' and differs markedly in leaf shape and texture, and fruit morphology.

Other species that appear to be closely related are 1) *X. oppositifolius*, *X. xerophilus* (and possibly *X. verticillatus*), and 2) *X. umbrosus* and *X. petiolatus*; these groups of species both have opposite leaves but are not closely related to each other as shown by the difference in placentation (see discussion above). The three remaining Australian species, *X. paradoxus*, *X. chrysanthus* and *X. whitei*, seem to form a group but this may only be due to the sharing of unspecialized (plesiomorphous) rather than specialised (apomorphous) character-states, and may not indicate common evolutionary descent; their affinities may lie with the *X. oppositifolius* group which shares the same placentation.

In this paper, *Xanthostemon* (including *Nani* Adanson) is treated as a single genus. A phylogenetic analysis of the genus and the genera *Purpureostemon* and

Pleurocalyptus (i.e. the *Xanthostemon* suballiance of Briggs and Johnson 1979) is in preparation (see Wilson 1987) and this will examine the evolutionary relationships between the species in these taxa.

In accordance with the conclusions reached so far, new combinations are made here for two Malesian species.

***Xanthostemon petiolatus* (Valeton) Peter G. Wilson, comb. nov.**

BASIONYM: *Nania petiolata* Valeton, Meded. Lands Plantentuin 40: 172 (1900); Ic. Bogor. 1 (4): t. 99 (1901).

***Xanthostemon verus* (Roxb.) Peter G. Wilson, comb. nov.**

BASIONYM: *Metrosideros vera* Roxb., Hort. Bengal.: 37 (1814); Fl. Ind. ed 2, 2: 477 (1832).

Xanthostemon

***Xanthostemon* F. Muell.**, Hooker's J. Bot. Kew Gard. Misc. 9: 17 (1857) *nom. cons.*

TYPE: *Xanthostemon paradoxus* F. Muell.

Nani Adans., Fam. Pl. 2: 88, 581 (1763) *nom. rejic.*

TYPE: *Metrosideros vera* Roxb.

Nania Miq., Fl. Ind. Batav. 1: 399 (1855) *nom. illeg.*

Draparnandia Montr., Mem. Acad. Lyon 10: 205 (1860)

TYPE: *Draparnandia multiflora* Montr.

Metrosideros subg. *Xanthostemon* (F. Muell.) F. Muell., Fragm. 1: 243 (1859).

Metrosideros sect. *Nani* (Adans.) Niedenzu, Nat. Pflanzenfam. 3(7): 88 (1898), as 'Nania Miq.'

Nani sect. *Xanthostemon* (F. Muell.) O. Kuntze in Post & Kuntze, Lexicon Gen. Pl.: 382 (1904), as 'Nania'

Fremya Brongn. & Gris, Bull. Soc. Bot. France 10: 372 (1863); Ann. Sci. Nat. Bot., sér. 5, 2: 131 (1864).

TYPE: *F. rubra* Brongn. & Gris

DISTRIBUTION: Northern Australia, New Caledonia, New Guinea, Solomon Islands, eastern Indonesia, Philippines.

Low shrubs to tall trees, bud scales lacking. *Leaves* of all species alternate in the juvenile stages, some species becoming opposite. *Inflorescences* of axillary monads, triads, botryoids, metabotryoids, thyrsoids or panicles. *Petals* 4 or 5, yellow, white or red. *Sepals* 4 or 5, persistent. *Stamens* longer than the petals, numerous, free, usually in a single whorl, sometimes in two whorls, rarely more; sometimes interrupted opposite each calyx lobe. *Anthers* with a broad connective, gland-tipped, often with smaller glands elsewhere in the connective; filaments dorsifixed, the point of attachment enclosed by the connective. *Ovary* almost superior to half inferior, 2–6-locular (mostly 3–5), surrounded by or included in a saucer- or cup-shaped hypanthium. *Stigma* small, flat or slightly convex, narrower than the style. *Placentation* axile, the ovules attached to the centre of the axis or to a rod- or bracket-like placenta upright in the basal angle of, or projecting from, the axis horizontally or obliquely into the loculus. *Ovules* numerous, hemitropous, bilaterally flattened and accumbent to the axis or placenta and adhering to it along their edges. *Capsule* woody, globular, loculicidal, with the hypanthium partly enclosing, or flattened under, the fruit;

sepals persistent. *Seeds* flattened, semicircular to deltoid, occasionally winged at the chalazal end. *Embryo* with broad cotyledons lying face to face; hypocotyl accumbent.

LEAF ANATOMY: Hypodermis present, 1–3 cells deep. Secondary leaf veins supported adaxially by a column of sclerenchyma reaching through the palisade mesophyll to the hypodermis, and abaxially by collenchyma or sclerenchyma plus collenchyma. Petiole trace V- to very broadly U-shaped with oil glands very often present within the arc of the xylem.

A genus of over forty species. The name is derived from the Greek *xanthos*, 'yellow', and *stemon*, 'stamen', a reference to the yellow stamens of the type species, although red- and white-stamened species are not uncommon in the genus.

The genus *Nani* was described by Adanson (1763) who took the name from the Ambonese word given by Rumphius (Herbarium Amboinense 3: 16, t.7, 1743) for the species that he called 'Metrosideros vera'. This volume of Rumphius' work was published before the starting date for valid publication of names but his illustration constitutes the type of Adanson's genus.

The validity of the names in Adanson's publication under the present rules of nomenclature has recently been questioned by Parkinson (1987). The questions raised by Parkinson are still unanswered; however, Adanson's generic names have been treated as validly published for at least the past 50 years and this seems likely to remain the case (Nicolson, pers. comm.). In this paper, Adanson's name is treated as validly published; in the event of the rejection of his names, the following discussion and the synonymy given above would need amendment.

The first valid publication of Rumphius' species is *Metrosideros vera* Roxb. (Hort. Beng.: 37, 1814) based solely on Rumphius' illustration. Lindley's later publication of the same name (Collectanea Botanica t.18, 1821) also cited Rumphius' illustration (the type) and must, therefore, be considered to be an isonym (Nicolson 1975) and superfluous. Neither Roxburgh nor Lindley acknowledged Adanson's publication.

Miquel (1855) published the genus *Nania*, latinising the Ambonese 'Nani', independently of Adanson; the name is therefore new rather than an orthographic variant. Miquel's species, *Nania vera*, has been taken by some as a new combination of Adanson's and Roxburgh's names but Miquel gives no indication that he was aware of either publication. However, Miquel's species citation includes Rumphius' illustration so his genus is illegitimate since it includes the type of a previously published name (*Nani* Adanson) which ought to have been used.

The combination from Adanson's generic name and Roxburgh's specific epithet has never been made, but some combinations in *Nani* were made by Kuntze (1891). Kuntze took up Adanson's name, although he preferred the latinised form *Nania* (this was an orthographic variant), and applied it to the extremely broad concept of the genus *Metrosideros* favoured by Mueller in his Systematic Census of Australian Plants. This broad treatment was not accepted by any later botanist although Valeton (1901) did accept *Nania* Miq. as a genus distinct from *Metrosideros* and Merrill (1952: 156) supported this view, at least in principle.

The lack of any widespread usage of the name *Nani*, coupled with the conclusion that the genus had affinities with *Xanthostemon* rather than *Metrosideros*,

prompted Wilson and Dawson (1981) to propose that *Xanthostemon* be conserved against it. The Committee for Spermatophyta of the IAPT has voted to recommend conservation of the name *Xanthostemon* F. Muell. (Taxon 33: 298, 1984); this recommendation was ratified at the International Botanical Congress in Berlin.

Key to the Species of *Xanthostemon* in Australia

1. Flowers with distinct depressions ('vesicles') in the hypanthium opposite the petals..... 2
Flowers lacking vesicles in the hypanthium..... 3
2. Flowers red; ovary densely pubescent..... 1. *X. youngii*
Flowers greenish yellow; ovary glabrous..... 2. *X. formosus*
3. Placenta projecting more or less horizontally into the loculus; ovules forming a complete ring..... 4
Placenta oblique to erect; ovules not forming a complete ring..... 9
4. Adult leaves opposite or in apparent whorls..... 5
Adult leaves alternate (sometimes, in *X. whitei*, with some branchlets bearing opposite leaves)..... 7
5. Leaves opposite..... 6
Leaves in apparent whorls of four..... 3. *X. verticillatus*
6. Flowers white; ovary hairy; bark scaly..... 4. *X. oppositifolius*
Flowers yellow; ovary glabrous; bark persistent, rugose.. 5. *X. xerophilus*
7. Hypanthium not enclosing the fruit at the base..... 8
Hypanthium partly enclosing the fruit..... 6. *X. chrysanthus*
8. Calyx, corolla, stems and leaves glabrous or covered with a white tomentum; leaves obtuse, shortly petiolate..... 7. *X. paradoxus*
Calyx, corolla, stems and leaves covered with a dense yellow-brown tomentum; leaves occasionally opposite, acute, distinctly petiolate..... 8. *X. whitei*
9. Petals ovate or elliptical; ovules attached at the apex of the placenta; seeds not winged..... 10
Petals narrowly spatulate; ovules attached part-way up the axis; seeds winged..... 12
10. Adult leaves alternate..... 11
Adult leaves opposite..... 9. *X. umbrosus*
11. Indumentum on young shoots golden brown; leaves 5.5–9.0 cm long, 2.5–4.0 cm wide..... 10. *X. psidioides*
Indumentum on young shoots reddish brown; leaves 7.0–18.0 cm long, 4.0–10.0 cm wide..... 11. *X. graniticus*
12. Leaves sessile or nearly so..... 12. *X. eucalyptoides*
Leaves petiolate..... 13. *X. crenulatus*

1. *Xanthostemon youngii* C. White & Francis, Proc. Roy. Soc. Queensland 37:159 (1926) Plate vi; Gugerli, Repert. Spec. Nov. Regni Veg., Beih. 120: 54 (1940).

HOLOTYPE: QUEENSLAND: Temple Bay, Cape York Peninsula, J.E. Young AQ 316316, vii.1923 (BRI).

Shrub (in heath communities) or tree with reddish brown, rough bark; young leaves and stems, floral parts and fruit white-pubescent. *Leaves* alternate in both juvenile and adult plants; petiole short, c. 0.5 cm long; lamina obovate to elliptical, 5–8 cm long and 1.5–3.5 cm broad, obtuse, glabrous, coriaceous with prominent venation. *Inflorescence* axillary, a monad or triad, borne at the apex of the seasonal growth unit. *Hypanthium* 17–18 mm broad, extending as a saucer around the ovary, with (4–) 5 distinct depressions (vesicles) opposite the petals. *Petals* 5, red, 7–10.5 mm long and up to 8 mm wide, finely pubescent, the margins ciliate. *Sepals* broadly triangular, 3–3.5 mm long. *Stamens* up to 25 mm long, in a continuous whorl around the rim of the hypanthium but drawn in towards the base of the ovary at the sides of the vesicles. *Ovary* almost superior, 3- to 5-locular, densely covered with hairs about 1 mm long. *Style* 15–20 mm long, terminal on the ovary; stigma not dilated, flat to convex. *Placentas* horizontal, bilaterally flattened. *Fruit* c. 15 mm in diameter; hypanthium everted under the capsule. *Seeds* not winged.

DISTRIBUTION: East coast of Cape York Peninsula, heath and low forest on sand dunes.

SELECTED SPECIMENS (2/9): QUEENSLAND: Cook District: Olive River, 12°10' S, 143°05' E, *Hyland* 7440, 7450 & 7474, 13.ix.1974 (QRS, UNSW); 3 km NW of Bolt Head, *Hind* 4562, 26.vii.1986 (NSW).

This is the only red-flowered species of *Xanthostemon* known in Australia. It has obvious affinities with *X. speciosus* Merr. from the Philippines (restricted to the continental Calamian-Palawan group) which also has a vesiculate hypanthium; the other red-flowered species, e.g. *X. ruber* from New Caledonia, *X. verdugonianus* from the Philippines, *X. novoguineensis* from New Guinea, and *X. confertiflorus* from Sulawesi, are not necessarily closely related either to *X. youngii* or to each other.

There have been occasional references to this species as '*X. youngiae*' (see, e.g., Lavarack & Godwin, 1987). There is no justification for this since the person after whom the species was named, J.E. Young, was a male.

Fruiting specimens of a plant resembling this species have been collected in similar communities near Cape Flattery; however, there are unconfirmed reports that this entity has yellow flowers.

2. *Xanthostemon formosus* Peter G. Wilson, sp. nov.

Arbor media, cortice squamoso. Folia juniora adultaque alterna, glabra, laminis plerumque 12–22 cm longis et 2–4.5 cm latis, chartaceis, acuminatis. Flores flavovirentes, petalis suborbicularis 1.5–1.8 cm latis, hypanthio vesiculato, ovario glabro, placentis horizontalibus. Capsula minute verrucosa; semina non alata.

HOLOTYPE: QUEENSLAND: Cook District: Portion 49V, Portion of Alexandra, Cooper Creek, 16°10' S, 145°25' E, *Gray* 3366, 26.iv.1984 (NSW). ISOTYPES: QRS, BRI.

Tree to 18 m tall and 30 cm d.b.h., with grey flaky bark. *Leaves* alternate in both juvenile and adult plants; petiole 0.5–1.5 cm long, becoming swollen at the base; lamina narrowly elliptical to oblanceolate, (9–)12–22 cm long and

2–4.5 cm broad, acuminate, glabrous, discolorous, chartaceous, midvein sunken above, prominent below, lateral veins and intramarginal vein conspicuous; oil glands numerous. *Inflorescence* an aggregation of monads at the apex of the shoot, subtended by reduced foliage leaves. *Hypanthium* 1.5–2 cm broad, saucer-like but with 5 distinct depressions (vesicles) opposite the petals. *Petals* 5, greenish yellow, suborbicular, 1.5–1.8 cm in diameter, glabrous, the margin irregular. *Sepals* yellowish, triangular to oblong, 0.7–1.0 cm long and 0.4–0.7 cm broad. *Stamens* c. 25, in a single series around the rim of the hypanthium, filaments 2–2.5 cm long. *Ovary* almost superior, (2- to) 3-locular, glabrous. *Style* 1.5–2.5 cm long, terminal on the ovary, persistent; stigma not dilated, flat to slightly convex. *Placentas* horizontal, bilaterally flattened. *Fruit* 1.5–2 cm in diameter, the surface minutely verrucose; hypanthium everted under the capsule. *Seeds* not winged. (Fig. 2)

DISTRIBUTION: Known only from the area around Cooper Creek (between Noah Creek and the Daintree River) where it occurs in rainforest along the creek.

SELECTED SPECIMENS (2/8): QUEENSLAND: Cook District: Cooper Creek, Gray 3345, 14.iii.1984 (QRS); *Sankowsky* 574, 16.xii.1986 (NSW).

This remarkable species is the first one known to have both a vesiculate hypanthium and yellow flowers. Apart from the vesiculate hypanthium it does not particularly resemble *X. youngii*; the leaves are chartaceous rather than coriaceous, acuminate rather than acute to obtuse, the ovary is glabrous rather than densely pubescent, the capsule minutely verrucose rather than \pm smooth and the style is markedly persistent. It can easily be distinguished from all other Australian yellow- or white-flowered species by the vesiculate hypanthium and the much larger perianth segments.

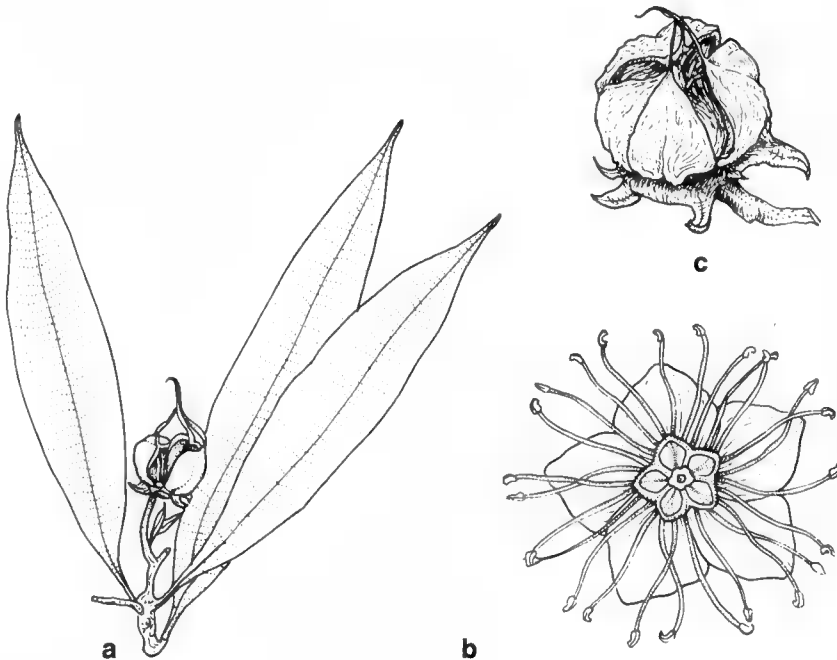


Fig. 2. *Xanthostemon formosus* Peter G. Wilson. a habit (x 0.4). b flower (x 0.8). c fruit (x 1.2). (a, c from Gray 4340; b from Gray 3366).

3. *Xanthostemon verticillatus* (C. White & Francis) L.S. Smith, Proc. Roy. Soc. Queensland 67: 38 (1955).

BASIONYM: *Metrosideros verticillata* C. White & Francis, Queensland Dept. Agric. Bot. Bull. 22: 24 (1920).

HOLOTYPE: QUEENSLAND: 'Bloomfield River', W. Poland AQ 342056, xi.1902 (BRI 36326, 36327).

Tree with tessellated, flaky bark; branchlets show sympodial growth, apparently due to regular abortion of the apical buds after flowering. *Leaves* mostly in apparent whorls of (3-)4(-5); petiole 0.5-0.8 cm long; lamina narrowly oblanceolate 4-9 cm long and (0.5-)0.8-1.3 cm broad, obtuse or sometimes mucronate at the apex, decurrent to the rather short petiole; oil glands numerous, oil yellow to orange. *Inflorescence* axillary triads, glabrous except for a faint pubescence on the sepals and petals; peduncles flattened or angular, 8-16 mm long; pedicels slender, 8-14 mm long. *Hypanthium* cup-shaped, contracted at the orifice, 5-7 mm in diameter, exceeding the top of the ovary. *Petals* 5, cream, ovate-orbicular, 5-7 mm long. *Sepals* triangular, 2-3.5 mm long. *Stamens* numerous, 2-2.5 cm long. *Ovary* almost superior, 3- to 4-locular, glabrous. *Style* longer than the stamens, 2.5-3.5 cm long, inserted in a depression in the ovary summit; stigma not dilated. *Placentas* horizontal with the ovules arranged in a complete ring. *Fruit* woody, 10-11 mm in diameter, with a distinct depression in the centre, hypanthium enclosing the basal part of the fruit and somewhat constricting it. *Seeds* not winged.

DISTRIBUTION: The only precisely known locality is the Daintree Logging Area where the species is a rheophyte in rainforest.

SPECIMEN EXAMINED: QUEENSLAND: Cook District: T.R. 165, Daintree L.A., 16°09' S, 145°17' E, Hyland 3920 RFK, 29.x.1978 (NSW, QRS).

The type collection consists of four elements, now mounted on two sheets at BRI. The protologue was accompanied by a photograph of one element (left hand specimen on sheet BRI 36327). Since these specimens are clearly all from one gathering and all were in the possession of the authors when the description was drawn up, I have treated the entire collection as holotype.

B. Hyland (pers. comm.) has not found this species in the Bloomfield River area; the type 'locality' given is probably a reference only to the Rev. W. Poland's address.

The collector's notes on the recent collection state that the flowers have 'a distinct odour of freshly cut purple passionfruit skin'. The species is the only *Xanthostemon* known to have verticillate leaves.

4. *Xanthostemon oppositifolius* F.M. Bailey, Cat. Indig. Nat. Pl. Queensland: 109 (1890), Queensland Fl. 2: 642 (1900); Gugerli, Repert. Spec. Nov. Regni Veg., Beih. 120: 58 (1940); W.D. Francis, Australian Rain-Forest Trees, edn 2: 329 (1951).

HOLOTYPE: QUEENSLAND: Noosa, A. F. Luya AQ 316328 (BRI).

Tall tree, to c. 40 m with scaly bark that is shed in flakes; young shoots and inflorescences very finely hairy. *Leaves* opposite (occasionally subopposite) in the adult; petiole 0.5-1.5 cm long; lamina ovate to elliptical or broadly lanceolate, 4-9(-11) cm long and (1.5-)2.5-5.5 cm broad, often shortly attenuate at the base, obtuse to rounded at the apex, coriaceous, veins prominent in dried specimens. *Inflorescence* an axillary triad, botryoid or metabotryoid;

flowers 3–9(–11) per inflorescence, white; peduncles 2–4 cm long; pedicels 1–2 cm long. *Hypanthium* 5–7 mm in diameter, dish-shaped with its rim approximately at the level of the ovary summit. *Petals* (4–)5, orbicular, 4–6 mm long. *Sepals* deltoid to oblong, 2–5 mm long, 2.5–3.5 mm broad. *Stamens* numerous, 8–10 mm long. Ovary more than half superior, 3- or 4- (rarely 2-) locular, densely covered with very short, pale hairs. *Style* about 10 mm long, inserted in a depression on the ovary summit; stigma narrower than the style. *Placentas* sub-central, arms slightly ascending, projecting into the centre of the loculus; the ovules forming a complete ring. *Fruit* woody, broadly ovoid, 10–13 mm in diameter; hypanthium enclosing the base of the fruit. *Seeds* not winged.

DISTRIBUTION: South-eastern Queensland, between Maryborough and Nambour, in rainforest.

SELECTED SPECIMENS (2/16): QUEENSLAND: Wide Bay District: Kaurivale, *Hyland 6675*, 23.i.1973 (QRS); 1.9 km along Bates Road from the Kin Kin road, *Beesley 955A & Ollerenshaw*, 10.xii.1986 (CBG, MEL, NSW).

5. *Xanthostemon xerophilus* Peter G. Wilson, sp. nov.

Arbor cortice cinereo, rugosissimo. Folia juvenilia alterna, adulta opposita et decussata, laminiis 6–11 cm longis et 2.5–5.5 cm latis, coriaceis, punctis glandulosis aurantiacis. Inflorescentia axillaris, botryoidalis. Flores luteoli, hypanthio late cupulato, staminibus numerosis, uniseriatis sed ante petala biseriatis, ovario glabro, placenta horizontali. Capsula globosa, brunneola-armeniaca, 1.0–1.4 cm diametro, 3–4-locularis; semina non alata.

HOLOTYPE: QUEENSLAND: Cook District: ca 45 miles S of Cape York, 11° 19'S, 142° 25'E, *Pedley 2737*, 27.vi.1968 (NSW). **ISOTYPE:** BRI.

Tree to 16 m tall with grey, hard, very rugose, somewhat tessellated bark; the young stems angular and yellowish tomentose. *Leaves* of juvenile plants alternate, of adults opposite and decussate, rarely subopposite; petiole 0.5–1.8 cm long; lamina broadly obovate to oblong-elliptical (4.5–)6–9(–11) cm long, 2.5–5.5 cm broad, margin undulate and the apex obtuse or shortly acuminate, discolorous, coriaceous, glabrous; midvein concave above, prominent below, venation reticulate, prominent below; oil glands numerous, oil orange. *Inflorescence* axillary, a 7–11-flowered botryoid, pedicels 1.2–1.7 cm long, peduncles covered in a fine, golden-brown tomentum. *Hypanthium* broad-cupulate, 5–7 mm in diameter, the rim extending beyond the top of the ovary. *Petals* 5, pale yellow, ovate, 4–5 mm long, 4–6 mm broad. *Sepals* 5, 2–2.5 mm long, deltoid to oblong, sparsely pubescent. *Stamens* numerous, 1.5–2 cm long, uniseriate (biserial opposite the petals). *Ovary* 3–4-locular, half inferior, glabrous. *Style* 2–2.5 cm long, inserted in a depression on the ovary summit. *Placentas* rod-like, terete, horizontal, reaching the ovary wall and bearing numerous ovules in an uninterrupted whorl on the margin of the slightly dilated apex. *Fruit* brownish orange when ripe, globose, 1.0–1.4 cm in diameter; hypanthium everted or partly enclosing the base of the fruit. *Seeds* not winged, 4–5 mm long. (Fig. 3)

DISTRIBUTION: Cape York Peninsula, north and south of the Jardine River in layered open forest with *Eucalyptus tetradonta* and *E. nesophila* (community 2b of Pedley & Isbell (1971); 5b of Lavarack & Stanton (1977)).

SELECTED SPECIMENS (3/12): QUEENSLAND: Cook District: Jardine River, *Brass 18901*, 21.v.1948 (CANB); 16 km S. Jardine R., *Wilson & Waterhouse UNSW 2734, 2735*, 5.x.1973 (NSW, UNSW).

Early specimens of this species were distributed as *Metrosideros* sp. aff. *tetrapetala* (i.e. *X. umbrosus*) to which it is superficially similar. Lavarack and Stanton (1977) erroneously refer this species to *X. paradoxus*.

The epithet refers to the preference shown by this species for the drier, open forest in contrast to the other Cape York species which usually occur in moister coastal or riparian situations.

6. *Xanthostemon chrysanthus* (F. Muell.) Benth., Fl. Austral. 3: 268 (1867); F.M.Bailey, Queensland Flora 2: 641 (1900); Gugerli, Repert. Spec. Nov. Regni Veg., Beih. 120: 79 (1940).

BASIONYM: *Metrosideros chrysantha* F. Muell., Fragm. 4: 159 (1864).

LECTOTYPE (here designated): QUEENSLAND: Rockingham Bay, *Dallachy*, 12.iv.1864 (MEL 63325).

SYNONYM: *Nani chrysantha* (F. Muell.) O. Kuntze, Rev. Gen. Pl. 1: 242 (1891) as 'Nania'.

Tall tree with fairly smooth, hard, grey bark, decorticating in hard scales or strips; twigs and shoots usually sparingly pubescent or glabrous. *Leaves* alternate in both juvenile and adult plants; petiole short, up to 1 cm long; lamina lanceolate to oblanceolate, (7-)10-15(-20) cm long and (2-)3-4.5(-7) cm broad, acute, chartaceous to coriaceous; oil glands sometimes containing red oil. *Inflorescence* axillary, a monad, triad or, sometimes, a metabotryoid, borne at the apex of the seasonal growth unit. *Hypanthium* cup-shaped, c. 5 mm broad, extending well beyond the ovary summit. *Petals* 4-5, yellow, ovate to orbicular, 7-9 mm long. *Sepals* yellowish, triangular, 3-3.5 mm long. *Stamens* numerous,

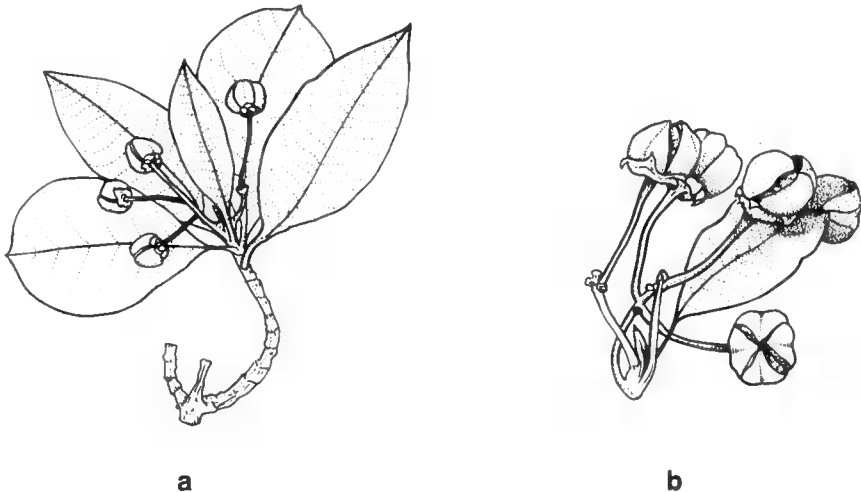


Fig. 3. *Xanthostemon xerophilus* Peter G. Wilson. **a** habit (x 0.4). **b** fruit (x 0.8). (**a** from Benson 576; **b** from UNSW 2735).

in one whorl, (15-)20-30 mm long. *Ovary* nearly superior, (2-)3(-4)-locular. *Style* (25-)30-40 mm long as long as or longer than the stamens, terminal or inserted in a shallow depression on the ovary summit, the base persistent; stigma small, convex. *Placentas* horizontal. *Fruit* 9-15 mm in diameter; hypanthium usually enclosing basal $\frac{1}{3}$ - $\frac{1}{2}$ of the fruit. *Seeds* not winged.

DISTRIBUTION: Coastal Queensland, between 12° S and 19° S, mostly in riparian forest.

SELECTED SPECIMENS (6/56): QUEENSLAND: Cook District: Junie Ck, *Dockrill* 571, 14.x.1972 (BRI, QRS); Shiptons Flat, *Brass* 20202, 12.ix.1948 (BRI, CANB); Cooper Ck, *Hyland* 5995, 11.iv.1972 (BRI, QRS); S.F.R. 756, Downey Ck, *Hyland* 5603, 1.xi.1971 (BRI, QRS, UNSW). North Kennedy District: Murray Falls, c. 23 km SW Euramo, *Boylard & Gillieat* 637, 29.xi.1967 (BRI); Wallaman Falls, *Vessey* 154, 14.ix.1963 (BRI).

7. *Xanthostemon paradoxus* F. Muell., Hooker's J. Bot. Kew Gard. Misc. 9: 17 (1857), Fragm. 1: 80 (1859); Bentham, Fl. Austral. 3: 269 (1867); Gugerli, Repert. Spec. Nov. Regni Veg., Beih. 120: 81(1940).

LECTOTYPE (here designated): NORTHERN TERRITORY: Sea Range, Victoria River, *F. Mueller* xii.1855 (MEL 63369).

SYNONYMS: *Metrosideros paradoxa* (F. Muell.) F. Muell., Fragm. 1: 243 (1859).

Nani paradoxa (F. Muell.) O. Kuntze, Rev. Gen. Pl. 1: 242 (1891) as 'Nania'.

Tree with thick, grey, persistent, rugose bark; branchlets and twigs pubescent to glabrous. *Leaves* alternate in both juvenile and adult plants; lamina elliptical, 5-16(-18) cm long and 3-6(-7) cm broad, obtuse, pubescent or glabrescent. *Inflorescence* axillary, a triad or metabotryoid, borne at the end of the seasonal growth unit, often aggregated as a pseudoterminal cyme. *Hypanthium* cup-shaped, 4-6 mm in diameter, exceeding the top of the ovary. *Petals* 5, elliptical, c. 5 mm long, yellow. *Stamens* in one whorl, yellow, rigid, 17-25 mm long. *Ovary* almost superior, 2-3- (rarely 4-) locular. *Style* 20-40 mm long, extending approximately as far as the ends of the stamens, inserted in a shallow depression on the ovary summit; stigma narrower than the style, convex. *Placentas* horizontal. *Fruit* 8-14 mm in diameter; hypanthium flattened under the fruit. *Seeds* not winged.

DISTRIBUTION: Kimberley Division of Western Australia and the Northern Territory; in savannah woodland or on rocky hills.

SELECTED SPECIMENS (9/116): WESTERN AUSTRALIA: Kimberley Division: Kalumburu, *Maconochie* 1253, 30.v.1971 (BRI, CANB, NT, PERTH); Marigui Promontary, *Kenneally* 2164, 27.viii.1974 (PERTH); 26 km E. Kununurra, *Beard* 4296, 3.vi.1965 (NSW, PERTH). NORTHERN TERRITORY: 47 miles (c. 76 km) N. Oenpelli, *Chippendale*, 16.vii.1961 (AD, BRI, CANB, MEL, NSW, NT); Nourlangie Rock, *Schodde* AE24, 3.v.1972 (CANB, DNA, NT); 6 miles (c. 9.7 km) S. Adelaide River, *Lazarides* 6967, 6.xii.1963 (BRI, CANB, NSW, NT); 23 miles (c. 37 km) NE. 'Tipperary', *Lazarides* 6690, 28.vii.1961 (AD, BRI, CANB, NSW, NT); Silver Mine Ck, Daly R. road, *Byrnes* 11, 3.xi.1966 (AD, NT); near Alligator Springs, 70 miles (c. 113 km) E. 'Carlton Hill', *Perry* 2614, 27.vii.1949 (AD, BRI, CANB, NSW, NT).

Herbarium specimens show a wide range of variation but detailed field observations, particularly in the Northern Territory, are required before a satisfactory taxonomic resolution can be achieved. Amongst the Australian populations, at least three distinct groups are discernible: (1) specimens collected on or around rocky outcrops have pubescent leaves 5-11 cm long, thin-walled pale brown fruits 0.8-1 cm in diameter with the style usually set slightly into the top, and pale yellow semi-persistent stamens; (2) specimens collected

in savannah woodland have glabrous to pubescent leaves 8–16 cm long, red-brown fruits 1.1–1.4 cm in diameter with the style terminal on the summit, and dark yellow deciduous stamens; and (3) specimens from low open woodland are similar to form 2 but always have tomentose leaves and fruit with a tardily dehiscent, heavily thickened pericarp markedly adnate to the remnants of the hypanthium. The limits of these ‘forms’ are unknown and there are still other specimens, from scattered localities, which are different again from any of these (e.g. *Webb & Tracey 13194* from Melville Island, *Webb & Tracey 12480A* from Katherine River, and *Barnett & Azzopardi 4* from Mt Brockman); these also need to be investigated.

In choosing a lectotype I have followed Merrill (1952: 155) who accepted the only collection available to him as typical but did not formally designate a specimen as type. The protologue was based on two different collections and Merrill had access to only one of these, a plant with “distinctly pubescent leaves, and densely cinereous-pubescent inflorescences” (specimens at K and G). Merrill described the savannah woodland populations from New Guinea, previously identified as *X. paradoxus*, as the new species *X. brassii*; this taxon is closely related to *X. paradoxus* but is specifically distinct in habit, flowering phenology and indumentum.

8. *Xanthostemon whitei* Gugerli, Repert. Spec. Nov. Regni Veg., Beih. 120: 83 (1940) as ‘whitii’; Merrill, J. Arnold Arbor. 33: 154 (1952).

SYNONYM: *Xanthostemon pubescens* C. White, Proc. Roy. Soc. Queensland 29: 57 (1917), *nom. illeg., non* Pampaloni, Nuovo Giorn. Bot. Ital. II, 13: 128 (1906).

HOLOTYPE: QUEENSLAND: Mazlins Creek, Herberton District, *J.F. Bailey AQ 316314* (BRI). ISOTYPE: MEL.

Tree up to 40 m tall with grey scaly bark; branchlets, inflorescences and under-surfaces of the leaves covered with a dense yellow-brown indumentum. *Leaves* alternate in the juvenile, alternate or sometimes opposite on some branchlets in the adult; petiole 1–2 cm long; lamina lanceolate, 7–16(–19) cm long and 3–5(–7.5) cm wide. *Inflorescence* an axillary triad, botryoid or metabotryoid. *Hypanthium* cup-shaped, 5–7 mm in diameter, extending beyond the top of the ovary. *Petals* (4–)5, elliptical, 4–5 mm long, creamy yellow. *Sepals* (4–)5, triangular to oblong, 3–4 mm long. *Stamens* yellow, numerous, in one whorl, 15–25 mm long. *Ovary* half inferior, 3- to 4-locular, glabrescent. *Style* 20–30 mm long, inserted in a depression on the ovary summit; stigma small, much narrower than the style. *Placenta* horizontal. *Fruit* 1–1.5 cm in diameter; hypanthium enclosing the base of the fruit. *Seeds* not winged.

DISTRIBUTION: North Queensland, Atherton Tableland region, in closed forest communities on basaltic red earths, on brown and yellow earths or on volcanic alluvium (Tracey 1982).

SELECTED SPECIMENS (2/22): QUEENSLAND: Cook District: S.F.R. 191, Barron L.A., *Hyland 6002*, 18.iv.1972 (BRI, QRS); Mena Creek, Paronella Park, *Smith 3711A*, 5.viii.1948 (BRI).

9. *Xanthostemon umbrosus* (A. Cunn. ex Lindl.) Peter G. Wilson & Waterhouse, Austral. J. Bot. 30: 444 (1982).

BASIONYM: *Tristania umbrosa* A. Cunn. ex Lindl., Bot. Reg. sub t.1839 (1836); Bentham, Fl. Austral. 3: 265 (1867).

HOLOTYPE: WESTERN AUSTRALIA: Shores of York Sound, *A. Cunningham* 16.ix.1820 (CGE). ISOTYPES: BM, K.

SYNONYMS: *Metrosideros tetrapetala* F. Muell., *Fragm.* 7: 41 (1869).

LECTOTYPE (here designated): QUEENSLAND: Cave Creek, Gilbert River, Daintree. (MEL 63313, left hand element).

Nani tetrapetala (F. Muell.) O. Kuntze, *Rev. Gen. Pl.* 1: 242 (1891) as 'Nania'.

Tree with grey, scaly bark. *Leaves* alternate in juvenile plants, opposite in adults; petiole 0.8–1.5 cm long; lamina elliptical, 5–8 cm long and 2–4.5 cm broad, obtuse, emarginate or mucronate. *Inflorescence* axillary, a cyme or botryoid; flowers usually 3–7 per inflorescence. *Hypanthium* 5.5–7 mm in diameter, a shallow dish with its rim at, or slightly below, the level of the ovary summit. *Petals* 4, rarely 5, cream, elliptical, 4–6 mm long and 3–4 mm broad. *Sepals* triangular, 2–4 mm long. *Stamens* numerous, 10–13 mm long, in 1–2 whorls (1 whorl opposite the sepals, 2 opposite the petals), filaments 2.5–6.0 mm long. *Ovary* half inferior, 3–4-locular. *Style* equal to or longer than the stamens, inserted in a depression on the ovary summit; stigma small, convex. *Placentas* axile, oblique, laterally flattened, bearing c. 14 ovules in an incomplete ring. *Fruit* globular, woody, 8–12 mm in diameter, dehiscence lines much paler than the red-brown fruit; hypanthium flat to everted under the fruit; sepals persistent, prominent. *Seeds* not winged.

DISTRIBUTION: Northern Australia, from Cape York Peninsula across to the Kimberley region of Western Australia.

SELECTED SPECIMENS (6/34): WESTERN AUSTRALIA: Kimberley Division: Upper reaches of Hunter R., *Kenneally* 8966, 9.vi.1984 (NSW, PERTH). NORTHERN TERRITORY: 8 miles (c. 13 km) SE. East Alligator R. crossing, *Byrnes* 1953, 29.vii.1970 (DNA, NT); Groote Eylandt, *Levitt*, 10.iii.1973, iv.1973 (BRI, DNA). QUEENSLAND: Cook District: Olive River, *Hyland* 3070 RFK, 13.ix.1975 (NSW, QRS); Tozers Gap, Tozer Range, *Brass* 19416, 2.vii.1948 (BRI, CANB, K); Gugu Yulangi main camp, *Hyland* 8082, 8.iii.1975 (NSW, QRS, UNSW).

The species has only recently been re-collected (vegetative material only) from the region where Cunningham collected the type. It is still poorly known throughout its range, and very few flowering specimens exist. The specimens show a great deal of variation, particularly in leaf shape, fruit size and habitat, and may represent more than one taxon. I am maintaining it as a single variable taxon until a fuller range of material is available.

This species (or species complex) is not closely related to any other Australian species; it is clearly distinct in having the obliquely inserted placenta. The nearest allies to this taxon are *Xanthostemon* sp. ("kasi kasi") from New Guinea and *X. petiolatus* from Sulawesi (described from a tree being grown at Bogor from seed supposedly originating in Java, but the species is not known from there).

10. *Xanthostemon psidioides* (*A. Cunn. ex Lindl.*) Peter G. Wilson & Waterhouse, *Austral. J. Bot.* 30: 444 (1982).

BASIONYM: *Tristania psidioides* A. Cunn. ex Lindl., *Bot. Reg. sub t.*1839 (1836); Bentham, *Fl. Austral.* 3: 264 (1867).

HOLOTYPE: WESTERN AUSTRALIA: Ravines of Regent River, Brunswick Bay, *A. Cunningham*, 10.x.1820 (CGE; not seen). ?ISOTYPE: K (dated ix.1820).

Small tree, up to 8 (rarely to 15) m tall, with dark, grey-black, tessellated bark; young stems and leaves covered with a golden brown indumentum, becoming

grey with age. *Leaves* alternate in both juvenile and adult plants; petiole (0.7–) 1.0–1.8 cm long; lamina elliptical, (3.5–)4.5–9.0(–11.5) cm long by (1.5–) 2.0–4.0(–5.8) cm broad, apex obtuse and rounded to acute; oil glands obscure. *Inflorescence* an axillary panicle or metabotryoid, branching disjunct opposite; peduncle 2–3 cm long; pedicels and floral parts finely pubescent. *Hypanthium* broad and shallow, 5–6 mm in diameter, extending like a saucer around the ovary. *Petals* 5, cream, ovate to orbicular, 3–4 mm long. *Sepals* (narrowly) triangular, 2–3 mm long, persistent. *Stamens* numerous, in one whorl, slightly interrupted in front of each sepal, 8–12 mm long. *Ovary* almost superior, 3-locular, tomentose. *Style* approximately as long as the stamens; stigma convex. *Placentas* upright, ovules attached near the apex. *Fruit* small, grey-tomentose, 6–7 mm in diameter; hypanthium enclosing basal $\frac{1}{4}$ of the fruit. *Seeds* not winged.

DISTRIBUTION: Disjunct between the Kimberley region of Western Australia and the Arnhem Land escarpment of the Northern Territory.

SELECTED SPECIMENS (6/22): WESTERN AUSTRALIA: Kimberley Division: Marigui Promontory, Brunswick Bay, *Kenneally* 2148, 27.viii.1974 (PERTH); Sale R., *Kenneally* 9675, 16.v.1986 (NSW, PERTH). NORTHERN TERRITORY: Wessell Islands, *Latz* 3474, 12.x.1972 (BRI, CANB, NT); c. 9 km NE. Jabiru, *Adams & Richardson* 3037, 19.ii.1973 (CANB, NSW); Deaf Adder Gorge, *Fox* 2522, 22.ii.1977 (DNA, CANB, MEL, NSW, NT); Koolpin Creek, *Dunlop* 4278, 29.ix.1976 (DNA, NSW).

11. *Xanthostemon graniticus* Peter G. Wilson, sp. nov.

Arbor parva vel media, cortice tessellato. Folia juniora indumento cinnamomeo mox supra glabrescentia, adulta alterna, laminis plerumque 7–18 cm longis et 4–10 cm latis, rigido-coriaceis, rugosis. Inflorescentia axillaris, metabotryoidalis. Flores cremei, hypanthio 7.8–8.0 mm diametro, ovario indumento cinnamomeo, placenta plus minusve erecta. Capsula 7–9 mm diametro; semina non alata.

HOLOTYPE: QUEENSLAND: Cook District: head of Roaring Meg Creek, 16°07' S, 145°24' E, *M. Godwin* C2826, 2.iii.1985 (NSW). **ISOTYPES:** BRI, QRS.

Tree to 13 m tall with dark brown flaky bark. *Leaves* alternate in adult plants; petiole 1–2.5 cm long; lamina elliptical, 7–18(–22) cm long and (3–)4–10(–12) cm broad, stiffly coriaceous, apex acute to shortly acuminate, indumentum pale red-brown to greyish when young, soon glabrescent above, becoming greyer and sparser below; midvein and main lateral veins sunken giving the lamina a rugose appearance, margins recurved; oil glands numerous. *Inflorescence* a metabotryoid, axillary, branching opposite to disjunct opposite; peduncle 2–3 cm long. *Hypanthium* broad and shallow (dish-like), 7–8 mm in diameter, the rim exceeding the ovary summit. *Petals* 5, cream, ovate to orbicular, 4.0–4.4 mm long and 3.8–4.0 mm wide, containing numerous oil glands, pubescent on the outer surface. *Sepals* 5, triangular, 2.8–3.2 mm long and 1.9–2.7 mm wide, pubescent on the outer surface. *Stamens* numerous, (5–)7–10 mm long, uniseriate, filaments free, anthers dorsifixed, the point of attachment enclosed by the broad connective which has a large gland at the apex and 1–3 smaller glands on each side. *Ovary* half inferior, (2–)3-locular, covered with a short, dense, reddish brown indumentum. *Style* up to 12 mm long, inserted in a depression in the ovary summit; stigma narrower than the style, flat. *Placentas* upright; ovules c. 10 per loculus, attached near the apex. *Fruit* depressed-globular, 7–9 mm in diameter, grey-tomentose; hypanthium enclosing the base of the fruit. *Seeds* not winged, c. 4 mm long. (Fig. 4)

DISTRIBUTION: Known so far from only three localities in the vicinity of Mount Pieter Botte, inland from Cape Tribulation, Queensland; it grows in open areas of mossy Araucarian-notophyll vine forest on creek banks in peaty soil on granite.

This species is most closely related to *Xanthostemon psidioides* from the Northern Territory and Western Australia. It differs from that species in its cinnamon-coloured indumentum and its rugose and coriaceous leaves. These two species constitute a distinct group which has no close affinities with any other Australian species; possible links with Malesian species have yet to be investigated.

As far as can be ascertained, the species is unique in the genus in its ecology; no other is recorded as growing on granite rocks.

12. *Xanthostemon eucalyptoides* F. Muell., Fragm. 1: 81 (1859).

LECTOTYPE (here designated): NORTHERN TERRITORY: Fitzmaurice River, *F. Mueller*, x.1855. (MEL 63296).

SYNONYMS: *Metrosideros eucalyptoides* (F. Muell.) F. Muell., Fragm. 1: 243 (1859); Bentham, Fl. Austral. 3: 267 (1867).

Nani eucalyptoides (F. Muell.) O. Kuntze, Rev. Gen. Pl. 1: 242 (1891) as 'Nania eucalyptodes'.

Tree up to 18 m tall with persistent, grey, fine-textured bark; young stems quadrangular. *Leaves* alternate in juvenile plants; opposite in adults; sessile or subsessile, petiole up to 0.2 cm long; lamina elliptical-oblong, somewhat

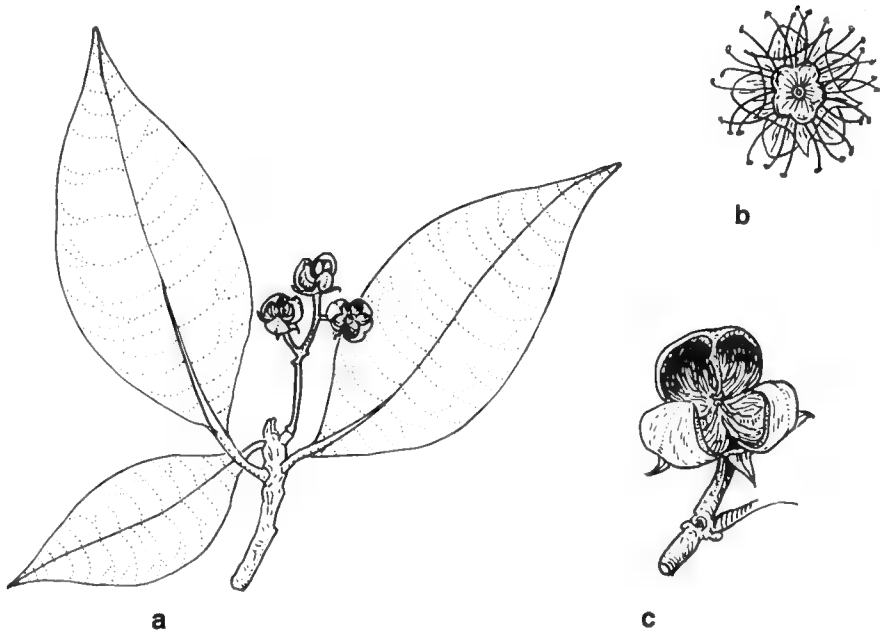


Fig. 4. *Xanthostemon graniticus* Peter G. Wilson. a habit (x 0.5). b flower (x 1). c fruit (x 2). (a, c from Godwin C2574; b from Godwin C2826).

cordate, mostly 5–12 cm long and 3–7 cm broad, obtuse, glabrous. *Inflorescence* an axillary panicle or metabotryoid with opposite branching, covered with a very fine indumentum; peduncles quadrangular; flowers numerous, c. 21 per inflorescence. *Hypanthium* broad and shallow, 4–5.5 mm in diameter. *Petals* 4(–5), linear to spatulate, 3–3.5 mm long and 1–1.5 mm broad, cream. *Sepals* linear, 2–2.5 mm long and 0.5 mm broad. *Stamens* numerous, in 1–2 whorls, 4.5–8.5 mm long. *Ovary* almost superior, (2–)3–4-locular. *Style* longer than the stamens, about 10 mm long, inserted in a depression on the ovary summit; stigma narrow, flat to convex. *Placentas* upright, ovules 8–10 per loculus, attached mid-way up the placenta. *Fruit* thin-walled, ovoid, about 6 mm in diameter; hypanthium everted under the fruit. *Seeds* winged; wing distal to the raphe.

DISTRIBUTION: Northern Territory and Western Australia in higher rainfall areas; almost always found near streams, on swampy ground, or on ground subject to seasonal inundation.

SELECTED SPECIMENS (4/30): WESTERN AUSTRALIA: Kimberley Division: Surveyor Falls, Mitchell Plateau, *George 13131*, 18.i.1975 (PERTH). NORTHERN TERRITORY: Oenpelli, *Specht 1244*, 22.x.1948 (AD, BRI, CANB, MEL, NSW); George Ck., Stuart Highway, *Byrnes 541*, 5.x.1967 (AD, DNA, NT); UDP Falls, *Martensz AE 533*, 24.i.1973 (BRI, CANB, NSW).

13. *Xanthostemon crenulatus* C. White, J. Arnold Arbor. 23: 82 (1942); Merrill, J. Arnold Arbor. 33: 156 (1952).

HOLOTYPE: PAPUA: Gaima, Lower Fly River, *Brass 8358*, xi.1936 (BRI).

Tree 10–20 m tall; bark grey, thick, the surface breaking up into corky flakes; young stems flattened, glabrous. *Leaves* opposite in the adult; petiole 1–1.5 cm long; lamina elliptical-oblong, 9–17 cm long and 6–11 cm broad, obtuse, emarginate or mucronate, margins crenulate. *Inflorescence* usually an axillary metabotryoid or panicle with opposite branching, covered with a fine indumentum; peduncle flattened; flowers numerous, c. 15 per inflorescence. *Hypanthium* broad and saucer-shaped, 4.5–6.5 mm in diameter. *Petals* 4(–5), cream, spatulate, 3.5–4.5 mm long and 2 mm broad. *Sepals* oblong, 2–2.5 mm long and 1–1.5 mm broad. *Stamens* numerous, 2.5–8 mm long, in (1–)2 whorls slightly interrupted opposite the sepals. *Ovary* almost superior, 3–4-locular. *Style* longer than the stamens, 8–10 mm long, inserted in a depression on the ovary summit; stigma convex. *Placentas* upright, ovules 9–11 per loculus, attached mid-way up the placenta. *Fruit* thin-walled, broadly ovate, about 7 mm in diameter; hypanthium flat to everted under the fruit. *Seeds* winged, wing distal to the raphe.

DISTRIBUTION: South-western Papua, and Cape York Peninsula as far south as the Cooktown area, common in forest adjacent to watercourses.

SELECTED SPECIMENS (4/31): PAPUA NEW GUINEA: Western District: near Morehead Patrol Post, *Pullen 7198*, 30.viii.1967 (BRI, CANB, LAE). QUEENSLAND: Cook District: Galloway Ck., Bamaga district, *Webb & Tracey 6047*, 4.v.1962 (BRI); Iron Range, *Brass 19140*, 11.vi.1948 (BRI, CANB); Muck R., Bathurst Bay, *Hyland 6304*, 27.vii.1972 (QRS).

This species is very closely related to *X. eucalyptoides* from which it differs in bark, leaf shape and petiole length. The two species are geographically isolated.

Excluded Australian binomials

X. brachyandrus C. White, Proc. Roy. Soc. Queensland 53: 219 (1942) = *Lindsayomyrtus brachyandrus* Hyland & Steen., Blumea 21: 189 (1973).

X. pachyspermus F. Muell. & F.M. Bailey, Occas. Pap. Queensland Fl. 1: 4 (1886) = *Ristantia pachysperma* Peter G. Wilson & Waterhouse, Austral. J. Bot. 30: 443 (1982).

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This index lists specimens by collector's name and collecting number (or date of collection for unnumbered collections); the numbers in parentheses refer to the species in the text.

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Randall 1 (4); Richards 59 (7); Ridley 121 (7); Ridsdale NGF 33564 (13); Risley 592 (8); Risley 6 (6); Robinson s.n., 23.6.1964 (7); Robinson s.n., 4.2.1964 (7).

Sanderson 185 (8); Sanderson 764 (6); Sankowsky 570 (8); Sankowsky 574 (2); Schodde 4116 (6); Schodde AE 10 (12); Schodde AE 24, 69 (7); Smith, L. 3711a (8); Smith, L. 4745, 5001 (6); Smith, L. 10143 (8); Smith, L. 11871, 11920 (6); Smith, L. 12018, 12684 (13); Specht 1114 (7); Specht 1244 (12); Specht 1263 (7); Spencer s.n., 7.1911 (10); St. John 24263 (7); Stocker 643 (6); Stocker 657 (8); Stocker 787 (6); Stocker 937 (13); Stokes 27 (7); Story 7691, 7736, 8185 (7); Symon 10223 (7).

Tracey 14222, 14786, 14841 (9); Tracey 14845 (6).

Vessey 154 (6).

Webb 1624 (4); Webb 3119 (6); Webb & Tracey 6047 (13); Webb & Tracey 9093, 9603, 9629 (6); Webb & Tracey 12480A, 12725 (7); Webb & Tracey 13146 (10); Webb & Tracey 13194 (7); Webb & Tracey 13823 (1); Wheelwright 22 (7); White & Francis BRI 179789 (4); White & Francis BRI 181794 (4); Williams, K. 82024 (9); Wilson UNSW 2825, 3718 (6); Wilson UNSW 3731 (8); Wilson UNSW 3736 (6); Wilson UNSW 4011, 4012 (7); Wilson UNSW 4083, 4098 (12); Wilson UNSW 4198 (7); Wilson & Waterhouse UNSW 2622B (6); Wilson & Waterhouse UNSW 2724, 2734, 2735 (5); Wilson & Waterhouse UNSW 2736, 2743, 2745 (13); Wilson & Waterhouse UNSW 2767 (6); Wilson & Waterhouse UNSW 2782 (13); Wilson & Waterhouse UNSW 2788 (6); Wilson & Waterhouse UNSW 2789 (9); Wilson & Waterhouse UNSW 2799 (13); Wilson & Waterhouse UNSW 2821 (6); Wilson & Waterhouse UNSW 4006 (12); Wilson & Waterhouse UNSW 4015, 4020 (7); Wilson & Waterhouse UNSW 4036 (12); Wilson & Waterhouse UNSW 4046 (7); Wilson & Waterhouse UNSW 4052, 4055 (12); Wilson & Waterhouse UNSW 4066 (7); Wilson & Waterhouse UNSW 4075 (10); Wilson & Waterhouse UNSW 4089 (12); Wilson & Waterhouse UNSW 4093, 4094 (10); Wilson & Waterhouse UNSW 4100/1, 4178, 4179, 4193 (7); Wilson, B. QRS 69599 (5); Wilson, I.B. 220 (7); Wilson, Paul 10682, 10916, 11430 (7); Winters s.n., 8.1913 (7); Wrigley & Telford NQ 1487 (9); Wynn 61 (7).

Young BRI 25311 (1).

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Nomenclatural notes, new taxa and the systematic arrangement in the genus *Scaevola* (Goodeniaceae) including synonyms

Roger Carolin

Abstract

Carolin, Roger (John Ray Herbarium, University of Sydney, Australia 2006) 1990. Nomenclatural notes, new taxa and the systematic arrangement in the genus *Scaevola* (Goodeniaceae) including synonyms. *Telopea* 3(4):477–515. A cladistic analysis of the species of *Scaevola* has resulted in a rearrangement of the subgeneric taxa defined by Bentham (1868) and Krause (1912). Some of the previously recognised subgeneric divisions are shown to be unnatural and some are discarded. Sect. *Crossotoma* is united with sect. *Scaevola* (sect. *Sarcocarpa*); sect. *Xerocarpa* is redefined to include sect. *Pogonanthera* which is reduced to a subsection and from which a new subsection is separated, subsect. *Parvifoliae*. *Nigromnia* is reduced to a synonym of *Scaevola*. Fourteen new taxa are described: *S. acacioides*, *S. browniana*, *S. browniana* subsp. *grandior*, *S. chrysopogon*, *S. densifolia*, *S. eneabba*, *S. glutinosa*, *S. parvifolia* subsp. *acuminata*, *S. parvifolia* subsp. *pilbarae*, *S. pulchella*, *S. revoluta* var. *viscida*, *S. spicigera*, *S. tenuifolia*, *S. virgata*; three new combinations are made: *S. revoluta* subsp. *stenostachya*, *S. globosa* and *S. linearis* subsp. *confertifolia*.

Introduction

A previous contribution in this series of precursors to the Goodeniaceae treatment in the Flora of Australia has dealt with the classification and nomenclatural problems in the genus *Dampiera* (Rajput & Carolin 1988). A similar treatment of the genus *Scaevola* is now provided.

Scaevola is the only genus of Goodeniaceae which has a significant number of species endemic outside the continent of Australia. Most species are endemic to Australia but two are widespread tropical strand species and occur in the Indopacific area (*S. frutescens*) and in the Atlantic and south-west Indian Oceans (*S. plumieri*). In addition a number of species occur throughout the Pacific Islands, often in montane situations, particularly in New Caledonia and the Hawaiian group, one species is restricted to Socotra Island in the Indian Ocean and another to Hainan Island in China.

This contribution is divided into two sections. The phylogeny and systematic results are considered first since the characters used to distinguish between species in the descriptions are discussed in detail in relation to the cladistic analysis. The second section contains the descriptions of new taxa, nomenclatural notes and typifications.

Bentham (1868) and Krause (1912) provided subgeneric classifications closely resembling each other. Reassessments of these are now needed.

As in the previous contribution, a phylogenetic classification is attempted using cladistic techniques.

Phylogeny and classification

It is necessary first to consider the circumscription of the genus *Scaevola*. Carolin (1959) suggested that *S. helmsii*, *S. stenophylla*, and *S. fasciculata* should be excluded from *Scaevola*. There are clear characters which indicate a close relationship between these species and *Goodenia* sect. *Monochila*. These are: (i) the fusion of the sepals only by their midline to the ovary and, moreover, not to the top; (ii) the compressed seeds; (iii) the white corolla with purplish spots at the base of the lobes; (iv) the long stiff hairs in the throat of the corolla (similar, in fact, to those of *Coopernookia*) which are not inserted on barbulae or lacinations of the wing; and (v) the stiff patent hairs on the style. For these reasons these three species are excluded from this analysis. Previously they have been included in *Scaevola* because of their indehiscent fruits. This single character definition is clearly not satisfactory. When I described the genus *Nigromnia* (Carolin 1974), I suggested that it was closely related to some *Scaevola* species. I have included it in this analysis to test its distinctness.

The terminal taxa used in this analysis are listed in Appendix 1, together with their constituents. When these terminal taxa contain more than one species the constituent species do not differ in any of the characters used in the analysis.

The characters used in the analysis are listed and discussed below. Multistate coding is used where the transformation series is considered to be linear. When it is considered to be branched, additive coding is used.

The polarity of the character states is determined largely by outgroup comparison. Carolin (1977) has provided a higher order cladogram which indicates the outgroups to be *Nigromnia*, *Diaspasis* and *Coopernookia*. *Nigromnia* is probably a derivative of one of the groups within *Scaevola* (see below) and is therefore not an outgroup for the whole genus. *Diaspasis* has many specialized features which make it necessary to refer to *Coopernookia* to obtain the most parsimonious interpretations of polarities. In some cases it is necessary to refer to the outgroups of the clade containing *Coopernookia* to determine the most parsimonious polarisation. Where the outgroups are unequivocal in determining polarities no further comment is provided. The asterisk (*) indicates the primitive condition. The numbering of the characters is that given in the figures and a summary of the characters is given in Appendix 2.

1. Shrubs (and climbers): 0; undershrubs: 1*; multicaulate from a stock: 2.

2. Young parts not viscid: 0*; young parts viscid: 1.

When the young parts are viscid the older parts are often covered with a varnish which eventually cracks and fragments. The varnish is secreted by glandular hairs which are either peltate or pseudostellate (see below), although some species which have glandular hairs with globular heads are viscid without producing a varnish (e.g. *S. glutinosa*). The outgroups appear to be equivocal with regard to this character. *Diaspasis* is not viscid whereas one species of *Coopernookia*, *C. polygalacea*, is. However, this is only one species and, since the outgroup of the clade containing *Coopernookia* and *Scaevola* has no viscid species, the most parsimonious interpretation is that the lack of this character is primitive.

3. Stems not ribbed: 0*; stems ribbed: 1.

4. Cauline leaves normally developed: 0*; cauline leaves mostly reduced to triangular 'scales' less than 5 mm long: 1.

5. Leaves not stem-clasping at the base: 0*; leaves stem-clasping at the base: 1. Some species have clearly petiolate leaves, e.g. *S. crassifolia*, and others are just as clearly sessile, e.g. *S. linearis*. However, the gradations between these extremes are so gradual over the genus that it is impossible to draw a rational boundary between the two states. I have therefore not used this feature in this analysis. There is, however, a clear difference between stem-clasping and not stem-clasping.

6. Simple hairs present: 0*; simple hairs absent: 1.

These hairs generally differ from those found elsewhere in the family since they are papillate (Carolin 1970).

7 and 8. Glandular hairs absent: 00; glandular hairs with globular heads: 01*; glandular hairs peltate: 02; glandular hairs pseudostellate: 11. (See Fig. 1).

Carolin (1977) has suggested a transformation series for these hair types. It is suggested that the globular head type has given rise to the peltate type by shortening of the stalk and broadening of the head into a shield shape. The pseudostellate type, now seen to be much more widespread in the genus than previously reported (Carolin 1970), also developed from the globular head type by an extension of each of the cells in the head. Sometimes the stalk of the pseudostellate type is also reduced. All these hair types are known to secrete substances in some species although in others they may be inactive in this respect (Carolin, pers. obs.). The viscid nature of the plant is probably a

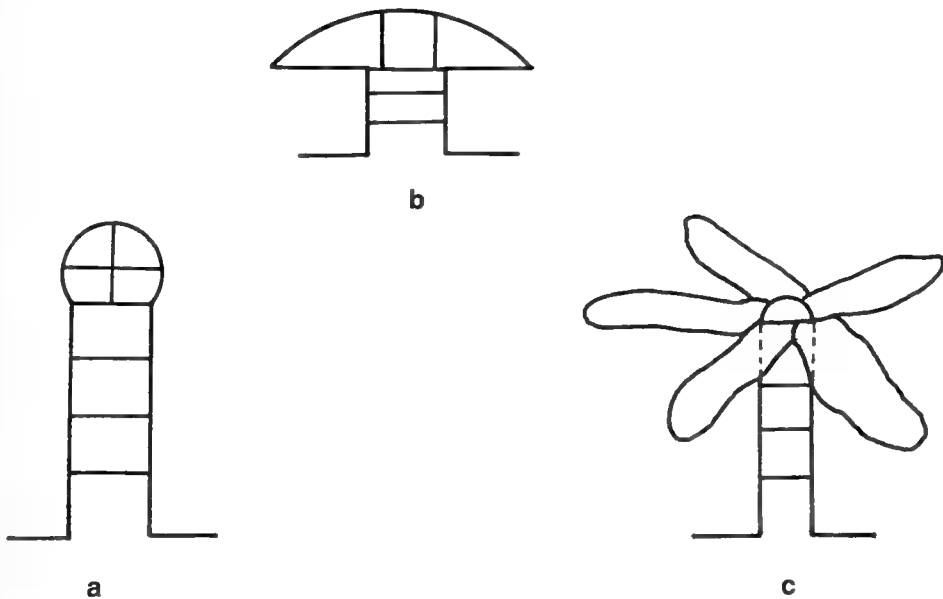


Fig. 1. Types of glandular hair (coding for characters 7 and 8 given in parentheses). [glandular hairs absent (00)]; a glandular hairs with globular heads (01); b glandular hairs peltate (02); c glandular hairs pseudostellate (11).

function of the amount secreted and possibly of the type of secretion. The pseudostellate glandular hairs of some species, e.g. *S. spinescens* and *S. coriacea*, do not appear to secrete at all and remain simply as a scurfy indumentum.

9. Compound thyrse: 0; thyrse reducing to a raceme or spike above: 1*; raceme or spike: 2.

10. Inflorescence mostly terminal: 0*; inflorescence mostly axillary: 1.

In those species with mostly lateral inflorescences the main stem produces a large number of more or less condensed inflorescences in the leaf axils. The terminal bud may or may not eventually produce one itself.

11. Bracts all more or less the same size as leaves: 0; bracts reducing in size towards the apex: 1*; bracts mostly reduced: 2.

This is a difficult character to score but it appears to be so useful in defining groups that it is included despite the need to make some relatively arbitrary decisions.

12. Bracts without marginal bristles: 0*; bracts with marginal bristles: 1.

13. Bracteoles similar to leaves but smaller: 0*; bracteoles much smaller than leaves, \pm lanceolate: 1; bracteoles minute: 2.

14. Flowers pedunculate: 0*; peduncles obsolete: 1.

The pedicel is the flower stalk above the bracteoles, the peduncle is the stalk below the bracteoles. See character 29 below.

15. Sepals >1.5 mm long: 0*; sepals \leq to 1.5 mm long: 1.

16. Sepals free: 0*; sepals connate with distinct lobes: 1; sepals connate into an undulate rim: 2.

17. Corolla not bearded inside: 0*; corolla bearded inside: 1.

The beard of the corolla refers to dense long hairs in the throat as opposed to a thin scattering of hairs or their absence. Generally there is a clear discontinuity between the two states. (Striations on the wings of the corolla lobes are an autapomorphy for the terminal taxon STR1.)

18. Barbulae broad (mostly 0.2 mm wide or more), flat: 0*; barbulae narrow (less than 0.2 mm wide), \pm terete: 1. (See Fig. 2.)

The barbulae occur on the margins of the corolla wings towards the base of the lobes and/or as outgrowths in the throat. They would appear to be analogues, but possibly not homologues, of the 'calli' in *Dampiera* (Rajput & Carolin 1988) and the 'enations' of *Goodenia* (Carolin, unpub). In *Coopernookia* and *Goodenia* sect. *Monochila*, there are long stiff hairs in these positions. In some species of *Scaevola*, e.g. *S. sericea*, these long stiff hairs occur at the ends of the lacinations of the corolla wings and on the ends of broad outgrowths from the throat which have the same texture as the wings. Thus it is the terminal hairs of the barbulae of *Scaevola* which are homologous with the stiff hairs inside the corolla of *Coopernookia* and *Goodenia* sect. *Monochila*. The body of the barbula, in *Scaevola*, is an extension of the margin of the wing. In many species the stiff terminal hairs of the barbulae are reduced to papillae, e.g. *S. linearis*,

whilst in others they may be obsolete, e.g. *S. sericophylla*.

19. Stiff hairs in place of barbulae: 0*; barbulae aculeate with stiff hairs: 1; barbulae papillate at top: 2; barbulae simple: 3; barbulae absent: 4. (See Fig. 2.)

The lacinations on the margins of most species of sect. *Scaevola* are considered to be homologous with the narrower barbulae of most other species and are here referred to as 'barbulae'.

20. Apex of anther glabrous: 0*; apex of anther hairy: 1.

21. Hairs present on lips of indusium: 0*; hairs absent from lips of indusium: 1.

22, 23 and 24. Indusium with hairs scattered over the upper surface: 000*; indusium with a few basal hairs on the upper surface: 010; indusium glabrous on the upper surface: 020; indusium with a stiff erect beard at the base on the upper surface, equalling or exceeding the lips: 100; indusium with a short flat beard at the base on the upper surface: 200; indusium with short flat dense beard on the upper surface: 101. (See Fig. 3.)

25. Mesocarp dry: 0*; mesocarp fleshy: 1.

26. Fruit with four fertile locules: 0*; fruit with two fertile and two sterile locules: 1; fruit with two fertile locules only: 2; fruit with only one fertile locule: 3.

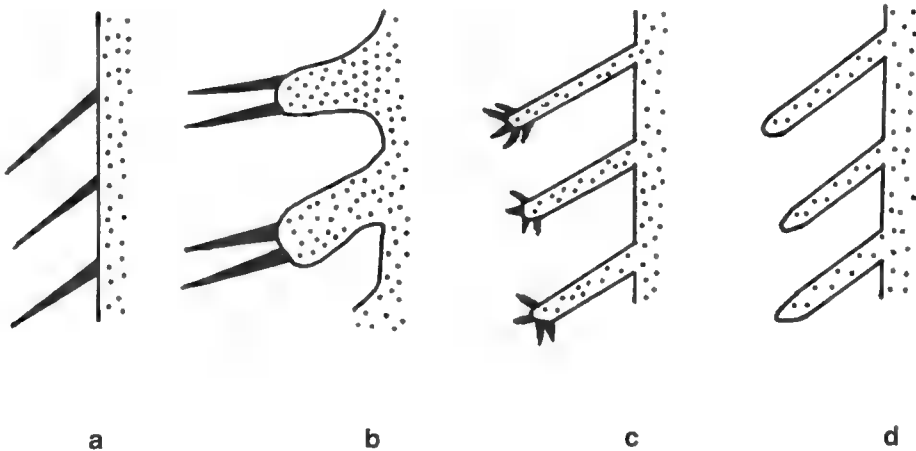


Fig. 2. Barbulae type and position on the margins of the wings or their extensions which are decurrent in the throat of the corolla (coding for characters 18 and 19 given in parentheses). **a** No barbulae, hairs on \pm straight margin (00); **b** Barbulae broad (lacinations), aculeate with long stiff hairs (01); **c** Barbulae narrow, papillate (the hairs reduced to papillae) (12); **d** Barbulae narrow, simple (13). The stippled area represents the multicellular petal tissue; the unicellular hairs are shown in black.

Carolin (1966) has described the characteristics of the fruit of the genus. Despite the outgroups only having two (or one) locules in the fruit, the floral anatomy (see also Carolin 1959) indicates that the primitive condition is four-carpellary and, therefore, in all probability four-locular. This is accepted as a basis for the analysis.

27. Endocarp smooth: 0*; endocarp rugose: 1.

28. Fruit glabrous: 0*; fruit hairy: 1.

The indumentum condition of the fruit is not necessarily the same as the rest of the plant and is treated as a separate character.

29. Flower pedicillate: 0*; Flower sessile in bracteoles: 1.

See character 14 above. This character was only used in the analysis of group B and therefore was not recorded for species included in the cladograms of group A.

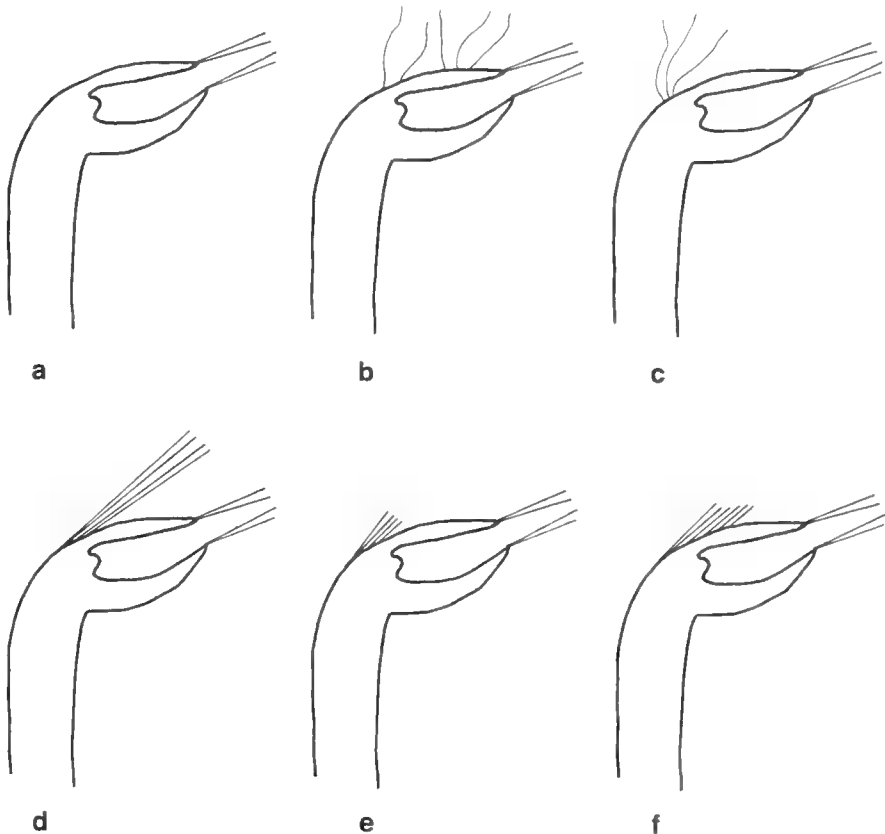


Fig. 3. Arrangement of the hairs on the upper surface of the indusium (coding of characters 22, 23, 24 given in parentheses). **a** Indusium glabrous (020); **b** Indusium with hairs scattered over the surface (000); **c** Indusium with a few basal hairs (010); **d** Indusium with a beard of long stiff hairs at the base mostly equalling or exceeding the lips (100); **e** Indusium with a short flat beard at the base (200); **f** Indusium with a short flat dense beard at the base (101).

The cladograms

The preliminary cladograms were generated by Swofford's PAUP package using global branch swapping and the MULPARS option (Swofford 1986) and an outgroup as defined by the primitive states of the characters (see above). One hundred trees with overall parsimony, and a strict consensus tree, were generated by the algorithm although many of these were in principle the same (see Swofford 1986). The strict consensus tree was then used as input to MACCLADE (Maddison and Maddison 1987) and manipulated to test the effect of moving specific clades.

When there is a great deal of homoplasy in a cladogram, there are almost always a number of alternative most parsimonious trees. The consensus tree is, then, usually much longer than those from which it is derived. Nevertheless, each of these latter is a possible phylogeny; that there are several most parsimonious trees indicates that the raw information will not resolve the phylogeny. There seems little point in showing any of these trees as we did for *Dampiera* (Rajput and Carolin 1988), since none of them are more preferred than the others. There may be ways of resolving such situations by weighting the less homoplasious characters but this is time-consuming without the necessary computer programs and it still may not produce a resolution. Moreover, giving an arbitrary weighting to a character at the start of an analysis, applies this weighting throughout the group under consideration. When one is dealing with a large group this may not be appropriate, since a character may be more variable on one clade than on another. Gauld and Underwood (1986) have addressed this problem to some extent but their technique is not incorporated into the more generally available packages. By scanning the series of most parsimonious trees, it is possible to select clades which are 'robust', i.e., occur in a large number of such trees. However, since most parsimonious solutions are N-complete, it may not be possible to assign probabilities to any particular clade and therefore one has no satisfactory measure of confidence except intuition. Even considering only the trees generated in this run, there are no resolutions of the polychotomies of the consensus tree which one could accept as being significantly more frequent. The most appropriate way of dealing with this problem available at present seems to be by using MACCLADE which enables clades to be manipulated individually to achieve a resolution based upon what one believes to be 'robust' characters.

The preliminary analysis was completed using all terminal taxa. Since there was a clear division into two main groups, however, the results are reported in two separate parts.

Three cladograms are figured. The first (Fig. 4) is the consensus cladogram generated by PAUP for all sections other than sect. *Scaevola*.

The second (Fig. 5) is the consensus cladogram for sect. *Scaevola* in which an extra character, number 29, has been included.

The third (Fig. 6) is the preferred cladogram established by manipulation with MACCLADE. In this I have given weight to the type of beard on the back of the indusium. Those species on the sub-sect. *Xerocarpa* clade which have a long beard I have grouped together on the same clade and those with the beard reduced to short appressed bristles I have grouped on another clade, reducing the tree length by 4 character state changes. No such manipulation was considered necessary in sect. *Scaevola*.

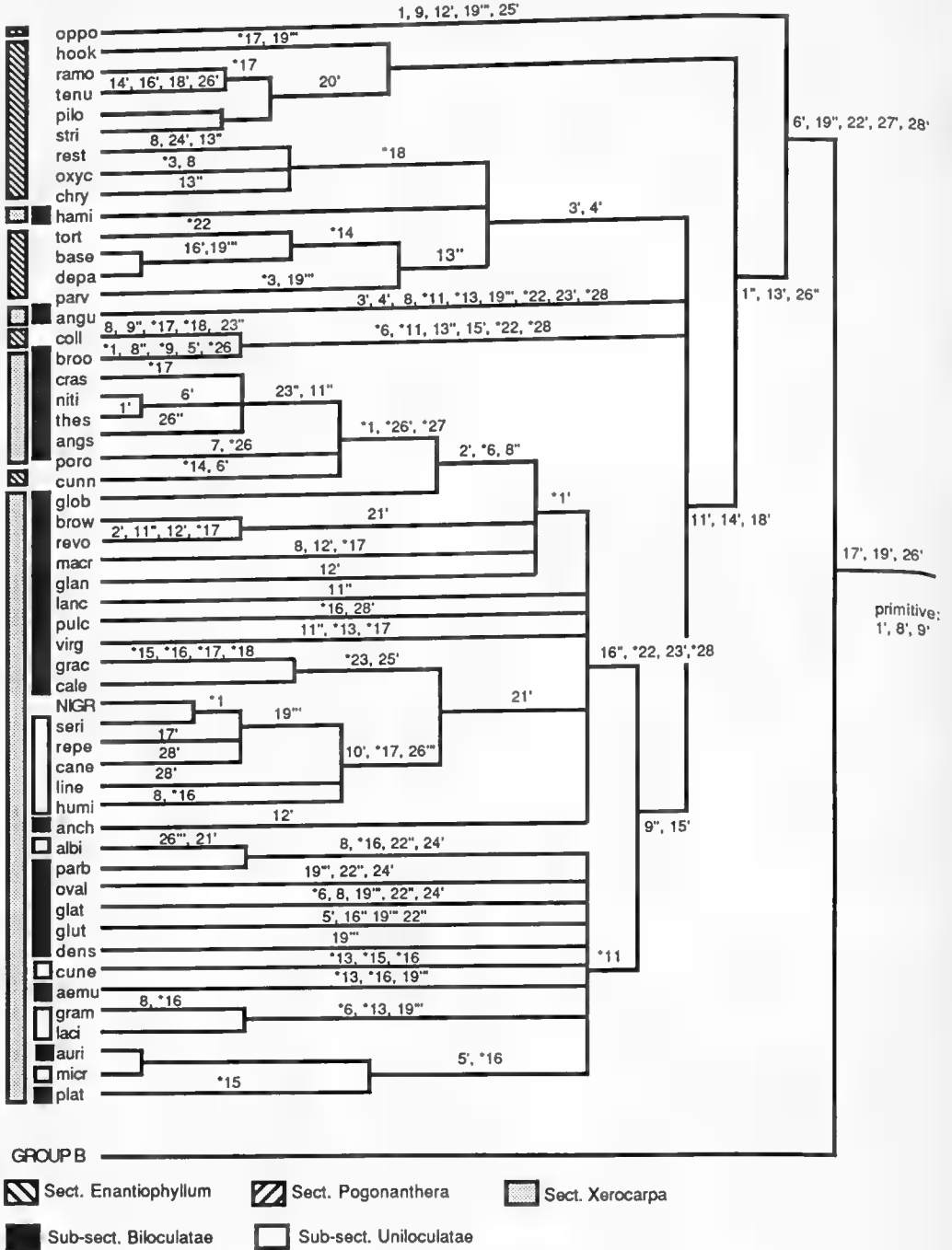


Fig. 4. The consensus cladogram for Group A. The key to the abbreviations of the names of the terminal taxa is provided in Appendix 1. The key to the character codes is provided in Appendix 2. The attachment of Group B (sect. *Sarcocarpa*, Fig. 5) is shown. A number without a prime represents a change of a binary character from state '0' to state '1'; a primed number indicates a change of a multistate character to the state indicated by the number of primes; an asterisked number represents a reversal of a character to the state indicated by the prime.

I have also indicated a possibly paraphyletic group of species which it may be useful to examine in the future. The frequently purple beard on the back of the indusium is possibly an advanced feature which unites them, although it is not consistent in some of the species. In addition *S. oxyclona* has the same purple beard.

Discussion

The first point to draw attention to is that three changes occur at the root of the cladogram, which may well indicate that the arguments used to polarize these character states are giving incorrect solutions.

The primitive character state of the barbulae (character 19) is, as mentioned above, not present in *Scaevola* and that has to change. The bearded throat of the corolla also appears to be primitive. The cladogram also suggests that a fruit with two sterile locules is primitive.

S. porocarya is the only member of the family which has four fertile locules. I have suggested (Carolin 1966) that this corroborates my interpretation of the 4-carpellary nature of the ovary of Goodeniaceae and is thus the primitive condition. The cladogram indicates that *S. porocarya* is not a primitive species and, indeed, that the state of four fertile locules is derived from the state of two fertile locules. Elsewhere (Carolin 1987) I have argued that large scale morphological reversion like this are unlikely to occur. It is difficult to do that here in view of the number of other advanced characters of the species in question. Moreover, if this reversion is disallowed the cladogram would show seven

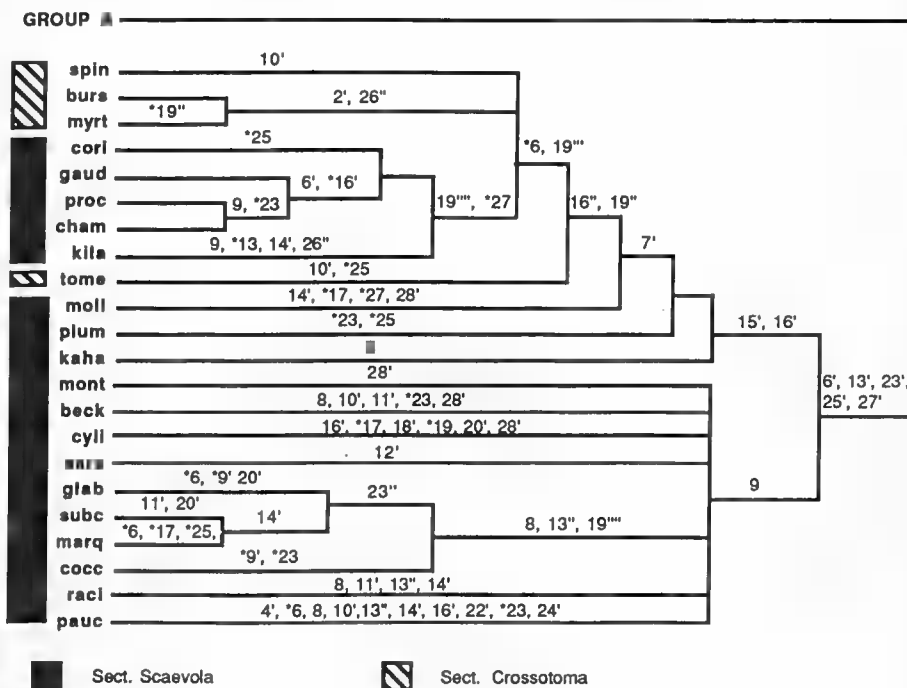
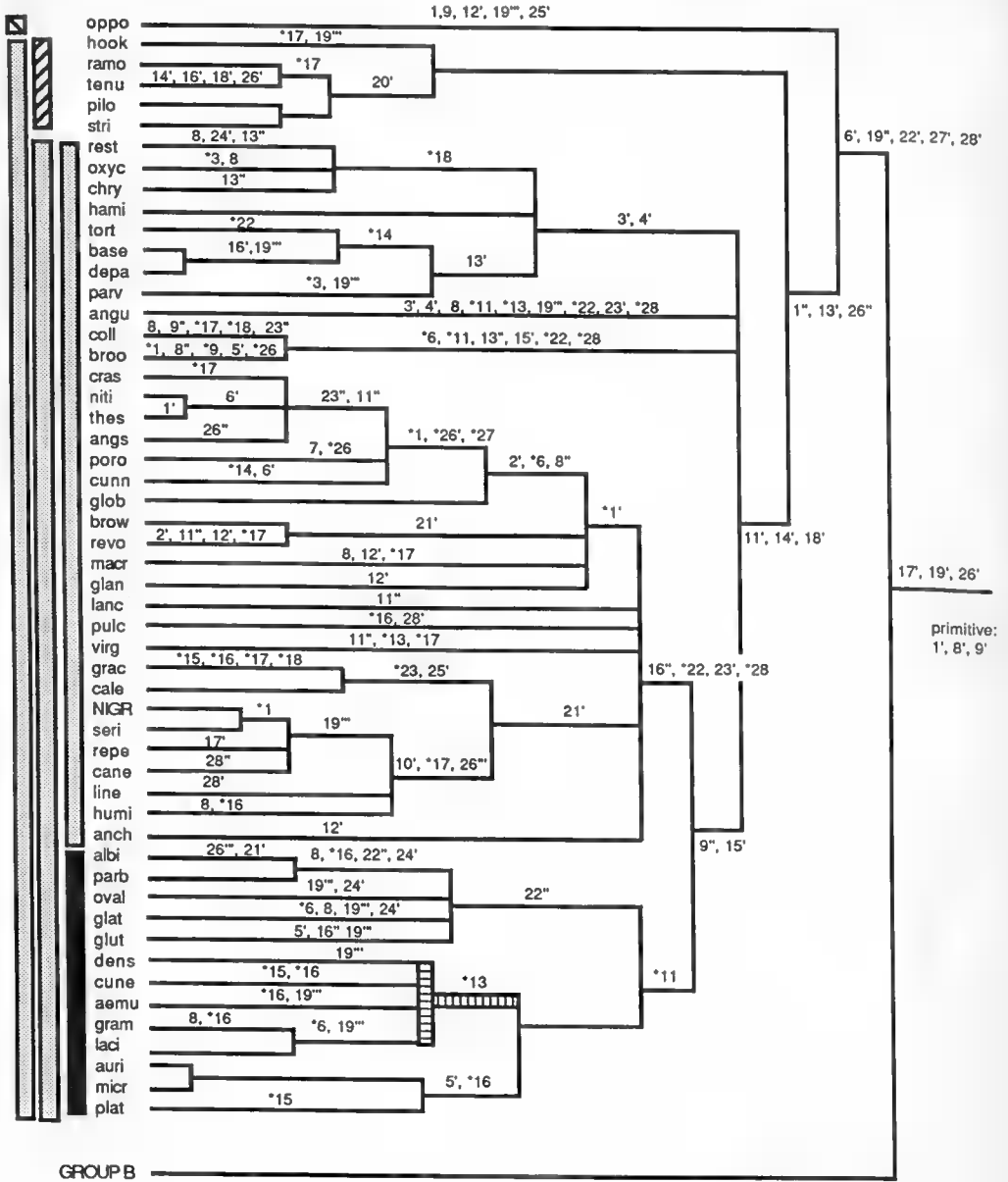


Fig. 5. Consensus cladogram of Group B. See Fig. 4 for explanation. Group A attachment is indicated. The whole of this group is referred to sect. *Scaevola* (*Sarcocarpa*) in this contribution.



Sect. Enantiophyllum
 Sub-sect. Pogonanthera
 Sect., Sub-sect. Series Xerocarpa
 Sub-sect. Pogogynae

Fig. 6. Preferred cladogram of Group A. See Fig. 4 for explanation. The clade including DENS, CUNE, AEM and GRAM-LACI represents a possibly paraphyletic group discussed in the text.

independent origins of the 2-locular condition. The problem of such apparently complex reversions needs addressing carefully but, despite this result, I am not convinced that overall parsimony is necessarily the answer.

The primitive state of characters number 1, 8 and 9 is set to '1'.

Also of interest is the change of state in the hairs on the back of the indusium at the base of Group A (sects. *Xerocarpa* and *Enantiophyllum*) to a long stiff beard (character 22). This suggests that the state 'Indusium with a few basal hairs' (character 23), which characterizes a number of clades above the first branching, is a reduction transformation of the long stiff beard and not of scattered hairs as the additive coding of character 22 and 23 implies. Changing the coding to allow for this new interpretation does not result in significant changes to the cladogram which is generated.

Some comment about *Nigromnia* is necessary at this stage. All the characters which I discussed when erecting *Nigromnia* are clearly autapomorphies for it; one of them, the dense axillary clustering of the flowers, is simply an extreme case of axillary spikes with numerous flowers. Although the general appearance of *N. globosa* is considerably different from other members of this group, there is little doubt about its position amongst those species with axillary spikes. However, I do not consider that the differences are great enough to warrant maintaining it as a separate genus and thus making *Scaevola* paraphyletic.

An examination of the clades in the preferred cladogram shows that mostly they are reasonably well founded. The position of the clade constituting *S. collaris* and *S. brookeana* is probably open to question since it is quite widely dispersed in the preliminary most parsimonious cladograms. *S. angulata* is also quite widely dispersed by the preliminary cladograms; it occurs in several positions in subsect. *Xerocarpa* and in several positions in subsect. *Parvifoliae*. Its position therefore remains doubtful. On the other hand there are some fairly well established clades within sect. *Xerocarpa*, e.g., the one rooted below *S. globulifera* with peltate hairs secreting varnish and few simple hairs (or none). *S. gracilis* and *S. calendulacea* (together with *S. porrecta*) also represent a well defined clade. All these species have fleshy fruits, like those of sect. *Scaevola*, and are strand plants or plants of coastal sand-dunes, probably dispersed to the outlying parts of the distribution of the clade by sea birds which presumably eat the mesocarp. The clade rooted below *S. humifusa*, characterized by the synapomorphy of lateral inflorescences, is also well defined.

Taxonomy

The sections as defined by Bentham (1868) and Krause (1912) do not appear to be natural groupings. They are discussed below in relation to the cladograms. The systematic arrangement suggested by the present study is presented at the end of this discussion.

Sect. *Sarcocarpa*

Bentham (1868) included only one species in this section for Australia. Bentham and Hooker (1876) and Krause (1912), dealing with the genus on a world-wide basis, each describe the section in much the same way. It is, in fact, better represented outside Australia than in it. The cladogram indicates that at least part of the section is related to sect. *Crossotoma* as circumscribed by Bentham (1868) and Krause (1912) with subsequent additions. This is primarily due to the peculiar psuedostellate hairs (see above) and the fleshy fruit. The

cladogram clearly indicates that some of the Hawaiian species are more closely allied to sect. *Crossotoma* than any of these are to some other Hawaiian species or to any of the New Caledonian species — a rather unexpected result. It also indicates that *S. coccinea*, from New Caledonia, is more closely related to *S. glabra*, from Hawaii, and to the Marquesan species, *S. capitata* and *S. marquesensis*, than it is to the other New Caledonian species. The first, two in particular, show a close relationship in the unique combination of a long pedicel with an obsolete peduncle (see characters 14 and 29), resulting in the bracteoles being inserted in the axils. This may possibly be due to convergence as a result of the specialized bird pollination of all these species. Although there remain a number of unresolved polychotomies in the Oceanic species, the cladogram suggests at least three colonizations of the Hawaiian Islands: *S. sericea*, the *S. gaudichaudiana* group and *S. glabra* as suggested by Patterson (1987). The cladogram indicates that sect. *Crossotoma* should be included with sect. *Sarcocarpa* (sect. *Scaevola*).

Sect. *Phacelophyllum*

Unfortunately, I could not obtain satisfactory material of the single species, *S. hainanensis*, of this section early enough to include in the analysis. Towards the end of the investigation, however, I was lent some material with a few flowers and it seems that it is closest to *S. plumieri*. It has aculeate barbulae and sepals connate into a sinuate tube. The flowers, although mostly solitary, have buds in the axils of the bracteoles indicating that they may on occasion develop into cymes. Even the peculiar swollen leaf base, which is characteristic of this species, appears almost as a development of the slightly swollen base in *S. plumieri*. It shows a superficial resemblance to *S. calendulacea* but it has large leaf-like bracts, unlike the reduced ones of *S. calendulacea*, and aculeate barbulae unlike the papillate ones of *S. calendulacea*. It has not been possible to determine the fruit type. I am here reducing this section to a synonym of sect. *Scaevola*.

Sect. *Pogonanthera*

Bentham (1868) and Krause (1912) circumscribe this section in exactly the same way. There is no one feature which satisfactorily differentiates this section from sect. *Xerocarpa* as circumscribed by them. Their emphasis appears to be on the presence of a peduncle in the former, although this does not occur in all the species included. The cladogram indicates that *S. cunninghamii* and *S. collaris* do not belong to the same clade as the rest of this section as defined by Bentham and Krause. Although I do not consider the systematic position of *S. collaris* established clearly, it does seem to belong with sect. *Xerocarpa*. *S. cunninghamii* clearly belongs to sect. *Xerocarpa*. The composition of the rest of the section is equivocal according to the preferred cladogram. There is no clear advanced character uniting the *S. ramosissima* group with the *S. parvifolia* group, whereas there are clear synapomorphies separating them. Moreover *S. hamiltonii*, which Krause includes in sect. *Xerocarpa*, falls here into the *S. parvifolia* group. It is probably better to recognize three sub-sections here since these clades have little in common. *S. angulata* remains an unresolved clade which prevents a completely confident separation of sub-sect. *Parvifoliae* and *Xerocarpa*.

Sect. *Xerocarpa*

This represents a fairly well founded clade, although it is necessary to exclude some of the species previously included in it and to enlarge its circumscription.

In particular, series *Parviflorae* of Bentham (1868), with subsequent additions, is referred to *Goodenia* sect. *Monochila* (see above). The other series which Bentham (1868) recognizes within sect. *Xerocarpa* do not appear to be natural groupings. The members of series *Monospermae*, which Krause (1912) raises to subsection *Uniloculatae*, and in which he includes Bentham's series *Parviflorae*, are scattered over several different clades and the series seems to be of little taxonomic significance (Fig. 4). Series *Pogogynae* is not represented by a clade on the preferred cladogram. However, I am suggesting that sub-sect. *Xerocarpa* be divided into two series, neither of them represented by well defined clades, but which may be useful in assessing the variation within the genus. Series *Pogogynae* consists of those species which have a well defined basal beard on the upper surface of the indusium. This beard may be long or short and corresponds more or less with Bentham's (1868) series *Pogogynae*. Series *Xerocarpa* consists of those species with a few basal hairs or with scattered hairs on the upper surface of the indusium. Whether either of these series is actually a clade depends entirely on the interpretation of the transformation of the indusial beard. The evidence presented here does not allow us to resolve this problem. Series *Macrostachyae* and *Globuliferae* appear to be quite polyphyletic and are therefore here reduced to synonyms.

As indicated above, the position of *S. oxyclona* is possibly not secure in sect. *Parvifoliae* since it shows resemblances to the paraphyletic series *Pogogynae*.

Sect. *Enantiophyllum*

van Leenhouts (1957) reduced this to a single species which here stands as a separate clade.

Synopsis of sections, subsections and series of Scaevola

Sect. *Scaevola*

Sect. *Sarcocarpa* Don, Gen. Hist. 3: 727 (1834).

ORTHOGRAPHIC VARIANT: *Sarcocarpeae* DC., Prodr. 7: 508 (1839).

LECTOTYPE: *S. plumieri* (L.) Vahl, here chosen.

Sect. *Crossotoma* Don, Gen. Hist. 3: 730 (1834).

LECTOTYPE: *S. spinescens* R. Br., here chosen.

Sect. *Phacelophyllum* K. Krause, Pflanzenr. 54: 118 (1912).

HOLOTYPE: *S. hainensis* Hance.

Mostly tall shrubs, often with large leaves. Vegetative growth usually continuing on the main inflorescence axis after flowering has ceased. Bracts leaf-like. Bracteoles usually small to minute. Barbulae often aculeate. Mesocarp fleshy.

Sect. *Enantiophyllum* Miq., Ann. Mus. Bot. Lugd. Bat. 1: 210 (1864).

HOLOTYPE: *S. amboinensis* Miq.

Scramblers with large opposite leaves. Vegetative growth continuing on main inflorescence axis after flowering has ceased. Bracts leaf-like. Bracteoles minute. Barbulae simple. Mesocarp fleshy.

Sect. *Xerocarpa* Don, Gen. Hist. 3: 728 (1834).

ORTHOGRAPHIC VARIANT: *Xerocarpeae* DC., Prodr. 7: 508 (1839).

LECTOTYPE: *S. crassifolia* Labill., here chosen.

Sect. *Gymnostegia* Benth. in Endl., Enum. Pl.: 68 (1837). (Bentham gives the name thus in the main text but in the footnote describing the section he gives '*Gymnostigma*'. It is, however, the nakedness of the indusium that is emphasised and I am here accepting the first spelling.)

TYPE: *S. thesioides* Benth.

Shrubs or herbs with a stock. Leaves various. Growth of the inflorescence axis terminating after flowering. Bracteoles various. Barbulae papillate, simple or absent. Mesocarp dry, thin.

Subsect. *Xerocarpa*

Subsect. *Biloculatae* K. Krause, Pflanzenr. 54: 145 (1912).

LECTOTYPE: *S. crassifolia* Labill., here chosen.

Subsect. *Uniloculatae* K. Krause, Pflanzenr. 54: 160 (1912).

LECTOTYPE: *S. canescens* Benth., here chosen.

Series *Monospermae* Benth., Fl. Austral. 4: 86 (1968).

LECTOTYPE: *S. canescens* Benth., here chosen.

Flowers mostly sessile. Leaves well developed. Anthers glabrous at tip.

Series *Xerocarpa*

Series *Globuliferae* Benth., Fl. Austral. 4: 85 (1868).

LECTOTYPE: *S. globulifera* Benth., here chosen.

Series *Macrostachyae* Benth., Fl. Austral. 4: 85 (1868).

LECTOTYPE: *S. macrostachya* Benth., here chosen.

Indusium without a definite basal beard.

Series *Pogogynae* Benth., Fl. Austral. 4: 98 (1868).

LECTOTYPE: *S. aemula* R. Br., here chosen.

Indusium with a basal beard of stiff bristles which may be reduced to short appressed hairs.

Subsect. *Pogonanthera* (Don) Carolin, **comb. nov.**

BASIONYM: sect. *Pogonanthera* Don, Gen. Hist. 3: 729 (1834).

ORTHOGRAPHIC VARIANT: *Pogonandra* DC., Prodr. 7: 511 (1839).

LECTOTYPE: *S. striata* R. Br., here chosen.

Flowers pedunculate. Anthers with hairs at tip (except *S. hookeri*).

Subsect. *Parvifoliae* Carolin, **subsect. nov.**

HOLOTYPE: *S. parvifolia* Benth.

Flores plerumque pedunculati; folia caulina parva.

Flowers usually pedunculate. Cauline leaves usually reduced. Anthers glabrous at tip.

Scaevola sect. *Xerocarpa* series *Parviflorae* Benth., Fl. Austral. 4: 86 (1868).

LECTOTYPE: *S. fasciculata* Benth., here chosen, is referred to the genus *Goodenia*.

Typifications, nomenclatural notes and new taxa

This section is dealt with in the same way as in the contribution on *Dampiera* (Rajput & Carolin 1988). Argument is provided there for the selection of various types in the cases of collections by R. Brown, L. Preiss, and E. Pritzel. The same symbols are used to designate the selection of lectotypes, i.e. when only one collection relates to the protologue this is shown by '*' after the type statement; when lectotypes have to be selected from more than one collection relating to the protologue this is shown by '#'.

When a name is considered to be a synonym of another name, the name which is currently accepted is given after '='.

In all cases, other things being equal, the specimen cited in the protologue which agrees most closely with the protologue description is selected. Where all agree well, the most complete specimen is selected.

When selected specimens are cited, the total number which was examined is indicated in parentheses.

The taxa are arranged in a supposedly phylogenetic sequence.

Taxa here included in *Scaevola*

Temminckia tahitensis Nadeaud, J. Bot. (Desvaux) 1897: 107 (1897) = *S. tahitensis* Carlquist.

LECTOTYPE: TAHITI: A 1200 mètres à la base du Mont Mauru, district de Hitiao à la seconde étape pour aller au Vaipurau, Mr Temarii, 4 Nov. 1896 (P).#

Scaevola spinescens R. Br., Prodr.: 586 (1810).

LECTOTYPE: SOUTH AUSTRALIA: Near the shores of Bay no 3., Anch(orage) 5, and Bay 5, South Coast, R. Brown (BM). ISOLECTOTYPE: K.#

There is only one sheet of Brown's collections of this species at BM and it bears two labels as indicated above. 'Anch(orage) 5' is the same as 'Bay 5', 'Bay 3' is not. It is quite impossible to separate the collections and the whole sheet is accepted as the lectotype. The sheet at K is labelled 'South Coast Bay IV, V, VII, XII, XIV'. In this case also it is impossible to separate the collections.

Scaevola acacioides Carolin, sp. nov.

Frutex ad 1 m altus pilis furfuraceis. Folia anguste oblongo-elliptica 25–50 mm longa crassa glabrescentes. Flores plerumque in dichasiis vel monochasiis dispositi, sessiles inter bracteolas. Corolla alba vel cremea ad 13 mm longa.

HOLOTYPE: WESTERN AUSTRALIA: Bee Gorge, lat: 22° 16' S; 118° 15' E, Wittenoom area, Blockley 21–9, 30 May 1966 (PERTH).

Shrub to 1 m high with scurfy hairs on the younger parts. *Leaves* thick, greyish green, narrow-oblong-elliptic, 25–50 mm long, 2–5 mm wide, tapering gradually towards base, glabrescent, with a few villous axillary hairs, acute, entire. *Flowers* in dichasia or monochasia or solitary in leaf axils, sessile between the bracteoles; peduncle 8–15 mm long; bracteoles deltoid, 1–1.5 mm long. *Sepals* connate into a sinuate rim c. 0.5 mm high. *Corolla* white to cream, 10–13 mm long, with some scurfy stellate-glandular hairs outside, with a dense beard of white hairs on connate part of lobes; barbulae prominent, papillate terminally; connate part of lobes 7–8 mm long; lobes equal, 5–6 mm long, 1.5 mm wide;

wing obsolete or very narrow. *Stamen* filaments filiform, c. 8 mm long; anthers oblong, 2 mm long, obtuse. *Ovary* 2-locular almost to summit, with a few scurfy hairs; style slightly curved, 7 mm long with a few simple hairs towards base; indusium transverse-obovate, 0.5 mm long, 1.5 mm wide, with a few white hairs above and white bristles c. 0.3 mm long on lips. *Fruit* not seen.

RANGE: Pilbara region of Western Australia.

HABITAT: Ironstone soils.

DISCUSSION: The longer leaves and the branched inflorescence distinguish this from other Australian species in sect. *Scaevola*.

SPECIMEN EXAMINED: WESTERN AUSTRALIA: 38 km W of Wittenoom, K. Newbey 10051 (PERTH).

Named for the superficial similarity of the leaves to the phyllodes of some *Acacia* sp.

Scaevola bursariifolia J. Black, Trans. & Proc. Roy. Soc. S. Australia. 51: 385 (1927).

LECTOTYPE: SOUTH AUSTRALIA: Bunda Plateau (north of Fowler's Bay towards Eucla), R. Tate, Feb. 1879 (AD).#

Scaevola groeneri F. Muell., Fragm. 6: 15 (1866) = ***S. myrtifolia*** (Vriese) K. Krause.

LECTOTYPE: WESTERN AUSTRALIA: Drummond 363 (MEL). ISOLECTOTYPES: BM, K, W.#

Merkusia myrtifolia Vriese, Natuurk. Verh. Maatsch. Wetensch. Haarlem ser. 2 10:72 (1854) = ***S. myrtifolia*** (Vriese) K. Krause.

HOLOTYPE: WESTERN AUSTRALIA: S.W. Australia, Drummond 363 (K).

ISOTYPES: BM, P. Vriese gives 'Drummond 263', but this is apparently a misprint for 363.

Scaevola tenuifolia Carolin, sp. nov.

Herba prostrata pilis brevibus patentibus oblecta. Folia linearia plerumque integra. Cymae axillares pedunculis arcuatis. Alae petalorum non striatae. Antherae comosae manifeste. Barbulae corollae brevissimae vel obsoletae.

HOLOTYPE: WESTERN AUSTRALIA: Foot of East Mount Barren, Blackall 1417, 26 Sept. 1931 (PERTH).

Decumbent to prostrate perennial herb to 1 m. *Stems* ± striate, mostly branching from the base, hispid with short patent simple and small red glandular hairs. Leaves sessile, linear, mostly entire, revolute; basal leaves 2–4.5 cm long, 0.2–0.4 cm wide, occasionally to 4-toothed towards apex; cauline leaves 0.7–3.5 cm long, 0.1–0.2 cm wide. *Flowers* in racemes or simple thyrses; peduncles curved, slender, 1–5 cm long; bracteoles linear-triangular, 2–8 mm long, entire. Sepals free, linear, c. 2 mm long. *Corolla* 12–20 mm long, blue to mauve; lobes apiculate, 7–10 mm long, 1.5 mm wide, with long patent simple white hairs outside, densely bearded inside; barbulae simple or almost obsolete; wings 4–6 mm long, 2 mm wide, not striate. *Stamen* filaments 2–4 mm long; anthers oblong, 1 mm long, apiculate and comose. *Ovary* oblong, c. 2 mm long, hairy as on sepals with denser glandular hairs; style 5–8 mm long; indusium c. 1 mm long, 2 mm wide, densely covered with white simple hairs and with dense marginal bristles c. 0.2 mm long. *Fruit* ribbed, 2-locular.

RANGE: South western Australia; only known from East Mount Barren and Thumbs Peak.

DISCUSSION: This species is related to *S. striata* from which it can be distinguished by the stiff patent hairs on the stems, the curved peduncles and the wings of the petals which are not striate.

SELECTED SPECIMENS EXAMINED (7): WESTERN AUSTRALIA: Top of Mt Barren, *Gardner & Blackall*, s. dat. (PERTH); SW to E slopes of East Mt Barren, *Willis*, 14 Oct. 1961 (PERTH); East Mt Barren, *George 3672*, 21 April 1962 (PERTH); Thumbs Peak Range, *George 7117*, 31 Oct. 1965 (PERTH).

Named for the narrow leaves. Latin, *tenuis*- = narrow; *-folium* = leaved.

Scaevola apterantha F. Muell., *Fragm.* 1: 121 (1859) = *S. ramosissima* (Sm.) K. Krause.

LECTOTYPE: VICTORIA OR NEW SOUTH WALES: Ranges beyond the Snowy River, F. Mueller, Jan. 1855 (MEL). There are two sheets at MEL apparently labelled by Mueller with this name. One of these has no locality label. Since Mueller writes "In montibus ad flumen Snowy River" in his protologue, the specimen so labelled is chosen as lectotype.

Scaevola benthamea Vriese in J.G.C. Lehmann, *Pl. Preiss.* 1: 411 (1845) = *S. calliptera* Benth.

LECTOTYPE: WESTERN AUSTRALIA: In limoso-arenosis, umbrosis prope praedium rusticum cel. Mairu ad fl. Canning, Perth, *Preiss 1520*, d. 2 m. Nov. 1839 (W). ISOLECTOTYPE: P.*

No specimens of this collection have been located at LD or at L.

Scaevola striata R. Br., *Prodr.*: 586 (1810).

LECTOTYPE: WESTERN AUSTRALIA: King George Third Sound, R. Brown, 2 Dec. 1801 (BM). ISOLECTOTYPES: K, MEL.#

Mounted on the same sheet as the lectotype is a specimen labelled 'S. striata ?, Bay I, S. Coast, Jan. 1802'. This specimen, however, has no open flowers and therefore does not correspond to the protologue.

Scaevola striata R. Br. var. *arenaria* E. Pritzel, *Bot. Jahrb. Syst.* 35: 569 (1905).

HOLOTYPE: WESTERN AUSTRALIA: Crescit in distr. Stirling interior. pr. Warrungup, *Diels 4945* (B—destroyed).
NEOTYPE: 1 mile (1.6 km) SE of Kukerin, *Newbey 1509*, 16 Oct. 1964 (PERTH).

Scaevola prostrata Vriese in J.G.C. Lehmann, *Pl. Preiss.* 1: 406 (1845) = *S. striata* R. Br.

LECTOTYPE: WESTERN AUSTRALIA: In solo subarenoso sylvae prope Middleton Bay, *Preiss 1490*, 23 Sept. 1840 (LD 0481). ISOLECTOTYPE: L 909,62...294. K. Krause (1912) reduces this to a synonym of *Dampiera diversifolia*. The type specimens, although very scrappy, appear to be *Scaevola striata*.#

Scaevola phlebopetala F. Muell., *Fragm.* 2: 18 (1860).

LECTOTYPE: WESTERN AUSTRALIA: Murchison River, *Oldfield* (MEL). ISOLECTOTYPE: K. Two collections of this species, with this labelling, are present in both MEL and K. The collection with the longer sepals and larger flowers is selected as the lectotype since it agrees more with the type description.

Scaevola hamiltonii K. Krause, *Pflanzenr.* 54: 153 (1912).

LECTOTYPE: ?NEW SOUTH WALES: Ohne genauen Standort, A.A. Hamilton (NSW). ISOLECTOTYPE: B (destroyed).*

***Scaevola chrysopogon* Carolin, sp. nov.**

Herba erecta glabra foliis caulinis anguste ellipticis pilis appressis obtectis. Flores sessiles plerumque solitarii. Sepala libera. Ovarium costatum pilis patentibus simplicibus brevis tenuibus obtectum. Indusium barbam chrysodromam densam in pagina posteriore aperens.

HOLOTYPE: WESTERN AUSTRALIA: 16 miles (25.6 km) S of Wannoo Roadhouse, NW Coastal Highway, *George 10367*, 9 Sept. 1970 (PERTH).

Perennial herb or undershrub to 60 cm high. *Stems* terete, slender, markedly striate, glabrous or occasionally with scattered short appressed simple hairs especially around the nodes. *Basal leaves* ovate, tapering or petiolate, 1–4 cm long, 3–10 mm wide, coarsely dentate, densely pubescent; *cauline leaves* sessile, narrow-elliptic, 2.5–10 cm long, 0.5–2 mm wide, with short appressed simple hairs, entire. *Flowers* axillary, mostly solitary or in cymes with up to 3 flowers, sessile between the bracteoles; bracteoles 2, linear-triangular, 1.2–2.5 mm long. *Sepals* free, triangular to narrow-triangular, 1.4–1.8 mm long, covered with short mostly appressed simple hairs and minute glandular hairs, with short coarse arcuate hairs on the margin. *Corolla* 13–23 mm long, cream to white; lobes apiculate, 7–11 mm long, covered outside with minute glandular hairs and long fine appressed simple hairs becoming shorter and tortuous or arcuate towards the base, with a very dense beard of long fine hairs in throat; *barbulae* simple; wings 0.7–1 mm wide, sparsely ciliate, mostly rounded at apex. *Stamen* filaments flattened, c. 7 mm long, glabrous; anthers 1.5–1.8 mm long, with a short truncate appendage. *Ovary* 2-locular, ovoid to narrow-ovoid, 3–6 mm long, ribbed, covered with short patent simple and minute glandular hairs; style to 9.5 mm long, glabrous; indusium 2 mm wide, with a dense golden brown beard about 1.5 mm long on posterior surface, with dense marginal bristles c. 0.7 mm long.

RANGE: Peron Peninsula and the region just south of Shark Bay in Western Australia.

DISCUSSION: This species can be distinguished from *S. restiacea* by the finer hairs on the ovary.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: Peron Peninsula, *Carolin 3318*, 28 Aug. 1961 (SYD); 54 km S of Denham, *George 9550*, 26 Aug. 1969 (PERTH); c. 14.5 miles (23.2 km) S of Wannoo, *Phillips*, 17 Sept. 1968 (CBG 025840); E of Nerren-Nerren, *Beard 7111*, 20 Oct. 1974 (PERTH).

Named for the golden brown hairs at the base of the upper surface of the indusium. Greek, *chrysos-* = golden, *pogon* = beard.

***Scaevola parvifolia* F. Muell. ex Benth. subsp. *pilbarae* Carolin, subsp. nov.**

Differt ab subspecie *parvifolia* sepalis sine pilis simplicibus lobis corollae pilis simplicibus tantum basin et apicem versus.

HOLOTYPE: WESTERN AUSTRALIA: 50 km S of Rudall River, *P. Wilson 10545*, 15 Aug. 1971 (PERTH)

Stems covered with minute glandular and simple hairs and \pm dense long patent simple hairs. *Basal leaves* lanceolate, to 2 cm long, to 5 mm wide, hairy as stems; *cauline leaves* ovate to lanceolate, 3–20 mm long, 2–5 mm wide, hairy as stems. *Bracteoles* triangular, 1.5–3 mm long, densely glandular hairy, with scattered long simple hairs. *Sepals* densely glandular hairy, rarely with long simple hairs around the margin. *Corolla* lobes densely glandular-puberulent on the outside occasionally with long simple hairs towards base and on apex.

RANGE: Pilbara region of Western Australia.

HABITAT: Sandy soils.

SELECTED SPECIMENS EXAMINED (26): WESTERN AUSTRALIA: Washing Machine Corner, *Harris 82*, 12 May 1982 (AD 98223490); 56 miles (89.6 km) from Port Hedland on Broome road, *Carolin 7610*, 4 Aug. 1970 (SYD); 72 miles (115 km) from Roy Hill on Wittenoom road, *Carolin 7699*, 7 Aug. 1970 (SYD); South Mt Hodgson, *Davis 174*, 20 Oct. 1979 (PERTH); near Upper Rudall River, *George 10830*, 23 May 1971 (PERTH, SYD); Little Sandy Desert, *Mitchell 517*, 22 July 1979 (NT); 4 miles (6.4 km) N of Jigalong on Rabbit Proof Fence, *Royce 1581*, 13 May 1947 (PERTH); 70 miles (112 km) N of Sandstone towards Wiluna, *Royce 10365*, 14 Oct. 1972 (PERTH).

The subspecific epithet refers to the Pilbara region which is the centre of the distribution (latinized and in the genitive case).

***Scaevola parvifolia* F. Muell. ex Benth. subsp. acuminata Carolin, subsp. nov.**

Differt ab subspecie *parvifolia* gemma acuminata.

HOLOTYPE: WESTERN AUSTRALIA: On Depot Springs near bore 25.5 km east of Depot Springs, *Saffrey 1058*, 27 Aug. 1970 (PERTH).

Stems scabrid with minute glandular hairs and patent \pm stiff long simple hairs. *Basal leaves* linear, 20–35 mm long, 5 mm wide, densely minutely glandular hairy, with minute simple hairs and long simple hairs; *cauline leaves* linear to lanceolate, 8–27 mm long, 3–7 mm wide, hairy as basal leaves. *Bracteoles* lanceolate to ovate, 1.5–4 mm long. *Sepals* 2–3 mm long, densely glandular hairy, with long simple hairs. *Corolla* 20–32 mm long; lobes 10–20 mm long, minutely glandular hairy and with patent to retrorse long simple hairs outside; bud acuminate.

RANGE: Austin, Coolgardie and Eucla Regions of Western Australia; Depot Springs to Great Victoria Desert.

DISCUSSION: Can be distinguished from subsp. *parvifolia* by the larger leaves, the larger flowers and the acuminate bud.

SELECTED SPECIMENS EXAMINED (17): WESTERN AUSTRALIA: 5 miles (8 km) from Melma on Leonora road, *Carolin 5894*, 26 Aug. 1967 (PERTH); 12 miles (19.2 km) S of Mt Magnet, *Demarz 5237*, 26 Oct. 1974 (PERTH); 76 km S of Neale Junction, Great Victoria Desert, *George 11948*, 15 Aug. 1974 (PERTH); c. 38 miles (60.8 km) SSW of Queen Victoria Springs, *Helms*, 23 Sept. 1891 (NSW).

The subspecific epithet refers to the shape of the flower bud. Latin, *acuminatus* = with the edges curving inwards and tapering gradually towards the top.

Scaevola patens F. Muell., *Fragm.* 3: 33 (1862) = *S. depauperata* R. Br.

HOLOTYPE: VICTORIA OR QUEENSLAND: Cooper's Creek (MEL). The protologue states 'In deserto juxta Cooper's Creek, *Wheeler*'. The only specimen that I have found corresponding to Mueller's description and even partly corresponding to his label citation is the one here assumed to be the holotype.

***Scaevola angulata* R. Br., *Prodr.*: 586 (1810).**

LECTOTYPE: NORTHERN TERRITORY: Carpentaria main(and), opposite Groote Island, *R. Brown*, 4 Jan. 1801 and Carpentaria Islands (BM).

ISOLECTOTYPES: MEL, P.* There is one sheet of this species collected by Brown at BM, attached are two labels as given. It is not possible to determine the application of the labels and there is very little difference between the specimens on the sheet. The whole sheet is selected as the lectotype.

***Scaevola pulchella* Carolin, sp. nov.**

Suffrutex ad 90 cm altus pilis simplicibus confertis caulis porcatis. Sepala libera. Barbulae corollae papillatae conspicuis alisque ciliatis. Ovarium biloculare pubescens.

HOLOTYPE: WESTERN AUSTRALIA: 80–85 miles (128–136 km) southwards from Onslow, Beard 2980, 24 Aug. 1963 (PERTH).

Ascending to prostrate pubescent shrub to 90 cm high. *Stems* ± ridged, slender, covered with long slender soft patent hairs. *Leaves* sessile, linear to elliptic-oblongate, 15–40 mm long, 4–10 mm wide, mostly entire to denticulate, pubescent with ± dense simple hairs, larger leaves obtuse and mucronate. *Flowers* in axillary or terminal spikes; bracts linear to oblong, lower bracts occasionally narrow-obovate and leaf-like, to 24 mm long, 1–6 mm wide, hairy as leaves; bracteoles narrow-elliptic to linear, 4–8 mm long, 0.7–1.7 mm wide, pubescent with a conspicuous tuft of silky hairs at the base. *Sepals* ovate-triangular, 1.5 mm long, free or slightly connate at the base, obscured by long hairs on ovary. *Corolla* bluish-mauve, 13–20 mm long, densely covered outside with long simple antrorse to ± patent hairs outside, sparsely bearded inside; lobes 7–11 mm long, 1–1.5 mm wide; wings c. 1 mm wide, sparsely ciliate with simple hairs; barbulae short, densely papillate terminally. *Stamen* filaments 4.5–5.5 mm long; anthers 1.5–2.5 mm long, truncate. *Ovary* 2-locular, ellipsoid, c. 2 mm long, densely covered with long ± patent simple hairs to 2 mm long; style 13–16 mm long, shortly pilose towards base; indusium 1.2 mm wide, glabrous, with short sparse bristles on lips. *Fruit* ellipsoid, 2–3 mm long, hairy as ovary.

RANGE: Carnarvon area and east of Exmouth Gulf in Western Australia.

HABITAT: *Triodia* communities.

DISCUSSION: The presence of free sepals, the ridged stems and the indumentum on the ovary are features which indicate an affinity with *S. hamiltonii* and its relatives.

SELECTED SPECIMENS EXAMINED (12): WESTERN AUSTRALIA: c. 125 km on NW Coastal Highway, Ashby 4030, 1 Aug. 1971 (AD 97417316); North West Cape, Butler 117, 1963 (PERTH); 3 miles (4.8 km) W of Giralalia, Tomkinson, Aug. 1963 (PERTH); c. 175 km from Carnarvon to Gascoyne rds. junction on Onslow road, Ashby 2920, 16 Aug. 1969 (AD 971020038, PERTH); Mia Mia, NW Coastal Highway, Ashby 5168, 26 June 1975 (AD 97631025); c. 3 km S of Lyndon River on NW Coastal Highway, Ashby 3209, 14 June 1970 (AD 971040192).

The collector of the holotype notes 'flowers bluish-mauve, pretty' and from this I have selected the specific epithet. Latin, *pulcher* = beautiful, pretty.

Scaevola multiflora Lindley var. *microstachya* Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 407 (1845) = *S. nitida* R. Br.

LECTOTYPE: WESTERN AUSTRALIA: In littore arenoso prope Oyster Harbour, Preiss 1488, 23 Sept. 1840. The only sheet of this collection which has so far been located is: LD 0477.

Scaevola fastigiata Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 406 (1845) = *S. nitida* R. Br.

LECTOTYPE: WESTERN AUSTRALIA: In littore arenoso ad Baldhead, Preiss 1491, 16 Oct. 1840 (LD 0468).

ISOLECTOTYPE: L 909,62 . . .561.*

Scaevola flaccida Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 407 (1845) = *S. thesioides* Benth.

LECTOTYPE: WESTERN AUSTRALIA: In arenosis prope urbem Fremantle, *Preiss 1521*, 13 Dec. 1838 (LD 0469).

ISOLECTOTYPES: L 903,311-. . .423, L 903,311-. . .425, P, W.* Vriese in J.G.C. Lehmann, Pl. Preiss. 2: 243 (1848) himself reduces this to a synonym of *S. thesioides*.

Scaevola paniculata Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 407 (1845) = *S. thesioides* Benth.

LECTOTYPE: WESTERN AUSTRALIA: In clivulis calcareis prope Limekiln, Perth, *Preiss 1516*, 5 Jan. 1839 (LD 0502).

ISOLECTOTYPES: K, L 903,311-. . .426, P, W.*

Scaevola thesioides Benth. var. *filifolia* E. Pritzel, Bot. Jahrb. Syst. 35: 571 (1905).

HOLOTYPE: WESTERN AUSTRALIA: Distr. Eyre propria Esperance in arenosis, fl. in Nov. *D(iels) 5937* (B-destroyed).

NEOTYPE: 4 miles (6.4 km) S of Trulove, *Blackall 1041*, 15 Oct. 1931 (PERTH).

Scaevola scabrida W. Fitzg., J. R. Soc. W. Australia 3: 215 (1918) = *S. macrostachya* (Vriese) Benth.

LECTOTYPE: WESTERN AUSTRALIA: King Leopold Range, *Fitzgerald 788*, May 1905 (NSW).#

Merkusia macrostachya Vriese, Nederl. Kruidk. Arch. 2: 154 (1851) = *Scaevola macrostachya* (Vriese) Benth.

LECTOTYPE: WESTERN AUSTRALIA: Various parts of N(orth) W(est) C(oast) (of Australia), *Cunningham* (K).

ISOLECTOYPE: BM.# It is difficult to be sure to which collection at K Vriese was referring. I have treated this as a lectotypification although the two specimens on the sheet selected may have been the only ones he used.

Scaevola caespitosa R. Br., Prodr.: 585 (1810) = *S. globulifera* Labill.

LECTOTYPE: WESTERN AUSTRALIA: In collibus sterilibus prope Portum Regis Georgii III m ora australi N. Hollandia, *R. Brown* (BM).

ISOLECTOTYPE: K.*

Scaevola globulifera Labill. var. *humilis* Benth., Fl. Austral. 4: 94 (1868) = *S. globulifera* Labill.

LECTOTYPE: WESTERN AUSTRALIA: *Drummond* (K).

ISOLECTOTYPES: MEL.*

Scaevola revoluta R. Br. var. *strigosa* Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 409 (1845) = *S. globulifera* Labill.

LECTOTYPE: WESTERN AUSTRALIA: In littore arenoso inter frutices ad Point Possession, *Preiss 1506*, 16 Oct. 1840 (LD 0484).

ISOLECTOTYPE: MEL.*

Scaevola cunninghamii var. *hispida* Benth., F-l. Austral. 4: 92 (1868) = *S. cunninghamii* DC.

LECTOTYPE: WESTERN AUSTRALIA: Depuech (Depuch) Islands, *Bynoe* (K).

ISOLECTOTYPE: ?BM.#

Scaevola browniana *Carolyn, sp. nov.*

Suffrutex ad 1 m. Folia late obovata ad lineari plerumque revoluta pilis longis sericeis strictis axillaribus. Flores in spicis productis ubi fructificantibus bracteis multo magnis minoribus quam foliis. Corolla coerulea vel alba glabra versus basim. Ovarium septum ovarii imperfectum. Fructus cylindricus glaber rugosus vel tuberculatus. Bractee inferiores foliaceae bracteolae plerumque lanceolatae.

HOLOTYPE: WESTERN AUSTRALIA: 6 miles (9.6 km) W of Louisa Downs Hstd., *Maconochie 1150*, 21 May 71 (NT 31143).

ISOTYPES: PERTH, CANB, K.

MISAPPLIED NAME: *Scaevola revoluta* auct. non R. Br. pro parte: Benth., Fl. Austral. 4: 96 (1869); Bailey, Queensl. Fl. 3: 909 (1900); K. Krause, Pflanzenr. 54: 155 (1912); Ewart & Davies, Flora Northern Territory: 268 (1917).

Perennial subshrub to 1 m, occasionally low and spreading, mostly densely tomentose-villous. *Stems* terete, occasionally ridged below the leaves, mostly tomentose-villous, occasionally pilose with long dense patent hairs. *Leaves* broad-obovate to linear, 6–55 mm long, 2–17 mm wide, sometimes shortly mucronate, sometimes denticulate; axillary hairs very long and dense, mostly sericeous, not woolly. *Inflorescence* a terminal or axillary spike, often elongating in fruiting stage and sometimes very long; bracts narrow-lanceolate to broad-ovate or obovate, 3.5–25 mm long, 1–10 mm wide, lower bracts occasionally leaf-like; bracteoles linear to ovate, mostly lanceolate, 2–9 mm long, 0.5 mm wide. *Sepals* reduced to an obscure rim c. 0.3 mm long, glabrous or fringed with short hairs. *Corolla* blue to white, 5–18 mm long, moderately to very densely hairy outside with long straight slender appressed to patent hairs, sometimes glabrous towards base, with a moderately dense to sparse beard; barbulae papillate, distinct; lobes shortly apiculate above wings, 2–6.5 mm long, 0.5–1.2 mm wide; wings 0.2–1 mm wide, rounded at apex. *Stamen* filaments 2.5–5 mm long; anthers 0.8–2 mm long, truncate to emarginate. *Ovary* obovoid to cylindrical, 1–1.5 mm long, glabrous, 2-ovular, with an incomplete septum; style 5–16 mm long, slender, flattened and very recurved towards the corolla lobes, mostly pilose with long slender hairs especially towards base; indusium 1–2 mm wide with sparse short hairs on both surfaces near base or with long slender hairs on posterior side near base, with minute to long bristles on lips. *Fruit* cylindrical, 3–5 mm long, rugose to striate-tuberculate, one-seeded, glabrous.

DISCUSSION: In the past the name *S. revoluta* has been applied to this species. It differs from that species particularly in the narrower bracteoles and the lack of the long ciliate bristles on the bracts and bracteoles. Moreover the bracts frequently intergrade with the leaves.

Named in honour of Robert Brown, the author of 'Prodromus Florae Novae Hollandiae'.

subsp. browniana

Leaves 6–36 mm long, 0.2–12 mm wide. Bracts narrow-lanceolate to ovate, occasionally broad-ovate, 3.5–25 mm long, 1–7 mm wide. Bracteoles 2–7 mm long, 0.5–1 mm wide. Corolla white to blue 5–11 mm long; lobes 2–4.5 mm long, 0.5–0.7 mm wide; wings 0.2–0.4 mm wide. Style pilose towards the base; indusium c. 1 mm wide, with sparse short hairs on both surfaces near base, with short to minute bristles on lips. Fruit 3–4 mm long.

RANGE: Hamersley Range, Kimberley region and Upper Fitzroy River in

northern Western Australia; Victoria River, Katherine Gorge, western Arnhem Land in Northern Territory; eastern Barkly Tablelands in Queensland.

HABITAT: In open woodland savannah, on sandstone ranges.

DISCUSSION: This subspecies circumscribes a considerable variation but there appears to be no distinct discontinuities in it.

SELECTED SPECIMENS EXAMINED (48): WESTERN AUSTRALIA: 16 km NW of Newman, *Toelken 6324*, 20 Sept. 1979 (AD 98007110); summit of Mt Bruce, Hamersley Range, *Beard 2919*, 19 Aug. 1963 (PERTH); Sir Graham Moore Island, *Wilson 11204*, 30 June 1973 (PERTH); Mt Anderson, *Broadbent 614*, 25 Jan. 1953 (PERTH). NORTHERN TERRITORY: Victoria River, Kununurra road, *Byrnes 707*, 7 May 1968 (NT 14374, PERTH, SYD); 21 km N of Jim Jim Falls, *Craven 6134*, 29 May 1980 (AD 98232271, CANB); c. 11 miles (17.6 km) SSW of Mt Gilruth, *Lazarides 7931*, 28 Feb. 1973 (CANB); 51 miles S of Hookers Creek Settlement, *Chippendale*, 14 July 1956 (MEL 1521630, NSW 82013, NT 2317). QUEENSLAND: Nicholson River area near Fish River gorge, *Kanis 1761*, 8 June 1974 (CANB, NT 53962).

subsp. **grandior** *Carolín*, subsp. nov.

Haec subspecies differt a typo bracteis foliosioribus et corolla 15–18 mm longa.

HOLOTYPE: WESTERN AUSTRALIA: Hidden Valley 3.2 km E of Kununurra, East Kimberley, *Kenneally 1909*, 3 Aug. 1974 (PERTH).

Leaves obovate to oblong, 12–55 mm long, 3–17 mm wide, obtuse, broadly sessile, tomentose. *Bracts* obovate, 11–22 mm long, 6–10 mm wide, leaf-like. *Bracteoles* lanceolate, 5–9 mm long, 0.5–1 mm wide. *Sepals* connate into an undulate tube c. 0.3 mm long, fringed by sparse simple small hairs. *Corolla* blue, 15–18 mm long, moderately densely hairy outside with long slender antrorse hairs; barbulae papillate, long and distinct; lobes 5–6.5 mm long, 1–1.2 mm wide; wings 0.6–1 mm wide. *Stamen* filaments 5 mm long; anthers 1.5 mm long. *Ovary* c. 1.6 mm long; style c. 14 mm long, pilose with very long patent hairs; indusium c. 2 mm wide, with long slender hairs on posterior side near base, with long bristles on lips. *Fruit* 5 mm long.

RANGE: Kununurra to the junction of the Hann and Fitzroy Rivers in Gardner and Fitzgerald Regions of Western Australia.

DISCUSSION: This subspecies differs from the type in having more leaf-like bracts, a larger corolla with longer and more distinct barbulae, generally larger floral parts and the longer more distinct hairs on the indusium.

SELECTED SPECIMENS EXAMINED (11): WESTERN AUSTRALIA: Hidden Valley, Kununurra, *Ollerenshaw 1674*, 31 May 1975 (CBG 7703666, SYD); Emu Creek E of Kununurra, *Symon 12122*, 19 May 1980 (ADW 54895, SYD); near junction of Hann and Fitzroy Rivers, *Fitzgerald 1173*, June 1905 (PERTH).

The flowers, in particular, are larger than those of the type variety and from this I have taken the varietal epithet. Latin, *grandior* = larger.

Scaevola revoluta R. Br., Prodr.: 586 (1810).

LECTOTYPE: NORTHERN TERRITORY: Carpentaria Islands, R. Brown, 20 & 21 Oct. 1802 (BM). **ISOLECTOTYPES:** K, NSW.#

There are two collections on the lectotype sheet which are virtually indistinguishable from each other.

Scaevola revoluta R. Br. subsp. *revoluta* var. *viscida* *Carolín*, var. nov.

Differt typo indumento glanduloso.

HOLOTYPE: NORTHERN TERRITORY: Barkly Tableland, Nicholson River area near Dry Creek Gorge in China Wall, *Kanis 1815*, 11 June 1974 (NT 53933).

Differs from the type variety in the very few long simple hairs, which may be quite absent, and the very dense viscid glandular indumentum.

SPECIMEN EXAMINED: QUEENSLAND: 8 miles (12.8 km) SW of Calvert Hills on Creswell Downs Road, *Carolin 9260*, 14 May 1974 (SYD).

***Scaevola revoluta* subsp. *stenostachya* (W. Fitzg.) *Carolin*, stat. nov.**

BASIONYM: *Scaevola stenostachya* W. Fitzg., J. Roy. Soc. W. Australia 3: 215 (1918).

HOLOTYPE: WESTERN AUSTRALIA: Near Isdell River, between Isdell Range and Graces Knob, *W. Fitzgerald 880* (NSW).

Merkusia glandulifera DC. var. *eglandulosa* Vriese, Nederl. Kruidk. Arch. 2: 166 (1851) = *Scaevola glandulifera* DC.

LECTOTYPE: the type of *Scaevola rufa* Vriese (see below).

***Scaevola rufa* Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 405 (1845) = *S. glandulifera* DC.**

LECTOTYPE: WESTERN AUSTRALIA: In calculus inter frutices sylvae ad radices jugi montium Darlings Ranges, Perth, *Preiss 1513*, 23 Sept. 1839 (LD 0471). ISOLECTOTYPES: L 903,311-. . .346, P, W.*

Vriese cites *Preiss 1513* under both *Merkusia anchusifolia* and *Merkusia glandulifera* in *Natuurk. Verh. Holl. Maatsh. Wetensch. Haarlem ser. 2 10: 67* (1854).

***Scaevola glandulifera* DC. var. *tenuis* E. Pritzl, Bot. Jahrb. Syst. 35: 570 (1905) = *S. glandulifera* DC.**

LECTOTYPE: WESTERN AUSTRALIA: In district Avon in collibus apertis a Moore River, *Pritzl 739*, flor. m. oct. (AD). ISOLECTOTYPES: B (destroyed), K, W.*

***Scaevola holosericea* Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 408 (1845).**

LECTOTYPE: WESTERN AUSTRALIA: In arenosis sylvae ad montem Eliza mountain Perth, *Preiss 1478*, 23 Sept. 1839 (LD 0472). ISOLECTOTYPES: L 909,62. . .321, L 903,311-. . .353, L 903,311-. . .354, MEL, W.*

***Scaevola sphaerocarpa* Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 409 (1845) = *S. anchusifolia* Benth.**

LECTOTYPE: WESTERN AUSTRALIA: In arenosis prope urbiculam Fremantle, *Preiss 1512*, 14 Dec. 1838 (LD 0486). ISOLECTOTYPES: L 909,62. . .318, MEL, P, W.*

***Scaevola eneabba* *Carolin*, sp. nov.**

Frutex pilis antrorsis rigidis. Folia lineari-oblongata ad 30 mm longa crassa. Bractae lanceolatae ciliatae ad 8 mm longae; bracteolatae angustiores ac plus minusve breviores. Corolla c. 9 mm longa extus pilis longis patulis stramineis. Ovarium pilis longis simplicibus albis patulis conferte obtectum.

HOLOTYPE: WESTERN AUSTRALIA: 40 mls (64 km) from Eneabba, *Humphreys*, 15 Oct. 1964 (PERTH).

Erect undershrub to 50 cm, with short antrorse simple hairs. *Leaves* thick, linear-oblongate, to 30 mm long, to 1.5 mm wide, entire, obtuse. *Flowers* in terminal spikes to 25 mm long; bracts lanceolate, to 8 mm long, c. 1 mm wide, ciliate; bracteoles similar to bracts but narrower and slightly shorter. *Sepals* deltoid, c. 1 mm long. *Corolla* (colour unknown) c. 9 mm long, pubescent outside with long stiff brownish simple hairs towards top and minute scattered

simple hairs all over, pubescent inside on lobes and in throat; barbulae few, papillate; lobes narrow-elliptic, c. 6 mm long, c. 1 mm wide; wings c. 1.5 mm wide. *Stamen* filaments c. 4 mm long; anthers c. 1 mm long, truncate-emarginate. *Ovary* covered with dense long spreading white simple hairs, 2-locular; style 7–8 mm long, pubescent with long hairs; indusium c. 1 mm long, with a few scattered hairs; bristles on lips widely spaced, weak. *Fruit* 2-locular; mature fruit not seen.

RANGE: Known only from the type collection.

DISCUSSION: Probably related to *S. anchusifolia* but the hairs on the ovary distinguish it.

Named for the locality of the type, which is an Aboriginal word and therefore indeclinable.

Scaevola longifolia Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 410 (1845) = *S. lanceolata* Benth.

LECTOTYPE: WESTERN AUSTRALIA: In solo limoso planitie ad fluvium Vasse River, Sussex, *Preiss 1472*, 7 Dec. 1839 (LD 0474). **ISOLECTOTYPES:** L 903,311-. . .398, L 903,-311. . .394, MEL, P, W. (see *S. virgata*).

Scaevola virgata Carolín, sp. nov.

Suffrutex virgatus perennis ad 45 cm. Folia linearia ad oblanceolata ad basim caulis amplectentia et pilis longis strictis vel tortuosis obtectis. Sepala in tubo connata margine sinuato vel truncato. Corolla alba vel coerulescens pallide 5–8 mm longi pilis sparsis extus obtectis plus minusve glabris ad basim. Fructus globuloso-cylindricus duobus loculis sterilibus et duobus loculis foecundis grandioribus.

HOLOTYPE: WESTERN AUSTRALIA: Between Northampton and Geraldton, *Ashby 1026*, 23 Aug. 1964 (AD 96523133). **ISOTYPE:** SYD.

Tufted usually much branched perennial subshrub to 45 cm. *Stems* terete, villous. *Leaves* linear to oblanceolate, 2–6 cm long, 3–8 mm wide, acute, mostly broadened and ± stem-clasping at base, entire to dentate, covered with ± dense long fine straight to tortuous hairs. *Inflorescence* a terminal or rarely axillary spike; bracts ovate to narrow-ovate, 4–27 mm long, 2–5 mm wide, acute to very acuminate, ± stem-clasping, covered with long fine straight hairs especially on margins and inner surface; bracteoles narrow-lanceolate, 3–6 mm long, 0.5–1 mm wide. *Sepals* connate into a sinuate or truncate rim, 0.25 mm long, glabrous. *Corolla* white to pale blue, 5–8 mm long, covered outside with ± sparse fine hairs, with sparse simple hairs inside; barbulae papillate and simple; lobes 2.5–4 mm long, 0.5–1 mm wide, apiculate above wings; wings 0.5–1 mm wide, obtuse to truncate. *Stamen* filaments 1.5 mm long; anthers 0.5 mm long, truncate. *Ovary* broad-ellipsoid, to 1 mm long, glabrous, 2-locular; style 3–4 mm long, covered with long fine hairs; indusium c. 1 mm wide with sparse short hairs at base and ± dense marginal bristles to 0.2 mm long. *Fruit* globular-cylindrical, c. 3 mm long, 2 mm wide, rugose, glabrous, with 2 locules containing seeds and 2 smaller sterile locules; endocarp bony, thick; mesocarp spongy, thin.

RANGE: Ogilvie Plains to Watheroo in southern Irwin and northern Drummond districts of Western Australia.

HABITAT: Scrubs or heath on rocky soils.

DISCUSSION: This species seems close to *S. lanceolata* and this name has indeed been applied to it. However the type of *S. lanceolata* is clearly not conspecific with it. The indumentum of *S. virgata* is finer, the hairs on the corolla are much less dense and even tending to be absent altogether from the base. *S. longifolia* is the name which has been most generally applied to it in the past but the type of that species is a specimen of *S. lanceolata*.

SELECTED SPECIMENS EXAMINED (34): WESTERN AUSTRALIA: Ogilvie Plains, *Blackall 4502*, 30 Aug. 1940 (PERTH); Northampton, *Carolin 3240*, 28 Aug. 1961 (SYD); Mt Sewell near Oakabella, *Green 445*, 11 Aug. 1956 (PERTH); 20 miles (32 km) N of Geraldton, *Newbey 2188*, 28 Aug. 1965 (PERTH); 10 miles (16 km) E of Geraldton, *Shaw 591*, 1 Oct. 1966 (AD 96832196); 27 miles (43.2 km) SE of Walkaway on Burma Road, *George 7853*, 4 Sept. 1966 (PERTH); Coorow-Carnamah, *Beard 1954*, 25 Sept. 1962 (PERTH); 14 miles (22.4 km) N of Badgingarra, *George 6729*, 13 Aug. 1965 (PERTH); Dinner Hill, c. 30 miles (48 km) W of Watheroo, *Carolin 3400*, 1 Sept. 1961 (SYD).

Named for the habit. Latin, *virgatus* = twiggy.

Scaevola suaveolens R. Br., Prodr.: 585 (1810) = *S. calendulacea* (Kennedy) Druce.

LECTOTYPE: NEW SOUTH WALES: Botany Bay, *R. Brown* (BM).# All the collections made by Brown fit his description quite well but only this one has a ripe fruit from which he could have determined it was a "berry".

***Scaevola spicigera* Carolin, sp. nov.**

Frutex expansus ad 50 cm pilis mollibus sericeis et glandulosis parvis obtectus. Folia oblongo-elliptica anguste 35–60 mm longa pilis sericeis in axillis. Flores in thyrsi spiciformes numerosi dispositi. Corolla alba 5–6 mm longa. Ovarium loculo uno. Indusium setis brevissimis in labiis dispositis. Fructus oblongus rugosus costatus plerumque semene solitario.

HOLOTYPE: WESTERN AUSTRALIA: 79 miles (126.4 km) S of Learmonth, *George 2399*, 2 June 1961 (PERTH).

Low spreading ± silky hairy shrub to 50 cm. *Leaves* narrow-oblong-elliptic to oblanceolate, 35–60 mm long, 3–8 mm wide, often more densely hairy below, entire, acute, tapering gradually towards base with a conspicuous tuft of silky axillary hairs. *Flowers* arranged in numerous spike-like axillary thyrses to 20 cm long; bracts leaf-like but smaller; bracteoles lanceolate, 4–6 mm long, to 2 mm wide, c. ½ as long as flowers or longer. *Sepals* reduced to a minute sinuate rim. *Corolla* white, 5–6 mm long, pubescent outside with ± appressed simple hairs, pubescent in throat; barbulae simple, scarcely distinguishable from hairs; lobes oblong-elliptic, c. 2.5 mm long, c. 0.5 mm wide; wing <0.5 mm wide, lacinate; connate part of lobes 2.5–3.5 mm long. *Stamen* filaments linear, c. 1 mm long; anthers oblong, c. 0.5 mm long. *Ovary* obovoid, pubescent, 1-locular except at base, with 2 ovules; style 2–2.5 mm long, glabrous except at base; indusium semi-orbicular, 0.5–1 mm long, glabrous except for a few short hairs close to base and very short bristles on lips. *Fruit* cylindrical, 3 mm long, pubescent, ribbed, rugose, usually with a single seed; epicarp very thin, dry, brown; endocarp thin.

RANGE: Vlaming Peninsula of Western Australia.

HABITAT: In *Triodia* grassland on red sandy soils.

DISCUSSION: Similar to *S. canescens* but the simple hairs are much less dense and accompanied by glandular ones. The inflorescences are more spike-like with longer internodes and the axillary hairs are silky and separate rather than woolly and felted.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: 10 miles (16 km) E of Ningaloo HS., *George 10235*, 4 Oct. 1970 (PERTH); Learmonth Road, 44 miles (70.4 km) S of Bullara turnoff, *George 3287*, 22 Nov. 1962 (PERTH); Cardabia Station turnoff on Learmonth Road, *Beard 3536*, 20 Aug. 1964 (PERTH); \pm 55 miles (88 km) N of Minilya River on road to Learmonth, *George 1434*, 31 Aug. 1960 (PERTH).

Named for the spike-like inflorescences. Latin, *spica* = spike, *-ger* = bearing.

Scaevola glaucescens Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 410 (1845) = *S. canescens* Benth.

LECTOTYPE: WESTERN AUSTRALIA: In arenosis prope urbiculam Perth, *Preiss 1477*, 15 April 1839 (LD 0463). ISOLECTOTYPES: K, L 903,311-...326, L 903,311-...327, MEL 1521288, P, W.*

Scaevola trinervis Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 407 (1845) = *S. canescens* Benth.

LECTOTYPE: WESTERN AUSTRALIA: In arenosis umbrosis sylvae prope lacum Keremulu, *Preiss 1479*, 16 Aug. 1839 (LD 0464). ISOLECTOTYPES: K, MEL.*

Scaevola sericophylla F. Muell. ex Benth., Fl. Austral. 4: 102 (1868).

LECTOTYPE: WESTERN AUSTRALIA: Murchison River, *Oldfield* (K).# There are two sheets at K, both labelled apparently by Mueller, one as *S. sericophylla* and the other as *S. oldfieldii* var. *sericophylla*. Both are also annotated by Bentham. One only, however, is clearly labelled "Murchison River". It is this specimen which is selected as the lectotype.

Scaevola repens Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 406 (1845).

LECTOTYPE: WESTERN AUSTRALIA: In arenosis sylvae prope urbiculam Perth, *Preiss 1519*, 20 Oct. 1839 (LD 0480). ISOLECTOTYPES: L 903,311-...415, L 903,311-...414, MEL, P, W.

Scaevola repens Vriese var. *angustifolia* Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 406 (1845).

LECTOTYPE: WESTERN AUSTRALIA: In arenosis umbrosis ad fl. Cygnorum, *Preiss 1493*, June 1839. The only sheet of this collection which has so far been located is LD 0480.

Scaevola oldfieldii F. Muell., Fragm. 2: 19 (1860).

LECTOTYPE: WESTERN AUSTRALIA: In campis arenosis et clivis rupestris ad flumen Murchison, *A. Oldfield* (MEL). Isolectotypes: MEL, K. There are two specimens at MEL which are candidates for the type, but only one is labelled as collected by Oldfield. This is selected as the lectotype.#

Scaevola humifusa Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 410 (1845).

LECTOTYPE: WESTERN AUSTRALIA: In solo sublimoso-arenoso planitie ad flumen Avon River, *Priess 1480*, 10 Sept. 1839 (LD 0473). ISOLECTOTYPES: L 903,311-...356, L 903,311-...358, MEL, P, W.*

Scaevola depressa Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 410 (1845).

LECTOTYPE: WESTERN AUSTRALIA: In regionibus interioribus Australiae meridionali-occidentalis, *Preiss 1502*, Nov. 1840 (LD 0467). ISOLECTOTYPE: L 909,62-...719 (pro parte). The specimen at LD is so poor that an identification is practically impossible. The sheet in L has three pieces mounted on it and two labels, i.e., *Preiss 1505* and *Preiss 1502*, the latter contained in an otherwise empty cellophane packet. It is not possible to determine which specimen belongs to which label. One specimen is *S. humifusa* and the other is *S. longifolia*.

Scaevola humifusa var. *pulvinaris* E. Pritzel, Bot. Jahrb. Syst. 35: 572 (1905) = *S. pulvinaris* (E. Pritzel) K. Krause.

HOLOTYPE: WESTERN AUSTRALIA: Bei Cranbrook an feuchten Plätzen auf Kahlen Flächen, *Diels 4403*, flor sept. (B-destroyed). NEOTYPE: 28.5 miles (45.6 km) N of Ravensthorpe, *George 314*, 13 Sept. 1959 (PERTH).

Scaevola arenaria E. Pritzl, Bot. Jahrb. Syst. 35: 572 (1905) = *S. humifusa* Vriese

LECTOTYPE: WESTERN AUSTRALIA: Hab. in distr. Avon pr. Tammin in arenosis apertis aridis, *Pritzl 754*, Oct. 1839 (K). ISOLECTOTYPES: BM, W.#

Scaevola globosa (*Carolin*) *Carolin*, comb. nov.

BAIONYM: *Nigromnia globosa* *Carolin*, *Nuytsia* 1: 292 (1974).

See above.

Scaevola linearis *R. Br.*, Prodr.: 586 (1810).

LECTOTYPE: SOUTH AUSTRALIA: Bay X, South Coast, *R. Brown* (BM). ISOLECTOTYPE: K.*

Scaevola linearis *R. Br.* subsp. *confertifolia* (*J. Black*) *Carolin*, comb. nov.

BAIONYM: *Scaevola linearis* *R. Br.* var. *confertifolia* *J. Black*, Fl. S. Australia. ed. 1: 565 (1929).

LECTOTYPE: SOUTH AUSTRALIA: Kangaroo Island, *J.B. Cleland*, 16 Nov. 1924 (AD). ISOLECTOTYPE: ?K.

Scaevola paludosa *R. Br.*, Prodr.: 586 (1810).

LECTOTYPE: WESTERN AUSTRALIA: Bay I, South Coast, *R. Brown*, 12 Jan. 1802 (BM)#. A specimen at K is dated 11 Jan. and is thus probably not strictly an isolectotype.

Scaevola ovalifolia *R. Br.*, Prodr.: 584 (1810).

LECTOTYPE: NORTHERN TERRITORY: Carpentaria, *R. Brown* (BM). ISOLECTOTYPE: MEL.*

Brown recognized two variations in this species. Specimens of both α and β are mounted on the same sheet at BM but there is no difficulty in distinguishing the glabrous form from the hairy one. *S. ovalifolia* α *cinerascens* is taken as the type to conform with current use. β *glabra* is now included under *S. glabrata* *Carolin*.

Scaevola glutinosa *Carolin*, sp. nov.

Frutex erectus plerumque viscidus ad 70 cm pilis glandulosis simplicibusque patentibus longis. Folia obovata dentata sessilia. Bractee minores. Bracteolae circa 1/4-plo longiore quam corolla. Corolla 14–24 mm longa. Indusium basi breviter barbatur. Ovarium duabus loculis.

HOLOTYPE: QUEENSLAND: Granada, about 50 miles (80 km) N of Cloncurry, *Everist 5225*, 11 April 1954 (BRI 231469).

Erect, \pm spreading usually viscid shrub to 70 cm high, pubescent with soft patent simple hairs and patent glandular hairs usually as long as the simple ones. *Leaves* obovate, 20–68 mm long, 6–26 mm wide, dentate, with an acute tooth at apex, sessile and at least upper ones broad and almost stem-clasping at base, pubescent as stems. *Flowers* in terminal spikes which elongate in fruiting stage to 12 cm long; bracts smaller than leaves, ovate-elliptic, to 15 mm long, slightly smaller towards top, dentate or entire, acute-acuminate; bracteoles linear-lanceolate, 7–11 mm long, c. 1/4 as long as corolla. *Sepals* connate into a sinuate rim 0.5–1 mm long. *Corolla* blue 14–24 mm long, pubescent outside with patent hairs, tomentose in throat; barbulae simple; lobes narrow-ovate, 6–11 mm long, to 1.7 mm wide; wings to 10 mm wide; connate part of corolla

8–13 mm long. *Stamen* filament 2–3 mm long; anthers narrow-oblong, 1–2 mm long, obtuse or truncate. *Ovary* pubescent with fine mostly simple hairs, 2-locular to top, 1.5–30 mm long; style 5–8.5 mm long, usually with a few scattered hairs; indusium depressed-obovate to 2 mm long, to 2.5 mm wide, glabrous below or with a few scattered long hairs, with a sparse beard of a few white bristles less than or scarcely equalling bristles on lips above. *Fruit* cylindrical, 4–6 mm long, \pm pubescent, rugose with 2 fertile locules and 2 small sterile cavities; mesocarp green, dry, thin; endocarp hard, woody.

RANGE: Northern Queensland in Cloncurry region.

HABITAT: Frequently on limestone.

DISCUSSION: The long viscid glandular hairs together with the patent simple hairs, the sparse short beard on the back of the indusium and the \pm stem-clasping upper leaves distinguish this species from other members of series *Pogogyneae*. The flowering spikes are more compact than most other species of this Section and the transition from leaves to bracts is more abrupt.

SELECTED SPECIMENS EXAMINED (11): QUEENSLAND: Digby Peaks Range, *Purdie 1047*, 10 Sept. 1977 (BRI 232747); 2 miles (3.2 km) S of Duchess, *Ollerenshaw & Kratzing 1249*, 6 Aug. 1974 (CBG 058322, BRI 201263); 32 miles (51.2 km) E of Cloncurry, *Lazarides 4071*, 9 Sept. 1953 (BRI 017290, CANB, NT 18784); "Sutherland" 60 miles (96 km) NW of Maxwelton, *Nelson & Entwistle 14*, 24 April 1963 (BRI 039198).

The specific epithet refers to the stickiness of the plant. Latin, *glutinosus* = glutinous, sticky.

***Scaevola densifolia* Carolin, sp. nov.**

Suffrutex prostratus pubescens. Folia oblanceolata 8–30 mm longa semper fasciculata. Flores in spicis foliosis. Bracteolae ad $\frac{1}{2}$ -plo longiores quam corolla instructus. Fructus late ovoideus gibbosus ac seriebus duabus tuberculorum.

HOLOTYPE: WESTERN AUSTRALIA: Hamersley River, *Allan 180*, 8 Nov. 1969 (PERTH). ISOTYPE: SYD.

Prostrate undershrub to 40 cm, pubescent with very short simple patent hairs and some longer ones. *Leaves* oblanceolate, 8–30 mm long, 2–9 mm wide, entire or sometimes with a prominent tooth on either side, mostly obtuse, tapering towards the base, often fasciculate in axils. *Flowers* in leafy spikes, sessile between the bracteoles; peduncles to 2 mm long; bracteoles linear, 5–7 mm long, c. 5 mm wide, to $\frac{1}{2}$ as long as corolla. *Sepals* triangular, to 2.5 mm long, connate into a tube to 0.5 mm long, sericeous. *Corolla* white or cream, 7–17 mm long, densely pubescent outside with coarse simple appressed hairs towards top becoming smaller and less appressed below, tomentose in throat; barbulae few, thin, simple, scarcely distinguishable from the hairs; lobes narrow-oblong-elliptic, 3–6 mm long, to 1.5 mm wide; wing to 1 mm wide; connate part of corolla 6–11 mm long. *Stamen* filament 2–4 mm long; anthers narrow-oblong, 1–2 mm long, truncate. *Ovary* pubescent, 2-locular, 1.5–3 mm long; style glabrous, 3–6 mm long; indusium semi-orbicular to semi-elliptic, 1–2 mm long, 1.5–2.5 mm wide, with a few short hairs at base on the upper surface not exceeding bristles on lips. *Fruit* broad-ovoid, 3–4 mm long, with two large lateral protuberances and a band of tubercles on posterior and anterior surface, pubescent with 2 fertile locules and 2 sterile cavities which almost join across the septum.

RANGE: Eyre Region of Western Australia.

DISCUSSION: Previously misplaced in *S. paludosa*. The fruit with two lateral protuberances and two bands of tubercles is unique in the genus.

SELECTED SPECIMENS EXAMINED (9): WESTERN AUSTRALIA: c. 58 km N of Oldfield River, *Eichler 20391*, 21 Oct. 1968 (AD 97018210, CANB, PERTH); West River, *Newbey 1726*, 13 Dec. 1964 (PERTH); Ravensthorpe, *Gardner*, Nov. 1944 (PERTH); Hamersley River, *George 1971*, 2 Dec. 1960 (PERTH); Fitzgerald River, *George 10561*, 19 Nov. 1970 (PERTH).

Named for the leaves which are crowded on the lateral branches. Latin, *densus* = dense, *-folium* = leaved.

***Scaevola aemula* R. Br., Prodr.: 584 (1810).**

LECTOTYPE: SOUTH AUSTRALIA: Bay X, South Coast, *R. Brown*, 1802 (BM). ISOLECTOTYPES: K, MEL.*

Scaevola sinuata R. Br., Prodr.: 584 (1810) = ? *S. aemula* R. Br.

LECTOTYPE: WESTERN AUSTRALIA: Goose Island Bay, *R. Brown*, May 1803 (BM). ISOLECTOTYPES: K, MEL.*

***Scaevola humilis* R. Br., Prodr.: 585 (1810).**

LECTOTYPE: SOUTH AUSTRALIA : Inlet XII, South Coast, *R. Brown* (BM). ISOLECTOTYPE: K.*

***Scaevola pallida* R. Br., Prodr.: 585 (1810).**

LECTOTYPE: VICTORIA: In campis graminosis Port Phillip, *R. Brown*, 25–28 Jan. 1804 (BM).#

Brown's protologue in the Prodrumus only indicates that the species was collected along the southern coast of Australia. There are at least two collections corresponding to Brown's manuscript description, the lectotype and one at K labelled Port Phillip, *R. Brown*, May 1802.

***Scaevola auriculata* Benth., Fl. Austral. 4: 99 (1868).**

LECTOTYPE: WESTERN AUSTRALIA: *Drummond 3rd coll. no. 153* (K). ISOLECTOTYPES: BM, MEL.#

There are two sheets at K bearing collections with this number, one bears a specimen of no. 153, the other bears a specimen of no. 157 as well. The lectotype is the sheet bearing the single collection.

Molkenboeria microphylla Vriese, Natuurk. Verh. Holl. Maatsch. Wetensch. Haarlem ser. 2 10: 44 (1854) = ***Scaevola microphylla* (Vriese) Benth.**

LECTOTYPE: WESTERN AUSTRALIA: ad flum. Cygn., *Drummond* (K). ISOLECTOTYPES: L 909,62. ...566, LD 0487.

Since Vriese cites "Herb. Hook." in the protologue, the specimen at K is selected as lectotype.

Molkenboeria macrophylla Vriese, Natuurk. Verh. Holl. Maatsch. Wetensch. Haarlem ser. 2 10: 44 (1854) = ***Scaevola macrophylla* (Vriese) Benth.**

HOLOTYPE: WESTERN AUSTRALIA: Nov. Holl. ad fl. Cygn. Spec. Drummondii (K).

***Scaevola platyphylla* Lindley, Sketch Veg. Swan R.: 26 (1839).**

This name was published on 1 December 1839. *Scaevola semiamplexicaulis* DC., Prodr. 7: 509 (1839) was published in 'late December'. The former name thus has priority by a few weeks.

Scaevola candollei Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 405 (1845) = *S. platyphylla* Lindley.

LECTOTYPE: WESTERN AUSTRALIA: In confragosis jugi montium Darling's Range Perth, Preiss 1497, Sept. 1841. (L 909,62. . .569). ISOLECTOTYPE: MEL 1521496.

Taxa here excluded from *Scaevola*

Typification of those species to be transferred to *Goodenia* will appear in the corresponding paper on *Goodenia*.

Scaevola umbellata Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 411 (1845) = ***Goodenia pulchella*** Benth.

LECTOTYPE: WESTERN AUSTRALIA: In humidis umbrosis prope urbiculum Perth, Preiss 1435a, 25 March 1839 (LD 0451). ISOLECTOTYPE: W. The species is clearly treated differently from its variations by Vriese and must thus be recognised as a separate taxon from any of them. # The variations given below are not designated as varieties by Vriese and therefore have no taxonomic status.

α procumbens Vriese, op. cit.: 412

SPECIMEN CITED: WESTERN AUSTRALIA: In arenosis aridis prope villam ccl. Andrews ad flum. Cygnorum, Preiss 1451, 2 Feb. 1839 (LD 0451 mounted on the same sheet as the type of the species).

β denticulata Vriese, op. cit.: 412

SPECIMEN CITED: WESTERN AUSTRALIA: In arenosis prope urbiculum Freemantle, Preiss 1428, 26 Dec. 1839 (LD 0452). DUPLICATES: G, L 903,311-. . .251, L 903,311-. . .252, W.*

γ spathulata Vriese, op. cit.: 412

SPECIMEN CITED: WESTERN AUSTRALIA: In solo sublimoso-arenoso Peninsulae Perth, Preiss 1430, 15 May 1839 (LD 0452 mounted on the same sheet as a specimen of β *denticulata*). DUPLICATES: G, L 903,311-. . .252, L 903,311-. . .253, W.*

Scaevola tenera Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 409 (1845) = ***Goodenia coerulea*** R. Br.

LECTOTYPE: WESTERN AUSTRALIA: In regionibus interioribus Australiae meridionali-occidentalis, Preiss 1442, Feb. 1841 (LD 0448). ISOLECTOTYPES: G, L 909,62. . .340.* Although Vriese describes var. β (see below), he does not describe a var. α as such.

var. **β pauciflora** Vriese, op. cit.: 409

LECTOTYPE: WESTERN AUSTRALIA: In arenosis districtus Sussex, Preiss 1482, 20 May 1839 (LD 0448). ISOLECTOTYPES: G, L 903,311-. . .240, P, W.#

Scaevola stricta Vriese in J.G.C. Lehmann, Pl. Preiss. 1:408 (1845) = ***Goodenia scapigera*** R. Br.

LECTOTYPE: WESTERN AUSTRALIA: In rupestris ad latera collium Konkoberuphills, Kent, Preiss 1511, 19 Nov. 1840 (LD 0466). ISOLECTOTYPES: G, L 903,311-. . .295, P.* The specimen at W labelled with this number does not seem to belong to Goodeniaceae.

Scaevola pusilla Vriese in J.G.C. Lehmann, Pl. Preiss. 1:412 (1845) = ***Goodenia tenella*** R. Br.

LECTOTYPE: WESTERN AUSTRALIA: In solo humoso humido umbroso ad Eight-mile Bridge, Plantagenet, Preiss 1470, Feb. 1841 (LD 0483). ISOLECTOTYPES: G, L 909,62-. . .385)*

Scaevola pterosperma Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 408 (1845) = ***Goodenia incana* R. Br.**

LECTOTYPE: WESTERN AUSTRALIA: Ad promontorium Cape Riche, *Preiss 1499*, 24 Nov. 1840 (LD 0482). ISOLECTOTYPES: G, L 903,311-...275, MEL 24038, P, W.#

Scaevola reinwardtii Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 409 (1845) = ***Verrauxia reinwardtii* (Vriese) Benth.**

LECTOTYPE: WESTERN AUSTRALIA: In planitie arenosa Quangen, Victoria, *Preiss 1454*, 20 March 1844 (W).*

Scaevola geniculata Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 404 (1845) = ***Goodenia affinis* (Vriese) Vriese.**

LECTOTYPE: WESTERN AUSTRALIA: In rupestribus promontorii Cape Riche, *Priess 1503*, 20 Nov. 1840 (LD 0470). ISOLECTOTYPE: MEL 24312.*

Scaevola verreauxii F. Muell., Bot. Teachings: 65 (1877) ex Index Kewensis 2: 821 (1895) is an error for '*Scaevola* and *Verreauxia*'.

Temminckia macrophylla Vriese, Nederl. Kruidk. Arch. 2: 146 (1851). This is not a member of the Goodeniaceae.

Temminckia microcarpa Nadeaud as cited in Index Kewensis, suppl. 2: 181 (1904) is a mistake and should read *Terminalia microcarpa* Nadeaud.

Taxon of uncertain position

Scaevola lyratifolia Vriese in J.G.C. Lehmann, Pl. Preiss. 1: 405 (1845)

There are no flowers on the specimens and it is not possible, as yet, to determine its correct placement.

LECTOTYPE: WESTERN AUSTRALIA: In saxosis prope catarractam capitis fluvii Cygnorum, *Preiss 1485*, 25 July 1839 (LD 0475). ISOLECTOTYPE: MEL 1521315.

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Appendix 1

Terminal taxa arranged in alphabetical order showing constituent taxa

- ACAC *S. acacioides* is not included since some important data are lacking.
- AEMU *S. aemula*, *S. amblyanthera*, *S. humilis*
- ALBI *S. albida*
- ANCH *S. anchusifolia*, *S. enneaba*
- ANGS *S. angustata*
- ANGU *S. angulata*
- AURI *S. auriculata*, *S. microphylla*
- BASE *S. basedowii*
- BECK *S. beckii*
- BROO *S. brookeana*
- BROW *S. browniana*
- BURS *S. bursariifolia*
- CALE *S. calendulacea*
- CANE *S. canescens*, *S. spicigera*
- CHAM *S. chamissoniana*, *S. gaudichaudiana*, *S. procera*
- CHRY *S. chrysopogon*
- COCC *S. coccinea*
- COLL *S. collaris*
- CORI *S. coriacea*
- CRAS *S. crassifolia*
- CUNE *S. cuneiformis*
- CUNN *S. cunninghamii*
- DENS *S. densifolia*
- DEPA *S. depauperata*
- FRUT *S. sericea*
- GAUD *S. gaudichaudii*
- GLAB *S. glabra*
- GLAT *S. glabrata*
- GLAN *S. glandulifera*
- GLOB *S. globulifera*
- GLUT *S. glutinosa*
- GRAC *S. gracilis*, *S. porrecta*
- GRAM *S. graminea*
- HAMI *S. hamiltonii*
- HOOK *S. hookeri*

HUMI	<i>S. humifusa</i>
KILA	<i>S. kilaueae</i>
LACI	<i>S. laciniata</i>
LANC	<i>S. lanceolata</i>
LINE	<i>S. linearis</i> , <i>S. paludosa</i>
MACR	<i>S. macrostachya</i>
MARQ	<i>S. marquesensis</i>
MOLL	<i>S. mollis</i>
MONT	<i>S. montana</i> , <i>S. indigofera</i> , <i>S. tahitensis</i> , <i>S. floribunda</i>
MYRT	<i>S. myrtifolia</i>
NITI	<i>S. nitida</i>
NIGR	<i>Nigromnia globosa</i>
OPPO	<i>S. oppositifolia</i>
OVAL	<i>S. ovalifolia</i>
OXYC	<i>S. oxyclona</i>
PARB	<i>S. parvibarbata</i>
PARV	<i>S. parvifolia</i>
PAUC	<i>S. pauciflora</i> , <i>S. verticillata</i>
PILO	<i>S. pilosa</i>
PLAT	<i>S. platyphylla</i> , <i>S. macrophylla</i>
PLUM	<i>S. plumieri</i> , <i>S. socrataensis</i> , <i>S. hainanensis</i>
PORO	<i>S. porocarya</i>
PROC	<i>S. procera</i>
PULC	<i>S. pulchella</i>
RACI	<i>S. racimigera</i>
RAMO	<i>S. ramosissima</i>
REPE	<i>S. repens</i> , <i>S. oldfieldii</i>
REST	<i>S. restiacea</i>
REVO	<i>S. revoluta</i>
SERI	<i>S. sericophylla</i>
SPIN	<i>S. spinescens</i>
STRI	<i>S. striata</i> , <i>S. calliptera</i> , <i>S. phlebopetala</i>
SUBC	<i>S. subcapitata</i>
TENU	<i>S. tenuifolia</i>
THES	<i>S. thesioides</i>
TOME	<i>S. tomentosa</i>
TORT	<i>S. tortuosa</i>
VIRG	<i>S. virgata</i>

Appendix 2

List of characters used in the cladistic analysis

1. Shrubs and climbers: 0; undershrubs: 1; multicaulate from a stock: 2.
2. Viscid on young parts: 0; not viscid on young parts: 1.
3. Stems not ribbed: 0; stems ribbed: 1.
4. Cauline leaves normally developed: 0; cauline leaves reduced to triangular 'scales' less than 5 mm long: 1.
5. Leaf base not stem-clasping: 0; leaf base stem-clasping: 1.
6. Simple hairs present: 0; simple hairs absent: 1.
- 7 and 8. Glandular hairs absent: 00; glandular hairs with \pm globular heads: 01; glandular hairs peltate: 02; glandular hairs pseudostellate: 11.
9. Compound thyrse: 0; thyrse reducing to a raceme or spike above: 1; raceme or spike: 2.

10. Inflorescences mostly terminal: 0; inflorescences mostly axillary: 1.
11. Bracts all \pm same size as leaves: 0; bracts reducing in size towards apex: 1; bracts mostly reduced: 2.
12. Bracts without marginal bristles: 0; bracts with marginal bristles: 1.
13. Bracteoles similar to leaves but smaller: 0; bracteoles much smaller than leaves, \pm lanceolate: 1; bracteoles minute: 2.
14. Flowers pedunculate: 0; peduncle almost obsolete: 1.
15. Sepals mostly $>$ 1.5 mm long: 0; sepals $<$ or $=$ 1.5 mm long: 1.
16. Sepals free: 0; sepals connate with distinct lobes sepals: 1; connate into an undulate rim: 2.
17. Corolla not bearded inside: 0; corolla bearded inside: 1.
18. Barbulae broad (mostly 0.2 mm wide or more), flat: 0; barbulae narrow ($<$ 0.2 mm wide) \pm terete: 1.
19. Stiff hairs in place of barbulae: 0 (does not occur in *Scaevola*); barbulae aculeate with stiff hairs: 1; barbulae papillate at top: 2; barbulae simple: 3; barbulae absent: 4.
20. Apex of anther glabrous: 0; apex of anther hairy: 1;
21. Hairs present on lips of indusium: 0; hairs absent from lips of indusium: 1.
- 22, 23 and 24. Indusium with hairs scattered over the upper surface: 000; indusium with a few basal hairs on the upper surface: 010; indusium glabrous on the upper surface: 020; indusium with a stiff erect beard at the base on the upper surface equalling or exceeding the bristles on the lips: 100; indusium with a short flat beard on the upper surface: 200; indusium with a short flat dense beard on upper surface: 101.
25. Mesocarp dry : 0; mesocarp fleshy: 1.
26. Fruit with four fertile locules: 0; fruit with two fertile locules and two sterile locules: 1; fruit with two fertile locules only: 2; fruit with only one fertile locule: 3.
27. Endocarp smooth: 0; endocarp rugose: 1.
28. Fruit glabrous: 0; fruit hairy: 1.
29. Flower pedicillate: 0*; flower sessile in bracteoles: 1.

Appendix 3

Character states of terminal taxa

Outgroup	10000	00110	00000	00000	00000	0000
<i>S. sericea</i>	00000	00100	00100	01010	00001	1100
<i>S. plumieri</i>	00000	00100	00101	11010	00001	1101
<i>S. coriacea</i>	00000	11120	00201	21700	00001	1001
<i>S. kilaueae</i>	00000	11100	00101	20010	00001	1101
<i>S. gaudichaudii</i>	00000	11120	00101	20740	00001	1001
<i>S. chamissoniana</i>	00000	01100	00101	20740	00201	1001
<i>S. mollis</i>	00000	11110	00101	10740	00201	1001
<i>S. spinescens</i>	00000	01121	00101	21120	00001	2001
<i>S. bursariifolia</i>	01000	01120	00111	21120	00001	2001
<i>S. myrtifolia</i>	01000	01120	00101	21120	00201	2001
<i>S. tomentosa</i>	00000	01121	00001	21130	00201	2001
<i>S. montana</i>	00000	00100	00100	01010	00001	1111

<i>S. beckii</i>	00000	00011	20101	00110	00201	1001
<i>S. glabra</i>	00000	10020	00210	01?40	00201	1000
<i>S. coccinea</i>	00000	10020	00210	01?40	00201	1000
<i>S. subcapitata</i>	00000	00000	20210	01?41	00201	1101
<i>S. marquesensis</i>	00000	10000	00100	11?40	00201	1100
<i>S. racimigera</i>	00000	00020	20211	01120	00001	1001
<i>S. pauciflora</i>	00010	00?20	20211	01120	00011	1001
<i>S. oppositifolia</i>	00000	10100	01000	01030	01001	111
<i>S. hookeri</i>	20000	10110	00100	00030	01010	211
<i>S. ramosissima</i>	20000	10110	00100	00021	01010	211
<i>S. pilosa</i>	20000	10110	00100	01021	01010	211
<i>S. tenuifolia</i>	20000	10110	00110	10121	01010	111
<i>S. striata</i>	20000	10110	00100	01021	01010	211
<i>S. restiacea</i>	20110	10010	10210	01020	01010	211
<i>S. chrysopogon</i>	20110	10110	10210	01020	01000	211
<i>S. oxyclona</i>	20010	10010	10110	01020	01000	211
<i>S. hamiltonii</i>	20110	10110	10110	01120	01000	211
<i>S. tortuosa</i>	20110	10110	10200	01120	00000	211
<i>S. basedowii</i>	20110	10110	10200	11130	01000	211
<i>S. parvifolia</i>	20010	10110	10210	01130	01000	211
<i>S. depauperata</i>	20110	10110	10200	11130	01000	211
<i>S. angulata</i>	20110	10010	00010	01130	00100	210
<i>S. pulchella</i>	20000	10120	10111	01120	00100	211
<i>S. collaris</i>	20000	00020	00211	00020	00200	210
<i>S. crassifolia</i>	01000	00220	20111	20120	00200	100
<i>S. angustata</i>	01000	00220	20111	21120	00200	200
<i>S. nitida</i>	01000	10220	20111	21120	00200	100
<i>S. thesioides</i>	11000	10220	20111	21120	00200	100
<i>S. globulifera</i>	11000	00220	10111	21120	00100	210
<i>S. porocarya</i>	01000	00220	10111	21120	00100	000
<i>S. cunninghamii</i>	01000	10220	10101	21120	00100	100
<i>S. browniana</i>	10000	10120	10111	21120	10100	210
<i>S. revoluta</i>	11000	10120	21111	20120	10100	210
<i>S. macrostachya</i>	10000	10020	11111	20120	00100	210
<i>S. glandulifera</i>	10000	10120	11111	21120	00100	210
<i>S. anchusifolia</i>	20000	10120	11111	11120	00100	210
<i>S. lanceolata</i>	20000	10120	20111	21120	00100	210
<i>S. virgata</i>	20000	10120	20011	20120	00100	210
<i>S. gracilis</i>	20000	10120	10110	00020	10001	210
<i>S. calendulacea</i>	20000	10120	10111	21120	10001	210
<i>S. canescens</i>	20000	10121	10111	20130	10100	311
<i>S. sericophylla</i>	00000	10121	10111	20130	10100	310
<i>S. repens</i>	20000	10121	10111	21130	10100	310
<i>S. brookeana</i>	00001	00200	00211	01120	00000	110
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<i>S. humifusa</i>	20000	10021	10111	01120	10100	310
<i>S. albida</i>	20000	10020	00111	01120	12010	311
<i>S. parvibarbata</i>	20000	10020	00111	01120	02010	211
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<i>S. glutinosa</i>	20001	10120	00111	21130	02000	211
<i>S. densifolia</i>	20000	10120	00111	11130	01000	211

<i>S. cuneifolia</i>	20000	10120	00010	01120	01000	211
<i>S. aemula</i>	20000	10120	00011	01130	01000	211
<i>S. graminea</i>	20000	00020	00011	01130	01000	211
<i>S. laciniata</i>	20000	00120	00011	11130	01000	211
<i>S. microphylla</i>	20001	10120	00111	01120	01000	211
<i>S. auriculata</i>	20001	10120	00111	01120	01000	211
<i>S. platyphylla</i>	20001	10120	00110	01130	01000	211
<i>Nigromnia globosa</i>	00000	10121	10111	20130	10100	310

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Nomenclatural notes and new taxa in the genus *Goodenia* (Goodeniaceae)

Roger Carolin

Abstract

Carolin, Roger (John Ray Herbarium, University of Sydney, Australia 2006). 1990. Nomenclatural notes and new taxa in the genus *Goodenia* (Goodeniaceae). *Telopea* 3(4):517-570. — Lectotypifications of a number of taxa in *Goodenia* are made and discussions of holotypes provided where necessary. The genera *Calogyne*, *Catospermum*, *Neogoodenia* and *Symphyobasis* are reduced to synonyms of *Goodenia* and the necessary new combinations are made. Forty-three taxa are described as new, i.e., *G. arachnoidea*, *G. arenicola*, *G. argillacea*, *G. bellidifolia* subsp. *argentea*, *G. berringbinensis*, *G. byrnesii*, *G. campestris*, *G. convexa*, *G. chthonocephala*, *G. delicata*, *G. drummondii*, *G. durackiana*, *G. fordiana*, *G. glareicola*, *G. gloeophylla*, *G. heterophylla* subsp. *eglandulosa*, *G. heterophylla* subsp. *montana*, *G. integerrima*, *G. janamba*, *G. kakadu*, *G. kingiana*, *G. leioperma*, *G. lyrata*, *G. macbarronii*, *G. malvina*, *G. muelleriana*, *G. nigrescens*, *G. ochracea*, *G. pallida*, *G. paludicola*, *G. pascua*, *G. potamica*, *G. perryi* Gardner ex Carolin, *G. phillipsiae*, *G. prostrata*, *G. racemosa* var. *latifolia*, *G. redacta*, *G. sepalosa* var. *glandulosa*, *G. tripartita*, *G. viridula*, *G. viscidula*, *G. watsonii* subsp. *glandulosa*, *G. willisiana*. The rank of three taxa is changed, i.e., *G. brachypoda* (F. Muell.) Carolin, *G. hederacea* subsp. *alpestris* (Krause) Carolin, *G. heterophylla* subsp. *teucrifolia* (F. Muell.) Carolin. Sixteen new combinations are made as follows. Transferred from *Calogyne*: *G. heteroptera* (F. Muell.) Carolin, *G. heppliana* (W. Fitzg.) Carolin, *G. holtzeana* (Specht) Carolin, *G. neglecta* (Carolin) Carolin, *G. pilosa* (R. Br.) Carolin, *G. porphyrea* (Carolin) Carolin, *G. purpurea* (F. Muell.) Carolin, *G. quadrifida* (Carolin) Carolin, *G. symonii* (Carolin) Carolin. Transferred from *Catospermum*: *G. goodeniacea* (F. Muell.) Carolin. Transferred from *Scaevola*: *G. helmsii* (E. Pritzel) Carolin, *G. fasciculata* (Benth.) Carolin. Transferred from *Neogoodenia*, with a new specific epithet: *G. neogoodenia* Carolin. Transferred from *Symphyobasis*: *G. macropectra* (F. Muell.) Carolin. Transferred from *Velleia*: *G. cusackiana* (F. Muell.) Carolin, *G. salmoniana* (F. Muell.) Carolin. A new name, *G. krauseana*, is provided for *G. nana* K. Krause non Vriese. The name *G. micrantha* Hemsley is validated.

Introduction

This is the third in a series of contributions which provide a basis for the taxonomic treatment of the family Goodeniaceae in the Flora of Australia, vol. 35. Previous ones have dealt with the taxonomy, phylogeny, nomenclature and new taxa in *Dampiera* (Rajput and Carolin 1988) and *Scaevola* (Carolin 1990). The present one deals only with the nomenclature and new taxa in the genus *Goodenia*. A contribution is being prepared which will consider the phylogeny and taxonomy of *Goodenia* and its satellite genera. Most of the preliminary analyses have been carried out but it is necessary to formalise the proposed taxonomic changes before these aspects can be submitted for publication in order that the Flora of Australia vol. 35 may proceed.

If *Calogyne*, *Catosperma*, *Neogoodenia* and *Symphyobasis* are accepted at generic level, the genus *Goodenia* is rendered paraphyletic (Carolin, unpub.). Consequently they are here reduced to synonyms of *Goodenia*. The status of the genus *Selliera* remains ambiguous after the analyses, and consequently it is retained for the time being.

Carolin (1967) provides a diagram which illustrates the terms used in describing the parts of the corolla.

The structure of this contribution is similar to the second part of the papers on *Dampiera* and *Scaevola*. Argument is provided by Rajput and Carolin (1988) for the selection of various types in the case of collections by R. Brown, L. Preiss, and E. Pritzel. Paralectotypes are given when more than one collection relates to the protologue. The asterisk, '*', indicates that only one collection relates to the protologue. The Guide to the Determination of Types in the International Code of Botanical Nomenclature has been followed to avoid possible arbitrary selection of lectotypes.

When a name is considered to be a synonym of another name, the name that is currently accepted is given after '='.

When selected specimens are cited, the total number examined is indicated in parentheses.

The taxa are arranged in a supposedly natural sequence.

***G. scapigera* R. Br., Prodr.: 578 (1810).**

LECTOTYPE: WESTERN AUSTRALIA: Bay 1 (Lucky Bay), *R. Brown*, 11 Jan. 1802 (BM). ISOLECTOTYPE: K.* Brown recognised two variants 'α' and 'β'. Both of these are represented on one sheet at BM although Brown has labelled none of the specimens as either α or β. Instead, the ones corresponding to β are labelled '*G. affinis*' and the others '*G. scapigera*'. It seems clear from this that one must select the specimen labelled '*G. scapigera*' by Brown as the lectotype and which he subsequently described as 'α'. β is conspecific with *G. decursiva*.

G. scapigera var. *foliosa* F. Muell. ex Benth., Fl. Austral. 4: 57 (1868) = ***G. decursiva* W. Fitzg.**

LECTOTYPE: WESTERN AUSTRALIA: Cape Arid and Cape Le Grand, *Maxwell* (K). The specimen second from the left on this sheet of mixed collections is selected.

***G. decursiva* W. Fitzg., West Australian Natural History Society 2: 25 (1905).**

LECTOTYPE: WESTERN AUSTRALIA: Esperance, *C. Andrews*, Oct. 1903 (PERTH). ISOLECTOTYPES: K, NSW 76592, PERTH.* There are two sheets at PERTH, both bearing the same label. One I have marked as the lectotype.

***G. watsonii* F. Muell. & Tate, Trans. Roy. Soc. South Australia 16: 371 (1892) (as *G. watsoni*).**

LECTOTYPE: WESTERN AUSTRALIA: near Gnarlbine, *R. Helms*, 12 Nov. 1891. Elder Expl. Exped. (MEL 22128). ISOLECTOTYPES: AD 96620133, K, MEL 22129, 22130, NSW 80794, 76581.*

***G. watsonii* subsp. *glandulosa* Carolin, subsp. nov.**

Sepala et corolla extus glandulosa. Thyrsus laxis. Pedunculi pedicelli, ovaria, sepala ac extus corollae glandulose pubescentes. Corolla plerumque 4–5 mm longa, coerulea faucis flavis. Ovulae 12–16.

HOLOTYPE: WESTERN AUSTRALIA: 20 miles East of Hyden, *J.S. Beard* 3908, 12 Jan. 1965 (PERTH).

This differs from the type subspecies as follows: Thyrses loose. Peduncles, pedicels and outside of flowers glandular pubescent. Corolla usually 4–5 mm long, blue, with yellow throat. Ovules 12–16.

RANGE: Lake Grace–Hyden region in Western Australia.

HABITAT: Open woodland.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: 8 miles (12.8 km) W of Lake Grace, *A.S. George 520*, 30 Jan. 1960 (PERTH); 16 miles (25.6 km) W of Lake Grace, *W.E. Blackall 1314*, 11 Nov. 1931 (PERTH); 12 miles (19.2 km) north of Lake Grace, *P.R. Jefferies 641029*, Oct. 1964 (PERTH).

The subspecific epithet refers to the glandular hairs on the inflorescence.

G. pinifolia *Vriese*, *Natuurk. Verh. Holl. Maatsch. Wetensch. Haarlem ser. 2* 10: 157 (1854).

LECTOTYPE: WESTERN AUSTRALIA: Ad flumen cygnorum, *Drummond*, 1839 (K). ISOLECTOTYPE: MEL 22082. *Vriese* writes 'Herb. Hook et Lindley'. The former specimen has been selected as the lectotype.*

G. fasciculata (*Benth.*) *Carolin*, **comb. nov.**

BASIONYM: *Scaevola fasciculata* *Benth.* in *Endl.*, *Enum. Pl. Hueg.*: 68 (1837).

HOLOTYPE: WESTERN AUSTRALIA: Swan River, *Huegel* (W).

G. squarrosa *Vriese* in *J.G.C. Lehmann*, *Pl. Preiss. 1*: 413 (1844) = **G. fasciculata** (*Benth.*) *Carolin*.

LECTOTYPE: Maddington, *L. Preiss 1467*, 2 Nov. 1839 (LD). ISOLECTOTYPE: K, MEL.*

G. drummondii *Carolin*, **sp. nov.**

Frutex erectus ad 1 m altus. Folia crassa, linearia vel anguste obovata 1–4 cm longa integra vel dentata sessilia glabra. Folia lateralia fasciculata in axillis foliorum in caule principali. Flores pedunculis bracteolatis brevissimis. Corolla alba signis purpurascensibus c. 6 mm longa glabra extus lobis ± aequalis palmatis alatis anguste. Ovulum unicum. Stylus 3.5 mm longus pilis purpureis pallide obtectus. Indusium oblongum. Nux globula c. 1 mm diametro.

HOLOTYPE: WESTERN AUSTRALIA: *Drummond s.n.* (MEL 21907). SUPPOSED ISOTYPES: MEL 21902, 21905, 21907, 21899.

Erect glabrous shrub to 1 m. *Stems* slightly branched, echinate with persistent leaf-bases. *Leaves* thick, tending to form axillary fascicles, linear to very narrow-obovate, 1–4 cm long, 1–4 mm wide, sessile, acute, entire or with few narrow teeth, with few very short axillary hairs. *Flowers* in terminal and axillary spike-like thyrses to 20 cm long; bracts linear-triangular, 1–2 mm long, acute; bracteoles similar but smaller. *Sepals* narrow-ovate to almost linear, 1–1.5 mm long, 0.4–0.5 mm wide, acute, entire, wholly adnate to ovary only at base and above that by median line only for about $\frac{2}{3}$ its length. *Corolla* white with purplish markings at base of lobes, c. 6 mm long, glabrous outside, sprinkled with stiff white simple hairs inside especially on veins, without auricles; anterior pocket obscure, c. $\frac{1}{2}$ as long as ovary; tube c. 2.8 mm long; lobes almost equal, narrow-ovate to narrow-elliptic, 2.5 mm long, 0.5 mm wide; wings 0.3–0.4 mm wide; connate part of inferior lobes 0.3–0.4 mm long. *Stamen* filaments linear, c. 4 mm long; anthers narrow-oblong, c. 1 mm long. *Ovary* septum minute; ovule solitary, erect; style 3.5 mm long, geniculate, with short stiff purplish simple hairs and some minute glandular ones; indusium oblong, c. 1 mm long, pale brown, not folded, glabrous or with a few hairs at base, with a ± straight orifice beset with minute bristles. *Fruit* an inferior nut, globular c. 1 mm diam., glabrous except for prominent pubescent beak. *Seed* ± compressed, brownish, ellipsoid, c. 1 mm long, smooth; rim and wing obsolete.

RANGE: Austin and Irwin Regions in Western Australia.

HABITAT: Woodlands and heaths on sandy soils.

DISCUSSION: This species was previously included under *G. stenophylla* (as *Scaevola stenophylla*) from which it differs in its smaller flowers with narrower corolla wings, narrower sepals, consistently a single ovule in the ovary and the considerably broader and frequently dentate leaves. It is also separated from *G. stenophylla* by a very considerable geographic discontinuity. In fact, it is more closely related to *G. helmsii*, from which it differs in the larger leaves.

SELECTED SPECIMENS (15): WESTERN AUSTRALIA: Latham, *D.A. Sargent 1372*, 23 Oct. 1921 (MEL 21908); 2 miles (3.2 km) along Balla Road from Geraldton–Carnarvon Hwy., *A.C. Burns 1070*, 30 Oct. 1966 (PERTH); 27 miles (43.2 km) E of Kalbarri, *A.S. George 7926*, 8 Sept. 1966 (PERTH); Moresby Range, *A.C. Burns 6*, 19 Sept. 1965 (PERTH); *Drummond 365* (MEL 21900, 21898, K).

Named for the collector of the type specimen, James Drummond, a famous collector of plants in Western Australia in the last century.

***G. helmsii* (E. Pritzel) Carolin, comb. nov.**

BASIONYM: *Scaevola helmsii* E. Pritzel, Bot. Jahrb. Syst. 35: 572 (1905).

LECTOTYPE: WESTERN AUSTRALIA: In distr. Coolgardie haud procul Southern Cross, *E. Pritzel 881* (NSW 76565). **ISOLECTOTYPES:** B (destroyed), K. **PARALECTOTYPES:** In distr. Avon interiore prope Tammin, *Diels 2866* (B destroyed); In distr. Coolgardie haud procul Southern Cross, *Diels 5591* (B destroyed).

***G. viscida* R. Br., Prodr.: 578 (1810).**

LECTOTYPE: WESTERN AUSTRALIA: Bay 1, orae australis Nova Hollandia, *R. Brown*, 12 Jan. 1802 (BM). **ISOLECTOTYPE:** K*.

***G. acuminata* R. Br., Prodr.: 546 (1810) = *G. ovata* Sm.**

LECTOTYPE: NEW SOUTH WALES: Grose River, *R. Brown*, 1803 (BM). **ISOLECTOTYPES:** K, MEL.*

***G. varia* R. Br., Prodr.: 576 (1810).**

LECTOTYPE: SOUTH AUSTRALIA: Bay III S. Coast, *R. Brown*, s.d. (BM). **ISOLECTOTYPES:** K, MEL.*

***G. mollis* R. Br., Prodr.: 577 (1810) = *G. grandiflora* Sims**

LECTOTYPE: QUEENSLAND: In monte prope Upper Lead, Broad Sound, *R. Brown*, s.d. (BM). **ISOLECTOTYPES:** K, MEL.*

***G. horniana* F. Muell. & Tate ex Tate** in Spencer, Report on the work of the Horn Scientific Exploring Expedition to Central Australia 3: 189 (1896).

LECTOTYPE: NORTHERN TERRITORY: George Gills Range, *R. Tate*, June 1894 (AD 97601116). **ISOLECTOTYPES:** MEL 23313, 23050, 23049, K.* Mueller and Tate mention the binomial in Trans. & Proc. Roy. Soc. South Australia 19: 82 (1895), but no description is supplied. The name was first published with a description by Tate himself as indicated. It is likely that all the specimens were available to the authors when they cast their description.

***G. chambersii* F. Muell., Fragm. 1: 204 (1859).**

LECTOTYPE: SOUTH AUSTRALIA: North western South Australia, *J. M'Douall* [sic] *Stuart* (MEL). **ISOLECTOTYPE:** K. There has been some confusion, probably introduced by Bentham, over the type of this species. He cites 'J. M'douall Stuart's' specimen from Mt Freeling under both *G. grandiflora* and *G. chambersii*. This specimen has no connection with Mueller's original description of *G. chambersii*. Mueller himself, in fact, identified

it as *G. grandiflora* (MEL 23113). Since Mueller's original description of *G. chambersii* was published in 1859, it must be related to specimens collected before that date. Unfortunately, none of Stuart's specimens are dated. However, he did not reach Mt Freeling, in the Reynolds Range, until April 1860. Any specimens from this locality can, therefore, have no significance here. The specimens from north-western South Australia, labelled '*G. chambersii*' by Mueller, must be the authentic ones used by him. Before 1859 Stuart had made only one well-documented journey into the north-west of S. Australia. It is unlikely that he did much travelling west of Lake Torrens previously. This first journey was completed in late 1858 and it was probably during this that the specimens were collected, possibly in the ranges to the west of the Lake Eyre Basin.

***G. kingiana* Carolin, sp. nov.**

Herba erecta suffruticosa vel frutex parvus usque 1.5 m altus. Folia lyrato-pinnatifida; lamina principalis ovata cordata grosse dentata pilis glandulosis et brevissimis simplicibus obiecta; pinnae laterales ovatae vel lineares petiolulatae. Flores pedunculis bracteolatis pedicellisque articulatis in racemis terminalibus dispositi. Corolla flava 2.5–3 mm longa glanduloso-pubescentis extus et seriebus enationum prominentibus intus. Ovarium glanduloso-pubescentis. Fructus late ovoideus 8 mm longum duabus valvis dehiscens.

HOLOTYPE: WESTERN AUSTRALIA: 16 miles (25.6 km) E of Kalli, *N.H. Speck 1052*, 22 July 1958 (CANB 109430). ISOTYPES: AD 96003018, BRI 020575, K.

Erect, viscid, suffruticose plant or undershrub to 1.5 m high. *Stems* ridged when young but becoming \pm terete, pubescent with both long and short glandular hairs but scarcely any simple hairs. *Leaves* lyrate-pinnate; terminal lamina ovate, 2–4 cm long, 1–2.5 cm wide, cordate at base, acute, coarsely dentate, glandular-pubescent with long and short hairs but also with a very short simple pubescence; lateral pinnae much smaller, ovate to linear, when ovate always distinctly petiolulate; petiole 3–7 cm long, slender. *Flowers* in terminal leafy racemes, rarely thyrses; peduncles 3–10 mm long, glandular-pubescent; bracteoles linear to oblanceolate or narrow-elliptic, 5–10 mm long, 1–1.5 mm wide, acute, entire or with a few lobes at base, usually \pm petiolate, glandular-pubescent; pedicel 15–20 mm long, similar to peduncle, articulate just below ovary. *Sepals* lanceolate, 4–5 mm long, c. 1.0 mm wide, acute, entire, glandular-pubescent, adnate to ovary nearly to its summit. *Corolla* yellow, 2.5–3 cm long, glandular-pubescent with a few short simple hairs outside, villous-hirsute towards base, with rows of very prominent enations inside, scarcely auriculate; anterior pocket \pm prominent, c. $\frac{2}{3}$ as long as ovary; tube 5–6 mm long; superior lobes narrow-oblong, c. 2 cm long, 3–4 mm wide; inferior lobes oblong-elliptic, 14–16 mm long, 5–6 mm wide, central one slightly broader than laterals; wings 3–4 mm wide; connate part of inferior lobes 10–12 mm long. *Stamen* filaments linear, 8–9 mm long; anthers narrow-oblong, 3.5 mm long, 0.8 mm wide. *Ovary* glandular-pubescent; septum about $\frac{2}{3}$ as long as loculus; ovules 20–26; style c. 25 mm long, sparsely villous; indusium depressed-ovate, 3 mm long, 6 mm wide, yellow-brown, \pm concave, with a slightly curved orifice beset with white bristles c. 0.5 mm long. *Fruit* broad-ovoid, 8 mm long, 6 mm wide, glandular-pubescent, with a distinct beak, 2-valved probably to base at maturity, each valve not or only shortly bifid. *Seeds* flat, only immature ones seen.

RANGE: Austin Region in Western Australia.

HABITAT: Feet of lateritic "breakaways".

DISCUSSION: This species differs from *G. grandiflora* and its closer relatives in the longer glandular hairs, the larger flowers with broader wings making a more

acute angle at the apex, and the petiolulate segments below the main lamina of the leaf.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: 43 miles (68.8 km) SE of Mileura, *N.H. Speck* 696, 7 Sept. 1957 (CANB 109429); 60 km NW of Cue, *P.G. Wilson* 9901, 1 Sept. 1970 (PERTH); Near Lake Austin, *H.S. King*, 1886 (MEL 23909, MEL 23091); Tching Range, *W.J. Peacock* 60858.1, 15 Aug. 1960 (SYD); Cue, *W.D. Campbell*, June 1902 (K); 3 miles (4.8 km) E of Cue, *C.A. Gardner*, 28 July 1927 (K).

Named in honour of H.S. King who first collected this species.

G. amplexans *F. Muell.*, Trans. & Proc. Philos. Inst. Victoria 2: 70 (1858).

LECTOTYPE: SOUTH AUSTRALIA: Foot of the Mount Lofty Ranges (MEL 23844). PARALECTOTYPES: Banks of the Torrens River, *F. Mueller*, Jan. 1848 (MEL22300); Nile Rivulet, *s.c.*, Nov. 1848 (MEL 23854). In the protologue Mueller gives as locality "Ridges and gullies near Adelaide". There are no specimens labelled in that way and the one selected as the lectotype is the only one collected in the area in question and annotated by Mueller with the name *Goodenia amplexans*.

G. fordiana *Carolin*, sp. nov.

Herba prostrata pubescens confertim molliter pilis simplicibus pro parte maxima induta. Scapi usque 20 cm longi in axillis foliorum rosulatorum inserti. Folia rosulata distincte petiolata: lamina elliptica vel late elliptica 10–25 mm longa 8–14 mm lata obscure dentata. Flores distantes pedicellis non articulatis, 1–1.5 cm longis in racemis foliosis dispositi. Corolla flava 8–10 mm longa seriebus enatorum intus. Indusium transverse ellipticum. Fructus et semina non videntur.

HOLOTYPE: NEW SOUTH WALES: Bushman Range near Coramba, *W. Heron*, Oct. 1913 (NSW 76620).

Prostrate herb, pubescent with soft simple and multicellular hairs, with a thin tap root and a distinct persistent rosette of leaves in axils of which arise leafy scapes to 20 cm long. Basal leaves narrowing abruptly into a \pm distinct petiole 1–3 cm long; lamina elliptic to broad-elliptic, 10–25 mm long, 8–14 mm wide, obscurely dentate to entire, obtuse, softly pubescent with mostly simple hairs on both surfaces, denser on lower surface; cauline leaves smaller. Flowers distant in leafy racemes; peduncles 1–2 cm long, pubescent; bracteoles linear, 2 mm long, 0.2 mm wide, acute, pubescent; pedicels 1–1.5 cm long, similar to peduncles, not articulate. Sepals linear, 2.5 mm long, 0.5 mm wide, acute, pubescent, adnate to ovary almost to its summit. Corolla yellow, 8–10 mm long, pubescent with soft mostly simple hairs outside, \pm pubescent inside towards base, with rows of distinct enations, auriculate; anterior pocket less than $\frac{1}{2}$ as long as ovary; tube 1.5 mm long; superior lobes narrow-oblongate, 5 mm long, 1 mm wide; inferior lobes elliptic, c. 3.5 mm long, 1.5 mm wide; wings 2 mm wide; connate part of inferior lobes c. 4 mm long. Stamen filaments linear, c. 1.5 mm long; anthers broad-elliptic, 0.5 mm long, with a short broad mucro. Ovary pubescent; septum c. $\frac{1}{2}$ as long as loculus; ovules 24–28; indusium transverse-elliptic, 0.7 mm long, 1.2 mm wide, scarcely folded, villous-pubescent, with a curved orifice beset with white bristles c. 0.1 mm long on both lips. Fruit and seed not known.

RANGE: North Coast District of New South Wales.

HABITAT: Forests and woodlands.

DISCUSSION: In some respects this species resembles *G. rotundifolia*, from which it can be distinguished by the softer pubescence, longer pedicels, more slender scapes with long internodes and the almost entire leaves.

SPECIMENS EXAMINED: NEW SOUTH WALES: North Coast: Lookout Road, Bellangry State Forest, *J.C. Cousins*, 23 Oct. 1958 (NSW 76619); Bulahdelah, *H.M.R. Rupp*, 12 Nov. 1923 (NSW 76621).

Named for Neridah Ford formerly of the National Herbarium of N.S.W. who first recognized this species and kindly drew my attention to it.

G. taylorii F. Muell. (as *G. taylori*), *Fragm.* 3: 141 (1862) = ***G. quadrilocularis* R. Br.**

LECTOTYPE: WESTERN AUSTRALIA: Orleans Bay, (*Maxwell?*) (MEL 22084). POSSIBLE ISOLECTOTYPE: K.* There is some confusion about the type of *G. taylorii* F. Muell. and the specimen which Mueller cites in *Fragm.* 6: 13 (1867) as *G. quadrilocularis*. The locality given for these two specimens in each case refers to '... in collibus arenosis ... Orleans Bay'. The descriptions are really very similar in important features, allowing for the fact that they were drawn up at different times.

There is only one specimen agreeing with these descriptions, collected in sand hills at Orleans Bay and housed in MEL. It is labelled '*G. quadrilocularis* R. Br'. Since this agrees with the description of *G. taylorii*, particularly with regard to the indumentum of the corolla, shape of the capsule and of the leaf, I am selecting this as the lectotype. It appears that Mueller (*Fragm.* 6: 13) used both this specimen and 'Towards the Great Bight' (MEL 22083), in casting his later description of *G. quadrilocularis*.

I have been unable to find any specimen at MEL, or elsewhere, labelled '*G. taylori*'.

***G. decurrens* R. Br.**, *Prodr.*: 575 (1810).

LECTOTYPE: NEW SOUTH WALES: Banks of Grose River, *R. Brown*, 1803 (BM). ISOLECTOTYPES: K, MEL, P.*

***G. dimorpha* Maiden & Betche**, *Proc. Linn. Soc. New South Wales* 28: 907 (1904).

LECTOTYPE: NEW SOUTH WALES: Woodford, Blue Mts., *J.H. Maiden*, Jan. 1899 (NSW); ISOLECTOTYPE: MEL. PARALECTOTYPES: Springwood, Blue Mountains, *E. Betche*, Feb. 1884 (NSW); Blackheath, Blue Mountains, *A.A. Hamilton*, Jan. & April, 1900 (MEL, NSW).

***G. dimorpha* var. *angustifolia* Maiden & Betche**, *Proc. Linn. Soc. New South Wales* 28: 907 (1904).

LECTOTYPE: NEW SOUTH WALES: National Park, *J.L. Boorman*, Jan. 1903 (NSW). PARALECTOTYPE: National Park, *J.L. Boorman*, Jan. 1903 (NSW).

***G. stelligera* R. Br.**, *Prodr.*: 575 (1810).

LECTOTYPE: NEW SOUTH WALES: Port Jackson (inter Sydney & South Head), *R. Brown*, May-June 1802 (BM). ISOLECTOTYPES: K, MEL, P.

***G. rostrivalvis* Domin**, *Biblioth. Bot.* 22: 1193 (1929).

LECTOTYPE: NEW SOUTH WALES: Sandsteinhugel in dem Blue Mountains bei Katoomba, *Domin*, April 1910 *Domin* (PR). PARALECTOTYPE: ohne nahere Standortsangabe, *A. Cunningham* (K).

G. bellidifolia var. *ramosissima* K. Krause, *Pflanzenr.* 54: 50 (1912). = ***G. bellidifolia* Sm. subsp. *bellidifolia*.**

HOLOTYPE: NEW SOUTH WALES: ohne genauen Standorts, *Caley* (B, destroyed). LECTOTYPE: The former isotype at BM. ISOLECTOTYPE: W.

***G. bellidifolia* subsp. *argentea* Carolin, subsp. nov.**

Folia ovata in petiolum gradatim decrescentes. Corolla villosa albide gossypine extus. Stylus plerumque glaber indusio plerumque oblongo 1 mm longo 0.6 mm

lato bicanaliculato infra setis super labio 0.2 mm longis. Capsula globula c. 2 mm diametro.

HOLOTYPE: NEW SOUTH WALES: 18 miles west of Emmaville, *W.J. Peacock* 6111.23.1, s.d. (NSW).

Perennial with a basal stock. *Leaves* in an ascending rosette, usually ovate, narrowing gradually into a short petiole. *Corolla* with few short appressed yellow hairs, which are scarcely visible without a x10 magnification, and numerous multicellular cottony hairs on outside. *Style* usually glabrous but for a few villous hairs towards top; indusium oblong or rarely slightly obovate, 1.0 mm long, c. 0.6 mm wide with a double groove and a single usually villous ridge below; indusium bristles usually less than 0.2 mm long. *Fruit* globular to subglobular, c. 2.0 mm diam. Seeds very dark brown to black.

RANGE: Northern parts of the Western Slopes, Tablelands and Coastal Districts of New South Wales; Darling Downs, Moreton and Wide Bay Districts of Queensland.

HABITAT: Grassland, scrubs and woodlands.

DISCUSSION: See Peacock (1962).

SELECTED SPECIMENS (106): NEW SOUTH WALES: Maryland, *E. Hickey* 101, Dec. 1884 (MEL 22017); Wallangarra, *J.L. Boorman*, Nov. 1912 (NSW 76795); Jennings, *J.L. Boorman*, Dec. 1903 (NSW 76810); Lookout Point, near Inverell, *P.B. Oelrich* AR921, 28 March 1950 (CANB 79360); Ben Lomond, *R.A. Boyd*, 25 Jan. 1955 (AD 95809061); 3 miles (4.8 km) N. of Bundarra, *W.J. Peacock* 6111.14.1, s.d. (SYD); Barcoongere SF., *W.J. Peacock* 6012.2.5, 10 Dec. 1960 (SYD); Laurieton, *J.L. Boorman*, Nov. 1915 (NSW 76503).

Named for the silvery hairs on the corolla; Latin, *argenteus* = silvery.

G. racemosa *F. Muell.*, *Fragm.* 1: 114 (1859).

LECTOTYPE: QUEENSLAND: Burnett River, *F. Mueller*, Nov. 1856 (MEL). ISOLECTOTYPES: K, MEL.

G. racemosa var. *latifolia* *Carolín*, var. nov.

Folia anguste oblonga. Corolla alis angulatis acute. Indusium depresso ovatum.

HOLOTYPE: QUEENSLAND: Isla Gorge, 16 miles (25.6 km) SSW of Theodore, *F. D. Hockings* 11, 1 Sept. 1963 (BRI 045529).

Differs from the type variety as follows: Leaves narrow-oblong, 7–10 mm wide. Corolla wings with \pm acute angles, c. 1.6 mm wide; auricles conspicuous, pubescent; inferior lobes c. 5 mm long. Indusium depressed-ovate.

RANGE: Leichhardt District of Queensland.

HABITAT: Rocky situations.

SPECIMEN EXAMINED: QUEENSLAND: Isla Gorge, *S. L. Everist* 8060, 28 Sept. 1968 (BRI 151669).

Named for the leaves which are wider than those of the type variety. Latin, *latus* = wide, *folium* = leaf.

G. disperma *F. Muell.*, *Fragm.* 1: 113 (1859).

LECTOTYPE: QUEENSLAND: Dawson River (MEL). ISOLECTOTYPE: K. PARALECTOTYPES: Uncertain. Mueller writes in the protologue, 'Inter campis sub-arenosis ad pedes montium inter flumina MacKenzie, Dawson, et Burnett'. I have not located any specimens from the Mackenzie or Burnett Rivers in MEL.

G. sessiliflora F. Muell., *Fragm.* 4: 145 (1864) = *G. disperma* F. Muell.
LECTOTYPE: QUEENSLAND: Cape River, *Bowman 231* (MEL 24292). PARALECTOTYPE:
Cape River, *Bowman 287*. Only these two specimens agree with the locality and collector given in the protologue; Mueller gives no numbers. Both agree with the description in the protologue and the most complete specimen has here been chosen.

***G. viridula* Carolin, sp. nov.**

Frutex ascendens ramificatus usque 40 cm altus. Caules tomenti denso albido vel flavo-albido pilis multicellularis gossypine obtecti. Folia linearia ubi juvenilia tomentosa gossypine marginibus revolutis. Flores sessiles in spicis terminalibus dispositi. Corolla viridula c. 4.5 mm longa gossypine extus pubescens dense in fauce intus sacco obsoleto. Capsula subglobosa 3 mm lata seminibus duobus oblongo-ellipticis c. 3 mm latis ora prominenti sed ala angusta.

HOLOTYPE: QUEENSLAND: c. 5 miles (8 km) east of Jericho, *L.S. Smith & S.L. Everist 97842*, Oct. 1940 (BRI 067478). ISOTYPES: CANB 12903, MEL 22355, K).

Ascending much-branched undershrub to 40 cm. *Stems* obscurely ridged when young but becoming terete, covered with a dense white or yellowish white cottony tomentum of multicellular hairs. *Leaves* linear, 1.5–5 cm long, 0.5–1.1 mm long, cottony tomentose when young, sessile, acute, entire, margins revolute but often becoming flatter towards tips, glabrescent, with a dense tuft of villous axillary hairs. *Flowers* sessile, in \pm terminal spikes; bracteoles linear, to 2 mm long. *Sepals* triangular to ovate, 0.8–1 mm long, c. 0.5 mm wide, acute, entire, sprinkled with cottony hairs, united to ovary nearly to its summit. *Corolla* greenish yellow, 4–9 mm long, sprinkled with multicellular cottony hairs on outside, densely villous in throat, auriculate; anterior pocket very short and obscure; tube 1–2 mm long; superior lobes narrow-oblong, 2–2.5 mm long, c. 0.5 mm wide; inferior lobes ovate, 2–4 mm long, 1 mm wide; wings 0.5 mm wide; connate part of inferior petals 1.5–2.5 mm long. *Stamen* filaments linear, c. 1.5 mm long; anthers oblong, c. 0.5 mm long. *Ovary* cottony-tomentose; septum scarcely $\frac{1}{2}$ as long as loculus; ovules 4–6; style 1.2–1.5 mm long, \pm villous towards base; indusium oblong, 1 mm long, 0.7 mm wide, brownish, not folded, with a very curved orifice beset with white bristles c. 0.3 mm long on upper lip and much shorter ones on lower lip; upper lip distinctly longer than lower one. *Fruit* subglobular, c. 3 mm diam., cottony-tomentose but for almost glabrous beak, 2-valved. *Seed* flat, yellow-brown, oblong-elliptic, c. 3 mm long, 1 mm wide, reticulate, with a prominent rim; wing narrow.

RANGE: South Kennedy and Mitchell Districts of Queensland.

HABITAT: Open woodlands and heaths.

DISCUSSION: This differs from *G. disperma* in the densely tomentose stems, linear revolute leaves and the smaller and greenish yellow flowers.

SPECIMEN EXAMINED: QUEENSLAND: Jericho, *M.S. Clemens*, April 1946 (BRI 067376).

Named for the greenish yellow corolla. Latin, *viridulus* = greenish.

***G. delicata* Carolin, sp. nov.**

Herbae ascendentes vel decumbentes radice tenui, sparsim arachno-pubescentes pilis multicellularibus saepe glabrescentes. Caules scapique usque 50 cm longi. Folia linearia usque anguste elliptica, 2–6 cm longa, 2–6(–13) mm lata integra vel dentibus paucis grossis versus basin sensim in petiolum indistinctum contracta. Flores in racemis foliosis dispositi; bracteolae lineares; pedicelli non articulati. Corolla flava sine enationibus, 10–13 mm longa; alis

1–1.5 mm latis; lobi superiores auriculati. Fructus globularis c. 8 mm diametro duabus valvis bifidis dehiscens. Semina plana, elliptico-oblonga reticulata ora crassa sed ala angustissima.

HOLOTYPE: QUEENSLAND: 13 miles (20.8 km) W of Westmar, *L. Pedley 506*, 15 Oct. 1959 (BRI 026704).

Ascending to decumbent, short-lived herb with thin tap root. *Stems* terete, condensed or elongated, with an indistinct rosette of leaves, with scapes to 50 mm long, arachnoid-pubescent when young but glabrescent. *Leaves* linear to narrow-elliptic, 2–6 cm long, 2–13 mm wide, narrowing very gradually into an indistinct petiole, acute, entire or with few coarse teeth, slightly recurved or slightly thickened at margin, sparsely arachnoid-pubescent with multicellular and sometimes simple hairs when young, often glabrescent especially above. *Flowers* in leafy racemes; peduncles slender, mostly 5–20 mm long, sparsely arachnoid and simple-pubescent to almost glabrous; bracteoles linear, 1–2 mm long, c. 0.5 mm wide, acute, pubescent to glabrescent; pedicels 5–10 mm long, not articulate, similar to peduncles. *Sepals* linear-ovate, 2–2.5 mm long, c. 0.5 mm wide, acute, sparsely arachnoid and simple-pubescent to almost glabrous, adnate to ovary nearly to its summit. *Corolla* yellow, 10–13 mm long, sparsely arachnoid-pubescent with multicellular hairs and some simple ones on outside often more numerous towards top, very sparsely pubescent towards base and without enations inside; anterior pocket almost obsolete; tube 4–5 mm long; superior lobes falcate-narrow-elliptic, 6–7 mm long, c. 1 mm wide; inferior lobes narrow-oblong, 4–4.5 mm long, c. 1.5 mm wide; wings c. 1 mm wide; connate part of inferior lobes 6–7 mm long. *Stamen* filaments linear, 3 mm long; anthers linear, 1.5 mm long, minutely apiculate. *Ovary* sparsely arachnoid and simple-pubescent; septum c. $\frac{1}{2}$ as long as loculus; ovules c. 12; style 4–5 mm long, glabrous, slightly geniculate; indusium very broad-elliptic, 1 mm long, 1.5 mm wide, purple-brown, glabrous, with a very slightly concave orifice beset with white bristles c. 0.1 mm long on both lips. *Fruit* globular, c. 8 mm diam., pubescent to almost quite glabrous, with a glabrous beak, 2-valved, each valve bifid for c. $\frac{1}{2}$ its length and spreading. *Seeds* flattened, pale yellow, elliptic-oblong, 2 mm long, aculeate; wing c. 0.1 mm wide.

RANGE: Western Plains of New South Wales; Darling Downs, Burnett and Wide Bay Districts of Queensland.

HABITAT: Forests and woodlands.

DISCUSSION: This species has been confused with *G. geniculata* by Bailey, Qld. Fl.: 898 (1900) etc. It differs from other species of the *G. hederacea* group in the very sparse indumentum and narrow leaves. The leaves are often almost entire. When simple hairs are present they are very short, patent and soft. The capsule is globular as compared with more elongated capsules in other members of the group.

SELECTED SPECIMENS (11): QUEENSLAND: Mt Perry, *J. Keys* (BRI I067585, 067586); Eidsvold, *H.S. McKee 10230*, 3 April 1963 (CANB 139062); Biggenden, *C.T. White 7280*, 11 Oct. 1930 (BRI 067567, 067568); Gayndah, *G.J.E. Schoneveld 249*, 1960 (BRI 1024882); Gurulmundi, *R.W. Johnson & L. Pedley 42*, 29 June 1955 (BRI 067566); 3 miles (4.8 km) N of Glenmorgan, *W.J. Peacock 6111.36.2*, s.d. (SYD); 15 miles (24 km) N of Jackson, *R. Melville 3466*, 25 March 1953 (NSW 88354).

Named for the Darling Downs on which it occurs. Latin, *delicatus* = darling.

***G. heterophylla* subsp. eglandulosa Carolin, subsp. nov.**

G. heterophylla subsp. 'B' Jacobs & Pickard, Plants of N.S.W.: 133 (1981).

Herbae ascendentes usque erectae pubescentes pilis simplicibus et multicellularibus nonnumquam glabriusculae. Folia ovata, serrata dentibus saepissime distincte mucronatis et marginibus recurvatis.

HOLOTYPE: NEW SOUTH WALES: South end of Jervis Bay, *F.A. Rodway*, Oct. 1954 (NSW 100834).

Ascending to erect herb with simple and multicellular hairs, sometimes glabrescent. *Leaves* ovate, 1–3 cm long, serrate, each tooth mucronate, sometimes with two basal lobes; margin recurved.

RANGE: Coastal Districts of New South Wales.

HABITAT: Frequently on deep sands but also on the massive sandstones of the Budawang Range near Milton. Also known from other rock formations in the Bulahdelah – Barrington Tops area.

DISCUSSION: Differs from the type subspecies in the pubescence of simple and multicellular hairs with no glandular hairs and although it is sometimes glabrescent; leaves ovate, serrate, each tooth \pm mucronate, with recurved margins. The relationship of this and the type subspecies is discussed by J. Hufton (Hons. Thesis University of Sydney, 1972).

SELECTED SPECIMENS (44): NEW SOUTH WALES: Bargoongarie Forest, *W.J. Peacock* 6012.2.3, 10 Dec. 1960 (SYD); Wallis Lake, *H. Salasoo* 3312, 6 Jan. 1967 (NSW 100618); Boolambayte Lake, *J. Hufton* 11, 1972 (SYD); Alum Mt, *E.F. Constable* 4294, 26 Aug. 1963 (NSW 71139); Kogarah, *J.H. Camfield*, Nov. 1896 (NSW 81425); Lower Budgong road 3 miles (4.8 km) N of Shoalhaven River, *L.A.S. Johnson & E.F. Constable*, 24 Nov. 1960 (NSW 50178); Turpentine Range, *J. Hufton* 35, 1972 (SYD)

The epithet refers to the lack of glandular hairs which are found in the type subspecies. Latin, *e-* = without, *glandulosus* = glandular.

***G. heterophylla* subsp. *teucrifolia* (*F. Muell.*) *Carolyn*, comb. nov.**

BASIONYM: *G. teucrifolia* *F. Muell.*, *Trans. & Proc. Philos. Inst. Victoria* 2: 70 (1858).

LECTOTYPE: QUEENSLAND: Moreton Bay, Glasshouse Mts., *s. c.* (MEL 23907). ISOLECTOTYPES: MEL 23911, 23908 pro parte, K. There are three sheets of this taxon at MEL bearing specimens from this locality; only one is annotated as '*G. heterophylla* Sm. var *teucrifolia*'. Since this specimen agrees as closely as any of them with the original description, I am selecting it as the lectotype.

***G. heterophylla* subsp. *montana* *Carolyn*, subsp. nov.**

[*G. heterophylla* subsp. 'C' *Jacobs & Pickard*, *Plants of N.S.W.* 133 (1981)].

Herbae suffruticosae erectae scabridae pilis antrorsis simplicibus et partibus junioribus pubescentibus pilis multicellularibus.

HOLOTYPE: NEW SOUTH WALES: Mt Colong, *E.F. Constable*, 4 March 1948 (NSW 81462).

Differs from the type subspecies as follows: erect, suffruticose herb, villous to cottony indumentum with multicellular hairs and only very few glandular hairs when young, becoming scabrid with short antrorse simple hairs. Leaves linear to narrow-oblong, 1.5–2.5 cm long, 2–3 mm wide rarely more, entire or nearly so; margins revolute.

RANGE: Central and Southern Tablelands Districts of New South Wales.

HABITAT: Forests.

SELECTED SPECIMENS (12): NEW SOUTH WALES: Big Hill Stn. Upper Burragorang Valley, *E.F. Constable*, 4 Oct. 1956 (NSW 42828); Yerranderie, *R.H. Cambage* 3131, 2 Dec.

1911 (SYD, NSW 81469); Moss Vale, *P. Snowden* 235, 31 Oct. 1962 (NSW 81456, CANB 190035); Wingello S.F., *E.F. Constable*, 21 Jan. 1956 (NSW 35344); Bluebush Range to Kiaramba Ridge, *L.A.S. Johnson*, 28 March 1948 (NSW 5023); Tolwong turnoff Nerriga-Jervis Bay road, *R. Pullen* 2025, 8 Dec. 1959 (NSW 1407).

Named from its occurrence in the Central and Southern Tablelands of New South Wales. Latin, *montanus* = montane.

***G. rotundifolia* R. Br., Prodr.: 576 (1810).**

LECTOTYPE: QUEENSLAND: Shoalwater Bay Passage, *R. Brown*, 26 Oct. 1802 (BM). ISOLECTOTYPES: K, MEL 23858, P. PARALECTOTYPE: Paterson River (East Coast), *R. Brown* (BM). Brown recognises two variations: α '*glaberrima*' and β '*pubescens*'. There are two collections of *G. rotundifolia* by Brown in BM, one from the Paterson River, N.S.W., and the other the lectotype. The general description he gives covers both of them fairly adequately. However the specimen from Shoalwater Bay, which is glabrous, is labelled *G. rotundifolia* both on the sheet and in his notes and agrees closely with α '*glaberrima*. . . .'. The Paterson River (East Coast) specimen however is referred to as '*G. crenata*' in his notes. This later name was never used but the specimen is labelled '*G. rotundifolia*' and agrees with the description of β '*pubescens*'. There seems little doubt that an element of α '*glaberrima*' must be selected as a type despite its being glabrous — an uncommon feature in the species.

***G. arenicola* Carolin, sp. nov.**

Herbae stoloniferae vel rhizomatosae. Folia oblanceolata 4–10 cm longa pilis simplicibus glandulosisque parvissimis integra vel dentata in rosulis indistinctis disposita. Flores in axillis foliorum in pedunculis pubescentibus bracteolatis dispositi. Sepala lineari-deltaoidea 5–6 mm longa. Corolla flava 15–17 mm longa pilis parvis extra atque enationibus intra. Ovarium attenuatum ad basim biloculatum fere ad summum. Indusium transverse oblongum 2 mm longum plicatum.

HOLOTYPE: QUEENSLAND: Stradbroke Island, *s.c.*, HT 13903, *s.d.* (NSW).

Branched, stoloniferous or rhizomatous herb. *Leaves* clustered at ends of short pubescent stems, oblanceolate, 4–10 cm long, 8–14 mm wide, tapering into a distinct petiole 2–4 cm long, entire or dentate, sparsely pubescent with minute simple and glandular hairs scattered over both surfaces. *Flowers* solitary in leaf axils, peduncles minutely pubescent, 3–4 cm long; pedicels 3–4 cm long; bracteoles linear, 4–6 mm long, 0.3 mm wide, pubescent. *Sepals* linear-deltoid, 5–6 mm long, acute, entire, pubescent, adnate to ovary to its summit. *Corolla* yellow, 15–17 mm long, pubescent outside with minute mostly simple hairs, minutely pubescent and with rows of enations inside, auriculate; anterior pocket very short and obscure, less than $\frac{1}{2}$ as long as ovary; tube 2.5–3 mm long; superior lobes falcate-oblanceolate, 10 mm long, 1.5–1.8 mm wide; inferior lobes ovate-oblong, 7–8 mm long, 2–2.5 mm wide; wings 2.5 mm wide; connate part of inferior lobes 6–7 mm long. *Stamen* filaments linear, 2–2.5 mm wide; anthers narrow-oblong, 1.8–2 mm long. *Ovary* tapering gradually to base, minutely pubescent; septum almost as long as loculus; ovules c. 30; style 5–6 mm long with a few scattered hairs; indusium transverse-oblong, 2 mm long, 2.5 mm wide, brownish, folded, glabrous above but pubescent beneath with a very curved orifice beset with minute white bristles c. 0.1 mm long. *Fruit* and seed not seen.

RANGE: Known only from the type collection.

HABITAT: Stabilized sand-dunes.

DISCUSSION: This species is clearly related to the *G. hederacea* group of species but very different from most of them. From other species with stoloniferous stems it differs in the minute soft indumentum and the very gradual taper to the base of the ovary.

Named for the habitat. Latin, *arena* = sand, *-cola* = an inhabitant or a dweller.

***G. hederacea* subsp. *alpestris* (K. Krause) Carolin, comb. nov.**

BASIONYM: *G. hederacea* var. *alpestris* K. Krause, Pflanzenr. 54: 56 (1912).

LECTOTYPE: VICTORIA: Australian Alps, Mt Buller, *F. Mueller* (K). PARALECTOTYPES: Hardinger Range, *F. Mueller* (B destroyed, P); Mt. St. Bernhard, *Walter*, Jan. 1899 (B destroyed); Harrierville, Mt St Bernhard, *Weindorfer* 66, Dec. 1902 (W); Mt Hotham, *Weindorfer*, Dec. 1902 (B destroyed); Mt Kosciusko, *Kretschmann*, Dec. 1892 (B destroyed).

G. hederacea var. *cordifolia* Ewart, Fl. Victoria: 1073 (1931) = ***G. hederacea* subsp. *alpestris* (K. Krause) Carolin.**

LECTOTYPE: Unfortunately no type for this variety has been located. Its identity is, however, not in doubt.

G. mooreana K. Krause, Pflanzenr. 54: 57 (1912) = ***G. xanthosperma* F. Muell.**

LECTOTYPE: WESTERN AUSTRALIA: Coolgardie, *Webster*, s.d. (BM); ISOLECTOTYPE: B destroyed. PARALECTOTYPES: Coolgardie, Gnarlbine, *S. Moore*, Sept. 1895 (BM); sudliche von Coolgardie, *Diels* 5236, Oct. 1901 (B destroyed).

***G. geniculata* R. Br., Prodr.: 557 (1810).**

LECTOTYPE: VICTORIA: Port Phillip, *R. Brown*, s.d. (BM). ISOLECTOTYPES: K, P.*

***G. lanata* R. Br., Prodr.: 577 (1810).**

LECTOTYPE: TASMANIA: Port Dalrymple, *R. Brown*, 5–6 Jan. 1804 (BM). ISOLECTOTYPES: K, MEL.*

***G. goodeniacea* (F. Muell.) Carolin, comb. nov.**

BASIONYM: *Scaevola goodeniacea* F. Muell., Fragm. 1: 121 (1859). (*Catospermum goodeniaceum* (F. Muell.) K. Krause). The original spelling of the generic name by Bentham in Hooker's *Icones Plantarum* tab. 1028 is 'Catospermum'; he subsequently altered this to 'Catosperma' in *Flora Australiensis* 4: 83 and K. Krause also used this spelling. 'spermum', however, is an acceptable latinization and there is no reason to change the original spelling.

***G. convexa* Carolin, sp. nov.**

Herba decumbens perennis. Folia obovata ad anguste obovata 3–12 cm longa dentata obtusa villosa utrinque pilis stellatis et multicellularibus in rosula pro parte maxima disposita. Flores in racemis foliosis pedunculis 1–6 cm longis. Bracteolae lineares vel anguste ovatae. Sepala anguste elliptica ad anguste oblonga 5–8 mm longa. Corolla flava 15–24 mm longa villosa extus sed sine enationibus intus. Capsula ovoideo-cylindrica 1–1.5 cm longa 4-valvulata.

HOLOTYPE: WESTERN AUSTRALIA: Swan River, *J. Drummond* 405 (K). ISOTYPE: MEL 24318.

Decumbent usually perennial herb with short erect ± branched stock, ± hirsute with mostly stellate and multicellular hairs. *Scapes* terete, to 15 cm long. *Leaves*

mostly ascending from stock, obovate to narrow-obovate, 3–12 cm long, 4–25 mm wide, narrowing very gradually towards base, dentate, with few simple hairs amongst others towards apex. *Flowers* in condensed or elongated racemes; bracts leaf-like; peduncles 1–6 cm long; bracteoles linear to narrow-ovate, 4–15 mm long, 1–3 mm wide; pedicel 3–5 mm long, often geniculate at bracteoles, not articulate. *Sepals* narrow-elliptic to narrow-oblong, 5–8 mm long, 0.5–2 mm wide, obtuse, pubescent with multicellular and stellate hairs the former yellowish and usually tangled together, adnate to ovary for $\frac{3}{4}$ its length. *Corolla* yellow, 15–24 mm long, villous-pubescent outside with stellate and multicellular hairs and with a few simple ones towards top, with few scattered hairs towards base inside but no enations, auriculate; anterior pouch obscure, $< \frac{1}{2}$ as long as ovary; tube 3–4 mm long; superior lobes narrow-oblong 12–15 mm long, 1.5–2 mm wide; inferior lobes narrow-oblong, 8–15 mm long, 1.5–2 mm wide; wings c. 2 mm wide; connate part of inferior lobes 4–6 mm long. *Stamen* filaments linear, c. 3 mm long; anthers narrow-oblong, c. 1.5 mm long. *Ovary* villous; septum almost as long as loculus; ovules c. 30; style 3–4 mm long, slightly villous towards top; indusium transverse-oblong to transverse-obovate, c. 3 mm long, 2–2.5 mm wide, slightly folded, villous, with a very convex orifice beset with white bristles c. 0.2 mm long. *Fruit* ovoid to cylindrical, 1–1.5 cm long, c. 6 mm wide, 4-valved but scarcely separating below level of sepals. *Seeds* flat, pale brown, elliptic, 1.8–2.5 mm long, smooth, with a distinct rim; wing 1.2–1.5 mm wide, mucilaginous.

RANGE: AVON District of Western Australia

HABITAT: Heath and open forests on sandy soils.

CHROMOSOME NUMBER: $n = 8$ (Peacock 1963, as *G. affinis*).

DISCUSSION: This species has previously been included in *G. affinis* and differs from it in the very convex lips of the indusium, the looser coarser simple hairs, and a tendency to form almost stoloniferous scapes. It also shows some similarities to *G. robusta* but its bracts and cauline leaves are never stem-clasping as in that species.

SPECIMENS EXAMINED (10): WESTERN AUSTRALIA: Jurien Bay road, *W.E. Blackall* 3658, 29 Aug. 1938 (PERTH); Younegin, *C.A. Gardner* 7483, 19 Oct. 1944 (PERTH); Taylors Well near Pingelly, *R.C. Carolin* 3166, 18 Aug. 1961 (SYD); 21 miles (33.6 km) W of Coorow, *C.H. Gittins* 1675, Sept. 1967 (NSW).

Named for the very convex orifice of the indusium. Latin, *convexus* = convex.

***G. tripartita* Carolin, sp. nov.**

Herba decumbens vel prostrata. Scapi usque 15 cm longi. Folia basalia anguste elliptica vel late elliptica vel obovata 4–7 cm longa 1–2 cm lata crenato-dentata albide villosa pilis stellatis et multicellularibus versus basim in petiolum contracta. Flores in pedunculis bibracteolatis. Corolla flava c. 18 mm longa gossypine villosa extus sine enationibus intus. Indusium 3-fidum ramo medio late obovato et ramo laterali curvo-lineari plicato. Capsula 2-valvulata sed non ad basim. Semina plana flava laevia elliptica 2 mm longa ala indistinctissima.

HOLOTYPE: WESTERN AUSTRALIA: Ongerup-Ravensthorpe, Fitzgerald River, *R.C. Carolin* 3569, 11 Sept. 1961 (NSW).

Decumbent to prostrate perennial herb with a strong taproot and stock, cottony-villous with stellate and multicellular hairs the latter often tangled together. *Scapes* terete, to 15 cm long. *Leaves* mostly basal, narrow-elliptic to broad-elliptic or obovate, 4–7 cm long, 1–2 cm wide, narrowing often abruptly

into a \pm distinct petiole, crenate-dentate, sometimes slightly crisped. *Flowers* in racemes; bracts leaf-like but smaller; peduncles 1–3 cm long; bracteoles linear, c. 4 mm long, 1 mm wide, often obscured by hairs; pedicels 1–2 cm long, geniculate at bracteoles, not articulate. *Sepals* linear, 4–5 mm long, 1 mm wide, \pm obtuse, adnate to ovary almost to its summit. *Corolla* bright yellow, c. 18 mm long, villous outside with stellate multicellular and a few simple hairs, sprinkled with a few hairs but without enations inside, auriculate; anterior pocket less than $\frac{1}{2}$ as long as ovary; tube 1.5–2 mm long; superior lobes narrow-obovate to narrow-elliptic, \pm falcate, c. 11 mm long, 2.5 mm wide; inferior lobes oblong-elliptic, 8–9 mm long, 2.5–3 mm wide; wings c. 2.5 mm wide; connate part of inferior lobes 5–6 mm long. *Stamen* filaments 3 mm long; anthers narrow-oblong, 2 mm long. *Ovary* septum almost as long as loculus; ovules 30–32; style 4 mm long, glabrous; indusium 3-fid; median branch broad-ovate, 1 mm long, 2.5 mm wide, yellow-brown, with few villous hairs, folded in front of the median branch, with a curved orifice beset with bristles c. 0.1 mm long or lips glabrous; side-branches curved-linear, c. 1 mm long, surmounted by a tuft of white bristles. *Fruit* ovoid, c. 13 mm long, c. 7 mm wide, 2-valved but usually only to midway, each valve bifid. *Seed* flat, yellow, elliptic, c. 2 mm long, smooth, with a distinct rim; wing almost obsolete.

RANGE: Esperance district of Western Australia.

HABITAT: Sandy soils

CHROMOSOME NUMBER: $n = 8$ (Peacock 1963, as *G. affinis*).

DISCUSSION: Previously included in *G. affinis*, this species can be distinguished by its 3-partite indusium.

SPECIMENS EXAMINED (39): WESTERN AUSTRALIA: Marchagee, *F. Vanzetti*, Oct. 1925 (PERTH); Waddouring, *W.B. Alexander 1242*, Oct. 1915 (PERTH); 1 mile (1.6 km) E of Boorabbin, *C.A. Gardner*, 20 Oct. 1945 (PERTH); 2 miles (3.2 km) from Dowerin towards Wyalkatchem, *M.E. Phillips*, 19 Sept. 1962 (CBG 019012, SYD); between Pingrup and Lake Grace, *W.E. Blackall 3054*, 21 Sept. 1933 (PERTH); Nyabing, *R.H. Kuchel 1881*, 17 Sept. 1964 (AD 96531152); 1 mile (1.6 km) S of Borden, *F. Lullfitz L3363*, 16 Aug. 1964 (PERTH).

The specific epithet refers to the indusium, which is divided into three distinct parts, two curved linear lateral lobes and a broad-ovate central part. Latin, *tri-* = three, *partitus* = partite.

***G. willisiana* Carolyn, sp. nov.**

Herba erecta vel ascendens villosa pilis stellatis et multicellularibus caulorrhiza erecta ramosa et scapis brevis. Folia basalia anguste elliptica vel anguste obovata, 4–9 cm longa, 4–18 mm lata. Corolla flava c. 15 mm longa villosa extus glabra et sine enationibus intus. Septum ovarii tres partes longitudinem loculi. Indusium transverse ellipticum 1.5 mm longum 2.5 mm latum plicatum. Capsula 2-valvulata. Semina plana flava laevia elliptica 2 mm longa, ala brevissima.

HOLOTYPE: Redcliffs, NW Victoria, *J.H. Willis*, Aug. 1940 (MEL 24304). There are three specimens mounted on the same sheet. 'Wimmera, *C. Walter*' without date, and 'Redcliffs, *J.H. Willis*, Aug. 1937' are herewith excluded from the type. The holotype consists only of the remaining specimen from Redcliffs.

Erect or ascending herb with thick taproot and usually a well-developed stock, covered with villous stellate and multicellular hairs the latter tangled around each other. *Scapes* terete, usually shorter than leaves. *Leaves* basal, narrow-elliptic to narrow-oblong or lanceolate, 4–9 cm long, 4–18 mm wide, narrowing

very gradually towards base, obtuse or acute, entire or irregularly dentate; cauline leaves if present never stem-clasping. *Flowers* apparently solitary in axils of basal leaves; peduncles to 5 cm long; bracteoles linear, c. 2 mm long, almost obscured by hairs; pedicels to 4 mm long, geniculate at bracteoles, not articulate. *Sepals* narrow-oblong, 3.5 mm long, 0.5 mm wide, acute, adnate to ovary nearly to its top. *Corolla* yellow, 15 mm long, villous-pubescent outside with stellate and multicellular hairs only very rarely with a few simple hairs towards top, glabrous or nearly so and without enations inside, auriculate; anterior pocket < 1/2 as long as ovary; tube 2–3 mm long; superior lobes narrow-obovate-elliptic, 8–9 mm long, 1.5–1.8 mm wide; inferior lobes oblong-elliptic, 5–6 mm long, c. 1.5 mm wide; wings c. 2.5 mm wide; connate part of inferior lobes 4–6 mm long. *Stamen* filaments linear, c. 2 mm long; anthers narrow-oblong, c. 1.5 mm long. *Ovary* septum 3/4 as long as loculus; ovules 28–30; style 3.5 mm long, glabrous, scarcely geniculate; indusium transverse-elliptic, 1.5 mm long, 2.5 mm wide, folded, glabrous on back, with few villous hairs on front, with a curved orifice beset with white bristles to 0.2 mm long on both lips. *Fruit* ovoid-ellipsoid, c. 1 cm long, 4–5 mm wide, 4-valved to midway or 2-valved to base with each valve bifid. *Seeds* flat, yellow, elliptic, 2 mm long, smooth, with a distinct rim; wing c. 0.1 mm wide.

RANGE: Southern part of South Australia, western Victoria and the Riverina district of New South Wales.

HABITAT: Mallee and open forest in dry communities.

DISCUSSION: This species has been referred to *G. affinis* in the past. The species related to *G. affinis* are listed below together with the main features distinguishing them.

G. affinis. Indusium with a shallowly concave upper lip; bristles short. Indumentum villous. Cauline leaves not stem-clasping.

G. willisiana. Indusium with a straight to slightly convex orifice; bristles long. Indumentum villous. Cauline leaves not stem-clasping.

G. convexa. Indusium with a very convex orifice; bristles long. Indumentum hirsute, tangled. Cauline leaves not stem-clasping.

G. tripartita. Indusium 3-lobed; bristles long on lateral lobes. Indumentum villous. Cauline leaves not stem-clasping.

G. robusta. Indusium with a very convex orifice; bristles short. Indumentum villous. Cauline leaves stem-clasping.

SPECIMENS EXAMINED (87): SOUTH AUSTRALIA: N of Caroline Bluff, Mt. Gambier, *J.B. Cleland*, 9 Nov. 1955 (AD 96720010); 10 miles (16 km) W of Minnipa, *H.W. Caulfield* 31, 21 Sept. 1955 (AD 96213166); Pinkawillinie, *R.D. Rohrlach* 189, 1 March 1959 (AD 95924013). VICTORIA: Nhill-Murrayville, *J.J. Ackland* 79, 1 Oct. 1963 (MEL 24305); Dimboola, *D. Kraehenbuehl* 35, 11 Oct. 1958 (AD 96422050). NEW SOUTH WALES: Rankins Springs road, *G. Althofer* 8A, 1966 (NSW).

Named for J.H. Willis, formerly of the National Herbarium of Victoria, who collected the type specimen.

G. geniculata var. *robusta* Benth., Fl. Austral. 4: 63 (1868) = *G. robusta* (Benth.) *K. Krause*, Pflanzenr. 54: 53 (1912).

LECTOTYPE: SOUTH AUSTRALIA: Marble Range, *Wilhelmi*, s.d. (K). **ISOLECTOTYPE:** MEL, *P. Paralectotypes:* Wimmera, *Dallachy* (MEL); Lake Koorong, Herb. Muell. (MEL); Marble Range, *Wilhelmi* (K, MEL, P).

G. glabra R. Br., Prodr.: 577 (1810).

LECTOTYPE: SOUTH AUSTRALIA: Port 1, R. Brown, s.d. (BM). ISOLECTOTYPE: K.*

G. gracilis R. Br., Prodr.: 575 (1810).

LECTOTYPE: QUEENSLAND: Broad Sound, R. Brown, 15 Sept. 1802 (BM). ISOLECTOTYPE: K.*

G. rosulata Domin, Biblioth. Bot. 22: 1198 (1929) = **G. paniculata** Sm.

LECTOTYPE: QUEENSLAND: Aperti loci arenosi in xerodrymio ad opp. Jericho, Domin 8783, March 1910 (PR 531399).

G. macbarronii Carolin, sp. nov.

Herba plus minusve annua. Folia basalia anguste obovata usque lineari-lanceolata 5–11 cm longa glabra crassa dentibus paucis. Flores in racemis vel thyraxis erectis dispositi. Bracteae lineares. Pedunculi glabri usque 25 mm longi bracteolis triangularibus. Corolla flava 7–9 mm longa pubescentia extus. Lobi superiores corollae auriculati. Capsula subglobosa 3–4 mm longa duabus valvis dehiscens. Semina nitida biconvexa orbicularia 0.5 mm diametro.

HOLOTYPE: NEW SOUTH WALES: Holbrook, E.J. McBarron 647, 10 Feb. 1947 (NSW). ISOTYPE: SYD.

Annual or short-lived erect perennial herb with a short stock, with well-developed secondary root system and sometimes a thickish tap root. *Scapes* terete or slightly angled when young, to 30 cm, glabrous. *Leaves* thick, mostly basal, narrow-obovate to linear-oblancoate, 5–11 cm long, 2–6 mm wide, narrowing very gradually into an indistinct petiole with a broadened scarious base, acute, with a few coarse teeth on margin, glabrous. *Flowers* in erect terminal thyrses or racemes; bracts linear, 2–20 mm long, 0.5–1 mm long; bracteoles triangular, 1–1.5 mm long, 0.3–0.5 mm wide, acute, glabrous or with a few mostly simple hairs; pedicel 0.5–3 mm long, simple-pubescent or glabrous below but mostly glandular-pubescent above articulate c. 0.5 mm below ovary. *Sepals* linear to elliptic, 1–2 mm long, 0.2–0.5 mm wide, glandular-pubescent with few simple hairs, acute, entire, adnate to ovary for $\frac{3}{4}$ its length. *Corolla* yellow, 7–9 mm long, glandular-pubescent with a few simple hairs outside, sprinkled with simple and glandular hairs, with very few obscure enations inside, auriculate; anterior pouch obscure; tube 2–2.5 mm long; superior lobes oblanceolate, c. 5 mm long, 1 mm wide; inferior lobes oblong-elliptic, 4–4.5 mm long, 1 mm wide; wings 1–1.2 mm wide; connate part of inferior lobes c. 2 mm long. *Stamen* filaments linear, 1.5 mm long; anthers narrow-oblong c. 1 mm long, c. 0.3 mm wide, apiculate. *Ovary* glandular-pubescent, with few simple hairs; septum $\frac{3}{4}$ as long as loculus; ovules numerous, scattered on placentas; style 5 mm long, villous-pubescent; indusium square, 1 mm long, brown sometimes tinged with purple, not folded but sometimes slightly notched, with a straight orifice beset with white bristles c. 0.1 mm long on upper lip and somewhat shorter ones on lower lip. *Fruit* subglobular to ovoid, 3–4 mm long, c. 2 mm wide, glandular and simple-pubescent, 2-valved almost to base, each valve entire. *Seeds* biconvex, yellow-brown, orbicular, 0.5 mm diam., reticulate-foveate, shining; wing < 0.1 mm wide, mucilaginous.

RANGE: North East Victoria; Western Plains, Western Slopes and Tablelands in New South Wales and Darling Downs in Queensland.

HABITAT: Damp places.

CHROMOSOME NUMBER: $n = 8$ (Peacock 1963, as *G. gracilis* Sm).

DISCUSSION: This has previously been confused with *G. gracilis*, from which it differs in the indusium which is not folded, and with *G. paniculata*, from which it differs in the thicker narrower leaves, the smaller square indusium which is never altogether purple, the smaller flowers and the chromosome number. The specimens from Victoria tend to have rather larger flowers but otherwise agree fairly well with those from north of the Murray River.

SELECTED SPECIMENS (25): VICTORIA: Ovens River, *F. Mueller*, 9 Feb. 1853 (MEL 23419). NEW SOUTH WALES: Maryland, *E. Hickey*, Jan. 1885 (MEL 23338); Tingha, *J.L. Boorman*, March 1917 (NSW 81554); Chandlers Peak Guyra, *J.L. Boorman*, March 1917 (NSW 81556); Warrumbungle Ranges, *E. Betche* 60, Jan. 1883 (MEL 23352); 15 miles (24 km) E of Rylestone, *H.S. McKee* 444, 10 Jan. 1953 (SYD). QUEENSLAND: Fletcher, Stanthorpe district, *W.J.F. McDonald* 1758, 31 Jan. 1977 (BRI 221919).

Named for the collector of the holotype, an avid collector, who was a veterinarian in the New South Wales Department of Agriculture.

***G. lamprosperma* F. Muell.**, *Fragm.* 1: 116 (1859).

LECTOTYPE: NORTHERN TERRITORY: Upper Victoria River, *F. Mueller*, Dec. 1855 (MEL 23395). ISOLECTOTYPE: K. Paralectotype: Near McAdams Range, *F. Mueller*, Dec. 1855 (MEL 23396).

***G. humilis* R. Br.**, *Prodr.*: 575 (1810).

LECTOTYPE: VICTORIA: Arthur's Seat, Port Phillip, *R. Brown*, 25 Jan. 1804 (BM). ISOLECTOTYPES: K, MEL, P.*

G. propinqua *W. Fitzg.*, *J. & Proc. Roy. Soc. Western Australia* 3: 213 (1918) = ***G. bicolor* F. Muell.**

LECTOTYPE: WESTERN AUSTRALIA: Inglis Gap, King Leopold Ranges, *W.V. Fitzgerald*, s.d. (NSW). PARALECTOTYPES: Bold Bluff, Isdell River, *W.V. Fitzgerald* (NSW).

***G. gloeophylla* Carolin, sp. nov.**

Herba erecta suffruticosa viscidula ad 50 cm alta. Folia caulina linearia ad anguste elliptica 4–8 cm longa anguste dentata plus minusve sessilia. Flores in racemis vel thyraxis terminalibus dispositi. Pedunculi bracteolati viscidula. Pedicelli articulati. Sepala anguste deltoidea 1–1.5 mm longa pilis glandulosis. Corolla lilacina vel violacea 10–12 mm longa pilis glandulosis extra. Ovulae in placentis irregulariter dispositae.

HOLOTYPE: WESTERN AUSTRALIA: Longini Landing, Kalumburu Mission, *D.E. Symon* 7125, 29 May 1971 (ADW 41918). ISOTYPES: CANB, PERTH, SYD.

Erect branched glandular-pubescent and viscid suffruticose herb. *Leaves* scattered along stems, linear to very narrow-elliptic, 4–8 cm long, 1–2.5 mm wide, tapering very gradually to a blunt tip and towards base into an indistinct petiole, dentate with narrow teeth, with very short villous axillary hairs. *Flowers* in terminal racemes or thyrses; bracts leaf-like but narrower and shorter and never exceeding flower; peduncles to 18 mm long; bracteoles linear, 3–8 mm long, acute, entire, often not exactly opposite; pedicels 2–4 mm long, articulate 1–2 mm below ovary. *Sepals* narrow-deltoid, 1–1.5 mm long, 0.3–0.5 mm wide, acute, entire, adnate to ovary almost to its summit. *Corolla* pale to deep purple, 10–12 mm long, glandular-pubescent outside, with few long simple hairs inside, indistinctly auriculate; anterior pocket prominent and half as long as or equal to ovary; tube 3–4 mm long; superior lobes narrow-oblong-elliptic, 6–6.5 mm long, 0.8–1.2 mm long; inferior lobes narrow-oblong-elliptic, 5–6 mm long, 0.8–1.2 mm wide; wings c. 1 mm wide. *Stamen* filaments linear, c. 3 mm long;

anthers narrow-oblong, 1.5 mm long, 0.3–0.5 mm wide. *Ovary* glandular-pubescent; septum almost as long as loculus; ovules c. 20 in two \pm irregular rows; style 4–5 mm long, glabrous; indusium broad-ovate-oblong, 1.5 mm long, 1 mm wide, purple, folded, with few long white hairs on both surfaces towards base, with a straight orifice beset with bristles to 0.1 mm long. *Fruit* cylindrical to ovoid, 8–10 mm long, 3 mm wide, 2-valved. *Seed* biconvex, brown, elliptic, 1.5 mm long, reticulate-foveate, glossy with a distinct rim; wing c. 0.1 mm wide.

RANGE: Gardner (Kimberley) Region of Western Australia and Darwin–Gulf Region of Northern Territory.

HABITAT: Heaths and shrublands on poor sandy soils.

DISCUSSION: This species is tentatively placed in section *Porphyranthus* on the basis of the irregular ovule insertion, and the seed ornamentation, the folded indusium with shortish bristles and the pedicel articulation. The suffruticose habit is unknown in the rest of that section.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: (see holotype). NORTHERN TERRITORY: 2–3 miles (3.2–4.8 km) N of El Sharana, *Martensz & Schodde AE 565* (NT 38842); Waterfall Creek 1 mile (1.6 km) above falls (South Alligator), *N. Byrnes NB1518* (NT 14994); 13° 03'S 132° 56'E, *M. Lazarides 8011*, 4 April 1973 (CANB 239891); 41 miles (65.6 km) from Pine Creek to U.D.P. Falls, *C.H. Gittins 2846*, 1 May 1975 (SYD, BRI).

Named for the viscid leaves. Greek, *gloeus* = sticky, *phyllon* = leaf.

G. purpurascens R. Br., Prodr.: 578 (1810).

LECTOTYPE: NORTHERN TERRITORY: Bay No. 3, Point 2, (i.e. Arnhem Bay), *R. Brown*, 3 March 1903 (BM).# Brown made two collections of this species, describing both collections in his field notes. In the Prodr. he describes this species as 'foliis radicalibus elongato-lanceolatis' but in his field notes only the specimens from Arnhem Bay are described as having lanceolate leaves. The Arnhem Bay specimens agree with this description whilst the other collection, from Groote Island, has linear leaves and Brown describes them as such in his field notes. The Arnhem Bay collection is therefore selected as the lectotype.

G. minutiflora F. Muell., Fragm. 8: 224 (1874).

LECTOTYPE: QUEENSLAND: Between the Norman and Gilbert Rivers, *T. Gulliver 68* (MEL 23997). ISOLECTOTYPES: MEL 23998, 22243.*

G. viscidula Carolín, sp. nov.

Herba annua adscendens ad 25 cm alta radicibus fibrosis. Folia spathulata 4–11 cm longa pubescentia viscidula pilis simplicibus ac glandulosis brevis integra vel dentis paucis parvis in rosula erecta vel adscendenti disposita. Flores in thyrsis vel cymo-paniculis dispositi. Pedicelli et pedunculi viscidula pilis simplicibus brevis et glandulosis capitate brunne vel fulve. Corolla lilacina 5–7 mm longa pilis brevis patentibus extra. Ovulae numerosae in placentis dispersae. Capsula subglobosa vel ovoidea c. 1.5 mm in diametro. Semina biconvexa elliptica c. 0.3 mm longa nitida.

HOLOTYPE: NORTHERN TERRITORY: 166 miles from Borroloola on Daly Waters road, *R.C. Carolín 9339*, 19 May 1974 (NSW). ISOTYPE: SYD.

Erect to ascending viscid annual herb to 25 cm high, covered with simple and somewhat more numerous shortly stalked yellowish or brownish tipped glandular hairs, with a short stock and an adventitious root system. *Leaves* mostly basal, spathulate in overall shape but with a rather more distinct petiole than in

other members of sect. *Porphyranthus*, (4-) 6-11 cm in overall length; lamina elliptic. 2-4 cm long, 10-20 mm wide, entire or obscurely toothed and sometimes with two narrow lobes near the base, usually acute. Cauline leaves similar but smaller. *Flowers* arranged in loose thyrses or cymo-panicles; bracts linear, c. 1 mm long; bracteoles linear, to 5 mm long, acute; often not exactly opposite; pedicels (6-) 9-11 mm long, articulate c. 0.5 mm below ovary. *Sepals* narrow-ovate-elliptic, 1 mm long, 0.3 mm wide, acute, adnate to ovary for $\frac{2}{3}$ its length. *Corolla* bluish purple, 5-7 mm long, pubescent with short soft patent simple hairs outside, with a few scattered hairs inside, indistinctly auriculate; anterior pocket scarcely $\frac{1}{4}$ as long as ovary; tube 2-3 mm long, curved; superior lobes narrow-oblong to oblanceolate, 3 mm long, 0.8 mm wide; inferior lobes ovate, 2 mm long, 0.8 mm wide; wings c. 1 mm wide; connate part of inferior lobes 2-3 mm long. *Stamen* filaments linear, 2 mm long; anthers narrow-oblong, 1 mm long. *Ovary* pubescent as outside of corolla; septum almost as long as loculus; ovules numerous, minute, scattered over both surfaces of septum; style 2.5 mm long, purple, villous; indusium square to oblong, c. 1 mm long, purple, not folded, with a straight orifice beset with short (0.1 mm) white bristles on upper lip, lower lip almost glabrous. *Fruit* subglobular to ovoid, c. 1.5 mm diam., pubescent, 2-valved often scarcely to midway very rarely to base, entire. *Seeds* biconvex, elliptic, c. 0.3 mm long, brownish, glossy, smooth to reticulate, with obscure rim; wing, narrow, mucilaginous.

RANGE: Burke District in Queensland and Darwin-Gulf District in Northern Territory.

HABITAT: Seasonally damp sites especially in *Melaleuca* and *Eucalyptus microtheca* woodland.

DISCUSSION: This species is distinguished from the other species grouped around *G. purpurascens* by the pubescent, viscid, \pm distinctly petiolate leaves. The flowers are somewhat larger than those of *G. paludicola* and *G. minutiflora*.

SELECTED SPECIMENS (6): NORTHERN TERRITORY: Camp-Oven Waterhole, *R.C. Carolin* 9167, 9 May 1974 (SYD); 14 miles (22.4 km) NW of Corinda on road to Westmoreland, *R.C. Carolin* 9146, 7 May 1974 (SYD); Edith Falls, *R.A. Perry* 1941, 28 Aug. 1948 (BRI 015293).

Named for the viscid nature of the whole plant. Latin *viscidulus* = somewhat sticky.

***G. paludicola* Carolin, sp. nov.**

Herba annua gracilis adscendens ad 25 cm radicibus fibrosis. Folia basalia adscendentis vel erecta lanceolata 4-7 cm longa glabra integra vel dentibus paucis parvis. Flores in thyrasis vel cymo-paniculis decompositis dispositi. Pedicelli et pedunculi pilis simplicibus patentis et pilis glandulosis capitatis nigris vel fuscis obtecti. Corolla lilacina 4-12 mm longa pilis simplicibus ac glandulosis extra. Ovulae numerosae in placentis dispersae. Capsula subglobosa 1.2-2.5 mm in diametro. Semina nitida fulva biconvexa elliptica 0.3-0.4 mm longa.

HOLOTYPE: QUEENSLAND: 14 miles (22.4 km) NW of Corinda on road to Westmoreland, *R.C. Carolin* 9147, 7 May 1974 (NSW). **ISOTYPE:** SYD.

Slender ascending annual herb to 25 cm, with a weak stock and mostly adventitious roots. *Scapes* numerous in axils of basal leaves, almost glabrous near base. *Leaves* almost all basal, ascending or erect, lanceolate, 4-7 cm long, 2-4 mm wide, tapering very gradually towards base into a very indistinct petiole,

acute, entire or with few very obscure teeth, glabrous. *Flowers* arranged in much-branched thyres or cymo-panicles; bracts leaf-like but smaller and somewhat pubescent; peduncles to 3 mm long, pubescent with patent simple hairs and long black or very dark brown-tipped glandular hairs; bracteoles linear, 3–5 mm long, pubescent as peduncles, acute, not always exactly opposite; pedicels 7–9 mm long, pubescent as peduncles, articulate c. 0.5 mm below ovary. *Sepals* ovate to lanceolate 1.5–1.8 mm long, 0.5 mm wide, simple- and glandular-pubescent, acute, adnate to ovary for $\frac{2}{3}$ its length. *Corolla* bluish purple, 4–5 (12) mm long, simple- and glandular-pubescent outside, with very few scattered simple hairs inside, auriculate; anterior pouch almost obsolete; tube 2–3 mm long; superior lobes narrow-oblong, 2–3 mm long, 0.5 mm wide; inferior lobes ovate to narrow-ovate, 1.2 mm long, 0.5 mm wide; wings c. 1 mm wide, \pm as long as lobes; connate part of inferior lobes 1.5 mm long. *Stamen* filaments linear, 1.5 mm long; anthers oblong, 0.5 mm long. *Ovary* glandular- and simple-pubescent; septum almost as long as loculus; ovules numerous, scattered over both surfaces of septum; style 4 mm long, slightly pubescent especially towards top; indusium \pm square but widening a little towards top, 0.5 mm long, purplish, glabrous, with an almost straight orifice beset with white bristles c. 0.2 mm long on upper lip but almost glabrous on lower lip. *Fruit* subglobular, 1.5–2.5 mm diam., simple- and glandular-pubescent, 2-valved to below midway but seldom to base, each valve entire. *Seeds* biconvex, yellowish, elliptic, 0.3–0.4 mm long, smooth, glossy, with an obscure rim; wing c. 0.1 mm wide, mucilaginous.

RANGE: Burke District in Queensland and northern part of Northern Territory.

HABITAT: Seasonally moist places, particularly in *Melaleuca* woodlands, but not on the heavier soils.

DISCUSSION: This species is rather similar to *G. minutiflora* but the corolla is larger and deeper in colour and the auricles on the superior lobes enclose the indusium.

SPECIMENS EXAMINED: QUEENSLAND: 4 miles (6.4 km) N. of Maggieville on Myravale road, *R.C. Carolín 8766*, 20 May 1974 (SYD). NORTHERN TERRITORY: Tin Camp Creek c. 20 miles (24 km) S of Nabarlek, *T.G. Hartley 13775* (NT 44774); Katherine Gorge, *C.L. Gunn 14* (NT 44320); Ferguson River, *M. Parker 112* (NT 41718).

Named after the swampy conditions in which this species grows in the wet season. Latin, palus, *paludis* = swamp, *-cola* = a dweller.

***G. berringbinensis* Carolín, sp. nov.**

Herba ad 30 cm scapis villosis. Folia basilia oblanceolata ad fere spatulata 3.5–6 cm longa villosa-pubescentia saepe glabrescentia. Flores in thyrsis laxis terminalis dispositi. Pedunculi 5–30 mm longi bracteolis lineari-ellipticis 4–15 mm longis. Pedicelli articulati 13–20 mm longi. Corolla flava villosa-pubescentia extus. Oculis numerosis in placentis dispersis. Capsula cylindrica 7–8 mm longa villosa-pubescentia bivalvularis sepalis longitudine $\frac{1}{2}$ partes adnatis. Semina numerosa parva nitidula 0.8 mm longa.

HOLOTYPE: WESTERN AUSTRALIA: Bed of Berringbine Creek, Belele Station, *C.A. Gardner 7857*, 15 Oct. 1945 (PERTH).

Villous and minutely glandular herb with a short usually branched stock, with thin tap root and a well-developed adventitious root system. *Scapes* terete, ascending to 30 cm. *Leaves* mostly basal, spreading or ascending, oblanceolate to almost spatulate, 3.5–6 cm long, 2–10 mm wide, tapering gradually into a

distinct petiole to 3 cm long with broad scarious base, obtuse, entire or with few blunt teeth, villous-pubescent, often \pm glabrescent. *Flowers* in loose spreading terminal thyrses; bracts linear to elliptic, 4–15 mm long, 1–2 mm wide, entire; peduncles 5–30 mm long; bracteoles sometimes not exactly opposite, linear-elliptic, 3–4 mm long; pedicels 13–20 mm long, articulate c. 1 mm below ovary. *Sepals* lanceolate-elliptic, c. 3 mm long, 0.5 mm wide, adnate to ovary for $\frac{1}{2}$ – $\frac{3}{4}$ its length. *Corolla* yellow with purplish auricles, c. 12 mm long, villous-pubescent with long simple and minute glandular hairs outside, with some scattered simple hairs inside, auriculate; anterior pocket not prominent, \pm as long as ovary; tube c. 3 mm long; superior lobes narrow-oblong, 8 mm long, 0.8 mm wide; inferior lobes oblong, 4–5 mm long, 0.8 mm wide; wings to 2 mm wide; connate part of inferior lobes 5–6 mm long. *Stamen* filaments c. 3.5 mm long; anthers narrow-oblong, 1.5 mm long. *Ovary* villous-pubescent; septum $\frac{2}{3}$ as long as loculus; style 7–8 mm long; indusium obtriangular, truncate at base, c. 1.5 mm long, 2 mm wide, convex, with an almost straight orifice beset with white bristles 0.3 mm long. *Fruit* ellipsoid to cylindrical, 7–8 mm long, prominently beaked (i.e. sepals attached about halfway), 2-valved to base, each valve entire. *Seeds* flat to biconvex, yellow-brown, elliptic, 0.8 mm long, smooth, glossy; wing c. 0.1 mm wide, mucilaginous.

RANGE: Known from the type collection only, north west of Meekatharra.

HABITAT: Red sandy loam.

DISCUSSION: The attachment of the sepals low down on the elongated capsule is characteristic of this species.

Named for the locality of the type collection.

G. lyrata *Carolin*, sp. nov.

Herba caulis prostratis usque 13 cm longis fere glabris sed pilis perpaucis minutis versus apicem et fasciculis pilorum villosorum in axillis instructis. Folia lyrata oblanceolata 7–28 mm longa crassa pubescentia molliter simpliciterque praesertim in marginibus costisque. Flores in racemis foliosis terminalibus dispositi. Pedunculi 2–3 mm longi pilis glandulosis simplicibusque bracteolis anguste ellipticis circa 3 mm longis. Pedicelli 3–5 mm longi articulati. Corolla flava 10–12 mm longa auriculata pubescens extus et pilis paucis simplicibus intus. Ovulae numerosae in duabus seriebus irregulari in placentis dispersae. Indusium transverse late oblongum circa 1.2 mm longum setis brevis purpurascens super labiis. Capsula ovoidea pubescens 5–6 mm longa 4-valvulata.

HOLOTYPE: WESTERN AUSTRALIA: 20 miles (32 km) W of Laverton, *A.S. George* 2798, 22 Aug. 1961. (PERTH).

Prostrate herb with a branched stock. *Stems* terete, to 13 cm long, glabrous but for a very few minute hairs towards top and conspicuous villous tufts in axils of leaves and bracts. *Basal leaves* thick, spreading, oblanceolate in outline, lyrate, 7–28 mm long, 2–5 mm wide, with a well-defined petiole, obtuse, with some minute soft simple hairs especially on margins and lower surface of midrib; cauline leaves, when present, usually less lobed and smaller. *Flowers* in terminal leafy racemes; bracts elliptic to oblanceolate, 5–9 mm long, 2–2.5 mm wide, shortly petiolate, entire or with few small teeth; peduncles 2–3 mm long, sprinkled with some minute glandular and simple hairs; bracteoles narrow-elliptic, to elliptic, c. 3 mm long, and 1 mm wide; pedicels 3–5 mm long, similar to peduncles, articulate just below ovary. *Sepals* narrow-deltoid to lanceolate, 2–3 mm long, 0.4–0.5 mm wide, acute, sprinkled with minute glandular and

simple hairs, adnate to ovary for c. $\frac{2}{3}$ its length. *Corolla* yellow, 10–12 mm long, sprinkled with minute soft simple and glandular hairs on outside, with few simple hairs inside, auriculate; anterior pocket indistinct; tube c. 3 mm long; superior lobes narrow-oblong, c. 6 mm long and 0.8 mm wide; inferior lobes narrow-oblong to narrow-deltoid, c. 4 mm long, 1 mm wide; wings c. 2 mm wide; connate part of inferior lobes c. 4 mm long. *Stamen* filaments linear, c. 1.5 mm long; anthers oblong, c. 1.5 mm long. *Ovary* tapering gradually towards base, minutely simple- and glandular-pubescent; septum almost as long as loculus; ovules numerous, in two very irregular rows on either side of placenta; style 4–5 mm long, villous; indusium transverse-broad-oblong, c. 1.2 mm long and 1.5 mm wide, purple, villous especially near base on undersurface, \pm convex on upper surface, with a straight orifice beset with purplish bristles c. 0.2 mm long. *Fruit* ovoid, 5–6 mm long, minutely simple- and glandular-pubescent, with a distinct beak, equally 4-valved. *Mature seeds* not seen.

RANGE: Known only from the type collection.

HABITAT: Red sandy loam.

DISCUSSION: The shape of the capsule, which is \pm equally 4-valved, the indumentum, the numerous somewhat irregularly arranged ovules which appear to give rise to small seeds, and the conspicuous tufts of villous wool in the axils of the leaves all indicate a relationship with *G. modesta* and its allies. *G. lyrata* is distinguished from other members of that group by the lyrate leaves.

Named after the lyrate basal leaves. Latin, *lyratus* = like a lyre.

G. erecta Ewart in Ewart & Davies, Fl. N. Territory: 265 (1917) = *G. modesta* J. Black.

LECTOTYPE: NORTHERN TERRITORY: 12 miles (19.2 km) NW of Nth. Terr. Survey Camp III, *G.F. Hill* 329, 12 June, 1911 (MEL).

G. claytoniacea F. Muell. ex Benth., Fl. Austral. 4: 79 (1868) [as *G. Laytoniana*, an orthographic error].

LECTOTYPE: WESTERN AUSTRALIA: Swampy flats of Don River, *Maxwell* (K). ISOLECTOTYPE: MEL. PARALECTOTYPES: *Drummond 1st coll. 42*; *Drummond 406* (MEL 23318); *Drummond* [159] (?MEL 23319), the sheet bearing this specimen has no collector's number but the number '159' is given in the protologue. Bentham described this species under the binomial '*G. laytoniana* F. Muell. Herb'. He cites the specimens indicated above but only one of these is now at K. This, since it agrees with the description, accordingly is selected as the lectotype. Mueller's writing is not always as legible as one would wish and it is fairly clear that Bentham intended to use Mueller's unpublished name but misinterpreted the handwriting. Furthermore, *G. claytoniacea* has been used consistently since Mueller corrected the name in 1882. Consequently I am herewith accepting the corrected name as legitimate.

G. arthrotricha F. Muell. ex Benth., Fl. Austral. 4: 62 (1868).

HOLOTYPE: WESTERN AUSTRALIA: *Drummond 190* (K). ISOTYPES: BM, MEL 24113.

G. bonneyana F. Muell., Fragm. 6: 226, t.53 (1868) = *G. arthrotricha* F. Muell. ex Benth.

LECTOTYPE: WESTERN AUSTRALIA: *Drummond 190* (MEL 24113). ISOLECTOTYPES: BM, K. PARALECTOTYPE: The plate, F. Muell., loc. cit. t. 53 (1868). Bentham and Mueller discuss or note each other's descriptions of, and comments on, both the names under consideration. Mueller cites even the page numbers of the reference to both species in Flora

Australiensis, but Bentham only refers to the plate of *G. bonneyana* and states explicitly that he has not seen the description of it. Despite this, there can only have been a few days or weeks between the issue of *Flora Australiensis*, vol. 4 on 16th December 1868 (see Stafleu & Cowan 1976) and *Fragmenta* vol. 6 'Fine Decembris 1868' as indicated on its last page. The mail ships took about 80 days to make the passage between Melbourne and London so, clearly, both must have had copies of at least part of each other's publications before the date of issue. Mueller probably received the Goodeniaceae proofs for *Flora Australiensis* in late July since a letter of 23 Sept. 1868 written by him to Bentham seems to be the first indication of his receiving proofs of vol. 4 which he was eagerly awaiting. I have been unable to find any reference to a distribution of the plates of *Fragmenta* before the publication of the corresponding fascicles. It is probable that Mueller included a print of *G. bonneyana* in the consignment of Goodeniaceae shipped at the beginning of April 1867. There is however, no evidence that this print of tab. 53 of *Fragmenta*, which would constitute a valid publication of *G. bonneyana*, was distributed to anyone other than Bentham before the fascicle containing the description was issued. The priority then must rest with *G. arthrotricha* since Dec. 16th can scarcely be taken to be the same as 'Fine Decembris'.

***G. coerulea* R. Br., Prodr.: 578 (1810).**

LECTOTYPE: WESTERN AUSTRALIA: Princess Royal Harbour, King Georges Sound, *R. Brown*, Dec. 1802 (BM). ISOLECTOTYPES: K, MEL, P.*

***G. trichophylla* Vriese ex Benth., Fl. Austral. 4: 67 (1868).**

LECTOTYPE: WESTERN AUSTRALIA: *Drummond 3rd coll. 158* (K). ISOLECTOTYPE: MEL, P, BM. PARALECTOTYPE: *Drummond 2nd. coll. 407* (K). *Drummond no. 158* is selected because the paralectotype has simple hairs on the calyx and corolla — a characteristic not mentioned by Bentham. Indeed he specifically emphasizes the glandular hairs.

***G. perryi* Gardner ex Carolin, sp. nov.**

Herba ascendens vel erecta usque 25 cm alta. Folia basalia oblanceolata 4–5 cm longa gossypine villosa integra fere sessilia. Flores in racemis terminalibus dispositi bracteis anguste oblongis usque linearibus 5–10 mm longis. Pedunculi bracteolis linearibus 2–6 mm longis. Sepala lineari-deltaoidea 7–8 mm longa. Corolla coerulea glabra extus sed pilis paucis atque enationibus intus auriculata plus minusve distincta. Ovarium villosum septo longitudinem loculi fere aequanto. Indusium suborbiculare c. 2 mm longum.

HOLOTYPE: WESTERN AUSTRALIA: Bunjil, *C.A. Gardner* 15 Oct. 1961 (PERTH).

Ascending or erect herb to c. 25 cm with a branched stock. *Stems* obscurely ridged when young becoming \pm terete, cottony hairy. Basal leaves oblanceolate, 4–5 cm long, 6–10 mm wide, tapering very gradually towards broadened base, obtuse, entire, cottony with multicellular cells; cauline leaves similar but smaller. *Flowers* in terminal thyrses or racemes; bracts mostly narrow-oblong to linear, 5–10 mm long, 0.5–2 mm wide, sessile, acute, cottony-villous, lower ones somewhat broader and more leaf-like; bracteoles linear, 2–6 mm long, 0.5 mm wide, cottony-pubescent. *Sepals* linear-deltoid, 7–8 mm long, 0.5–0.8 mm wide, acute, entire, cottony-pubescent on both surfaces, adnate to ovary almost to its summit. *Corolla* blue, with yellowish throat, 15–18 mm long, glabrous outside, with very few short hairs and rows of enations inside, auriculate; anterior pouch indistinct, $\frac{1}{2}$ – $\frac{2}{3}$ as long as ovary; tube c. 3 mm long; superior lobes oblong-oblanceolate, 15 mm long, 2 mm wide; inferior lobes oblong, 8–9 mm long, 2.5 mm wide; wings c. 3 mm wide; connate part of inferior lobes 8–10 mm long. *Stamen* filaments linear, c. 4 mm long; anthers narrow-oblong, 1.5 mm long. *Ovary* cottony-villous; septum almost as long as loculus; ovules c. 40; style 6 mm long, villous-pubescent; indusium suborbicular, c. 2 mm diam.,

brownish, villous-pubescent, with a curved orifice beset with white bristles c. 0.5 mm long. *Fruit* and seed unknown.

RANGE: Known only from the type collection.

HABITAT: Unknown.

DISCUSSION: This species shows some similarity to *G. incana*, from which it can easily be distinguished by the glabrous outer surface of the corolla.

The species epithet probably commemorates Dick Perry, a forester who spent some time in the field with C.A. Gardner, including the Bunjil area (Maslin, pers. comm.).

G. incana R. Br., Prodr.: 578 (1810).

LECTOTYPE: WESTERN AUSTRALIA: Bay I, South Coast, R. Brown, 7 Jan. 1804; (BM). ISOLECTOTYPE: K.* The lectotype is mounted on the same sheet as 'Chotarup, F.V. Mueller' & 'Drummond 3 Coll. no. 155'.

G. pterigosperma R. Br., Prodr.: 578 (1810).

ORTHOGRAPHIC VARIANT: *G. pterygosperma* Vriese, Natuurk. Verh. Holl. Maatsch. Wetensch. Haarlem ser. 2, 10: 153 (1854).

LECTOTYPE: WESTERN AUSTRALIA: Bay I (Lucky Bay) South Coast, R. Brown, 12 Jan. 1802 (BM). ISOLECTOTYPE: (K).* The isolectotype of *G. pterigosperma* at K contains a fragment of another species which I have been unable to identify with certainty.

G. cyanea F. Muell., Fragm. 1: 155 (1859) = *G. pterigosperma* R. Br.

LECTOTYPE: WESTERN AUSTRALIA: [Phillip's Range], Maxwell (K). PARALECTOTYPES: uncertain. There are no specimens from Phillips Range, the locality given in the protologue, which have been labelled *G. cyanea* by Mueller. The closest to it seems to be the specimen at K, labelled by Mueller, from S.W. Australia. Mueller probably used other material, which was subsequently labelled '*G. pterygosperma*', for his description of *G. cyanea*, before sending it to Kew for Bentham to use in *Flora Australiensis*. The specimen selected as the lectotype is labelled *G. cyanea* in Mueller's handwriting, and agrees with his description.

G. glareicola Carolín, sp. nov.

Herba erecta caulorrhiza basibus emortuis foliarum obiecta. Scapi glabri ad 30 cm. Folia basalia linearia usque oblanceolata crassa glabra integra obtusa sessilia. Flores in racemis terminalibus dispositi. Sepala lanceolata 1.5–4 mm longa glabra. Corolla coerulea sed flava in fauce ad 15 mm longa glabra extus et intus atque seriebus enationum auriculata sacco angusto ovarium aequans. Ovarium glabrum stylo villosioque latissimo obovato. Fructus ovoideus 8–9 mm longus plerumque quatuor valvis dehiscens. Semina plana brunnea reticulata elliptica ala lata hyalina.

HOLOTYPE: WESTERN AUSTRALIA: Near Newdegate, W.E. Blackall 1364, 18 Nov. 1931 (PERTH).

Glabrous often glaucous erect perennial herb with thickened stock surrounded by dead leaf-bases, with slightly thickened tap-root. *Scapes* terete or slightly angular when young, to 30 cm high, 2–3 mm thick. *Basal leaves* thick, linear to oblanceolate, 20–30 mm long, 2–4 mm wide, sessile with broadened base, entire, glabrous except for some villous wool in axils; upper leaves becoming smaller. *Flowers* in terminal racemes, lower peduncles occasionally bearing two flowers; peduncles 8–20 mm long; bracteoles linear-lanceolate, 2.5–3 mm long; pedicels 5–14 mm long, articulate c. 1.5 mm below ovary. *Sepals* lanceolate,

1–4 mm long, acute, adnate to ovary almost to its summit. *Corolla* blue, yellow in throat, c. 15 mm long, glabrous outside, with some very short hairs and obscure enations inside, auriculate; anterior pocket narrow but as long as ovary; tube 2–3 mm long; superior lobes narrow-oblong to oblanceolate, 7–7.5 mm long, c. 1.5 mm wide; inferior lobes narrow-ovate, 6.5–7 mm long, to 2 mm wide; wings 2–2.5 mm wide; connate part of inferior lobes 4.5–5 mm wide. *Stamen* filaments linear, 2.5 mm long; anthers oblong, 1.5 mm long. *Ovary* glabrous; septum nearly as long as loculus; style to 6 mm long, villous; indusium broad-ovate, 1.5 mm long, 2 mm wide, brownish, with a slightly curved orifice beset with bristles c. 0.4 mm long which are purplish at tips. *Fruit* ovoid, 8–9 mm long, 2-valved to base, each valve often bifid. *Seeds* flat, brown, elliptic, 2 mm long, reticulate; wing hyaline, c. 0.7 mm wide.

RANGE: Hyden to Tammin, Western Australia.

HABITAT: Gravelly sands.

DISCUSSION: The lack of hairs and the broad hyaline wing on the seed distinguish this species from other members of sect. *Coerulea*.

SELECTED SPECIMENS (23): WESTERN AUSTRALIA: Bundering, *C.A. Gardner* 2026, 15 Nov. 1923 (PERTH); 16 miles (25.6 km) N of Lake Bidy, *W.E. Blackall* 1364, 18 Nov. 1931 (PERTH); Frank Hann National Park, *R.D. Royce* 10199, 10 Dec. 1971 (PERTH); Tammin, *C.A. Gardner* 12116, 26 Nov. 1953 (PERTH); 12 miles (19.2 km) W of Ballidu, *J.W. Green* 768, 3 Nov. 1956 (PERTH).

Named after the gravelly soils in which this species is sometimes found. Latin, *glarea* = gravel, *-icola* = living in.

G. eatoniana *F. Muell.*, *Fragm.* 8: 186 (1874)

LECTOTYPE: WESTERN AUSTRALIA: Blackwood River, *Jas. Forrest* (MEL 22369). PROBABLE ISOLECTOTYPE: K.* *Mueller* simply cites 'In Australia extratropica occidentali ad flumen Blackwood River'. There are a number of collections from the Blackwood River but of these it would seem that only that of John Forrest, who was in that area in 1870, was actually made before *Mueller's* description in 1873. One of these sheets is therefore selected as the lectotype. The collector's name on the herbarium label 'Jas. Forest' is presumably a mistake for 'John Forrest'.

G. hassallii *F. Muell.*, *Fragm.* 6: 10 (1867).

LECTOTYPE: WESTERN AUSTRALIA: In Australis occidentali, *Drummond s.n.* (MEL) 24091. ISOLECTOTYPE: K. MEL 24006*

G. nigrescens *Carolin*, *sp. nov.*

Herba erecta usque 20 cm alta nigrescens vel memnonia si siccata. Folia anguste oblonga vel oblanceolata 2–5 cm longa glabra vel strigosa integra vel dentata versus basin sensim in petiolum contracta. Flores in racemis terminalibus dispositi bracteis foliosis sed linearibus. Pedunculi 5–18 mm longi bracteolis linearibus duabus circa 2–3 mm infra ovario insertis. Sepala linearilanceolata vel anguste elliptica 4–5 mm longa. Corolla ochracea pubescens simpliciter et glandulose extus et villosis enationibus pilis fere occultis intus. Capsula ovoido-cylindrica usque 1.5 cm longa glabrescens duabus valvis ad basim dehiscens. Semina orbicularia usque 3 mm in diametro reticulata ala angusta.

HOLOTYPE: NORTHERN TERRITORY: 28 miles (44.8 km) NE of Banka Banka, *G. Chippen-dale*, 16 June 1960 (NT 7023).

Erect perennial or annual herb to 20 cm, becoming dark-brown or black when dried, with a branched stock c. 0.3 mm wide. *Stems* compressed, distinctly

ridged, glabrous. *Leaves* scattered on stem, narrow-oblong to oblanceolate, 2–5 cm long, 3–5 mm wide, narrowing very gradually towards base, entire dentate or lobed, obtuse, glabrous or with minute glandular hairs when young, with a tuft of villous axillary hairs. *Flowers* in terminal racemes; bracts linear, to 5 cm long, to 3 mm wide at base of raceme but mostly c. 3 mm long and 1 mm wide, entire or dentate, glabrous; peduncles 5–18 mm long, glabrous; bracteoles linear, 2–3 mm long, c. 0.5 mm wide, glabrous or with few appressed simple hairs, sometimes not exactly opposite; pedicels 1–2 mm long, glabrous, articulate. *Sepals* linear-lanceolate to elliptic or narrow-elliptic, 4–5 mm long, 0.5 mm wide, acute, entire, nearly glabrous but usually with very few appressed simple and glandular hairs, adnate to ovary for $\frac{3}{4}$ its length. *Corolla* deep yellow, brownish in throat, c. 18 mm long, densely pubescent outside with glandular and simple hairs, with villous-pubescent hairs arranged in basally widening zones and obscure enations almost hidden by hairs which frequently surmount them inside, auriculate; anterior pouch scarcely as long as ovary; tube 1–2 mm long; superior lobes narrow-oblong, c. 10 mm long, c. 1 mm wide, winged on upper margin only, barbulate on lower margin; inferior lobes oblong, mm long, 2–2.5 mm wide; wings 2–2.8 mm wide; connate part of inferior lobes 6–7 mm long. *Stamen* filaments linear, 2.5 mm long; anthers oblong, 1.5 mm long. *Ovary* with a few scattered appressed simple and glandular hairs; septum c. $\frac{2}{3}$ as long as loculus; ovules c. 30; style 3.5–4 mm long, glabrous; indusium oblong-ovate, 2.5 mm long, 1.5–2 mm wide, sprinkled with villous hairs, concave to slightly folded, with a curved orifice beset with white bristles c. 0.5 mm long on upper lip and shorter ones on lower lip. *Fruit* ovoid-cylindrical, \pm compressed, 1.2–1.5 cm long, 0.4–0.5 cm wide, almost glabrous, 2-valved to base, each valve entire. *Seeds* flat, brown, orbicular, 4.3 mm diam., reticulate-foveate, with an obscure rim; wing 0.2–0.3 mm wide.

RANGE: Barkly Tablelands in the Northern Territory.

HABITAT: Grey soils.

DISCUSSION: This species is distinguished from others which have strigose hairs and bracteoles, by the narrow indusium, the glandular pubescence on the outside of the corolla, the lack of a lower wing on the superior corolla lobes and the narrow wing on the seed.

SPECIMENS EXAMINED: NORTHERN TERRITORY: 7 miles (11.2 km) N of Brunchilly, *G. Chippendale*, 17 June 1960 (NT 7064); 17 miles (27.2 km) NW of Brunette Downs HS., *G. Chippendale*, s.d. (NT 5017); 28 miles (44.8 km) NE of Alexandria Stn. HS., *C.S. Christian 1545*, 15 June 1948 (CANB 109464).

Named from its showing a marked tendency to blacken when dried. Latin, *nigrescens* = becoming black.

G. fascicularis *F. Muell. & Tate*, Trans. & Proc. Roy. Soc. South Australia 13: 108 (1890).

HOLOTYPE: SOUTH AUSTRALIA: Basedow Ranges, *Tietkens*, 1889 (MEL). This name has been overlooked until recently. Unfortunately it predates the name previously used for this species, viz. *G. subintegra*. The type of *G. fascicularis* is a poor specimen with linear basal leaves and villous hairs on the back of the indusium. Many other specimens also have villous hairs on the indusium despite the numerous statements in the literature to the contrary.

G. subintegra *F. Muell. ex J. Black*, Trans. & Proc. Roy. Soc. South Australia 51: 383 (1927) = *G. fascicularis* *F. Muell. & Tate*.

LECTOTYPE: NEW SOUTH WALES: Darling River, *Dallachy* (K). This is the same specimen chosen as the lectotype for *G. glauca* var. *sericea* Benth. Mueller in Victorian Naturalist 5: 13 (1888) writes 'This plant to which as a mere variety or as a distinct species the name *subintegra* may be assigned. . . .' This, of course, is not valid publication. Black cites no specimens but refers to Mueller's statement given here. I am therefore accepting that *G. subintegra* is *G. glauca* var. *sericea* Benth., raised to specific rank.

G. glauca var. *sericea* Benth., Fl. Austral. 4: 77 (1868) = *G. fascicularis* F. Muell. & Tate.

LECTOTYPE: NEW SOUTH WALES: Darling River, *Dallachy* (K). PARALECTOTYPES: Sturt's Creek and Dawson River, *F. Mueller* (MEL 23532); In the Interior, *Mitchell* (K, MEL 23562); Plains of the Condamine, *Leichhardt* (MEL 23551?); Armadillo, *W. Barton* (MEL 23554, NSW 76573). Bentham only makes indirect reference to specimens he referred to this species, but there are two labelled by him with Flora Australiensis labels at K. One of these has been selected as the lectotype.

G. glauca F. Muell., Trans. & Proc. Victorian Inst. Advancem. Sci.: 40 (1855).

LECTOTYPE: VICTORIA: On the grassy banks of the Avoca, *s. c.*, *s.d.* (MEL). PARALECTOTYPES: K, MEL. There are several sheets from this locality in MEL and it is not clear if they are from the same collection. One I have marked as the lectotype.

G. lunata J. Black, Trans. & Proc. Roy. Soc. South Australia 51: 384 (1927).

LECTOTYPE: SOUTH AUSTRALIA: Cordillo Downs, *J.B. Cleland*, 27 May 1924 (AD97006372). PARALECTOTYPES: Macumba River, *J.B. Cleland* (AD); Alberga River, *H.W. Andrews* (AD97006371). The typification of *G. lunata* presents a serious problem. The specimens from Black's herbarium labelled with this name are poor, none of them having intact indusia which bear the characters that distinguish the species. There is, however, a drawing of an indusium on AD 97006371 which makes it clear that this, at any rate, was taken from a specimen of *G. lunata*. Unfortunately two specimens are mounted on this sheet with the note, by someone other than J. Black, that it was difficult to decide which specimen belonged to which label. In fact one of these labels is not cited by Black and therefore that collection has no claim to any sort of type status: this drawing is most probably from the non-type material. The only specimen that one can be sure has type status, i.e. the one sheet AD 97006372, is a very poor specimen with no flowers and no drawings of flowers. There appears to be no choice but to select this as the lectotype.

G. argentea J. Black, op. cit.: 384 (1927) = *G. lunata* J. Black

LECTOTYPE: SOUTH AUSTRALIA: Strangeways Springs, *W.L. Cleland*, no date (AD 96845153). ISOLECTOTYPE: K. PARALECTOTYPE: Yadrakina Soak (east of Lake Torrens), *s.c.* (AD).

G. pasqua *Carolin*, sp. nov.

Herba strigosa erecta vel ascendens usque 50 cm. Folia anguste elliptica vel oblanceolata 4–8 cm longa integra vel dentata versus basim sensim in petiolum contracta et in rosulis disposita. Flores in racemis terminalibus laxis vel subumbellatim dispositi pedunculis ebracteolatis articulatis. Septum ovarii breve. Lobi inferiores corollae alis inaequalibus. Capsula ovoido-ellipsoidea duabus valvis integris dehiscens. Semina elliptica reticulata brunnea, ala 0.3–0.4 mm lata.

HOLOTYPE: WESTERN AUSTRALIA: 11 miles (17.6 km) from Roeburne on Port Hedland road, *R.C. Carolin* 7894, 14 Aug. 1970 (NSW).

Ascending to erect herb, with short stock and thin tap-root, with strigose simple hairs. *Scapes* terete, to 50 cm long. *Leaves* mostly basal, spreading, narrow-elliptic-oblong, 4–8 cm long, 5–10 mm wide, tapering very gradually towards base, entire to dentate, with strigose hairs and long cottony multicellular hairs the latter becoming less frequent with age, with a small tuft of villous axillary hairs; cauline leaves much smaller and narrower. *Flowers* in terminal racemes or subumbels; bracts mostly linear, 2–12 mm long, to 1 mm wide; peduncles 2–4 cm long, articulate c. 1 mm below ovary; bracteoles absent. *Sepals* lanceolate, c. 2 mm long, adnate to ovary for $\frac{2}{3}$ – $\frac{3}{4}$ of its length. *Corolla* yellow with brownish markings in throat, 8–10 mm long, strigose outside, with a few villous hairs inside particularly in throat, auriculate; anterior pocket distinct, $\frac{1}{2}$ – $\frac{2}{3}$ as long as ovary; tube 2–2.5 mm long; superior lobes narrow-oblong, 5–5.5 mm long, 1–1.5 mm wide; inferior lobes ovate-oblong, 4–4.5 mm long, c. 1.5 mm wide; wings c. 1.5 mm wide, wing above auricle 0.5 mm wide and c. $\frac{2}{3}$ as long as lobe; connate part of inferior lobes 3–3.5 mm long. *Stamen* filaments 1.5 mm long; anthers oblong, 1 mm long. *Ovary* strigose; septum c. $\frac{1}{2}$ as long as loculus; ovules 23–35; style c. 3 mm long; indusium square to transverse-elliptic, to 1.7 mm long, to 2 mm wide, brownish, slightly convex, pubescent on both surfaces, with a \pm concave orifice beset with white bristles c. 0.3 mm long. *Fruit* ovoid-ellipsoid, slightly compressed, 2-valved to the base, each valve entire. *Seeds* flat, brown, elliptic, c. 3 mm long, reticulate; wing pale brown, to 0.5 mm wide.

RANGE: North-western Australia west of the Great Sandy Desert.

HABITAT: Grassy plains on heavy soils.

DISCUSSION: The size and shape of the fruit and, in particular, the unequal wings on the superior corolla lobes of this species separate it from *G. glauca* and its allies, although the indumentum are very similar.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: 50 miles (80 km) from Onslow on Roebourne road, *R.C. Carolín 7859*, 11 Aug. 1970 (SYD, PERTH); 127 miles (203 km) from Onslow on Roebourne road, *R.C. Carolín 7846*, 11 Aug. 1970 (SYD); 322 miles (51.2 km) from Dampier on Onslow road, *R.C. Carolín 7886*, 12 Aug. 1970 (SYD); 21 miles (33.6 km) N of Sandy Creek on Rabbit Proof Fence, *R.D. Royce 1687*, 15 May 1947 (PERTH).

Named after its habitat in open grassy plains. Latin, *pascuus* = relating to pastures.

G. heteromera *F. Muell.*, *Fragm.* 1: 115 (1858).

LECTOTYPE: VICTORIA?: In moist grassy places on the Murray River, *s.c.*, *s.d.* (MEL 23624). PARALECTOTYPES: The protologue gives Murray, Darling and Avoca Rivers. There are a number of specimens at MEL collected on these Rivers which would have been available to Mueller when he cast the diagnosis: the one selected is the most complete of these specimens.

G. tenella *R. Br.*, *Prodr.*: 577 (1810) non *Andr.*, *Bot. Repos.* 7: t.466 (1807), nom. superfl.

HOLOTYPE: WESTERN AUSTRALIA: King George's Sound, *Mr. Bauer* (BM). ISOTYPE: *K. G. tenella* *Andr.* is fortunately a superfluous name since Andrews writes '... and is by Labillardère figured under the title of *Velleia trinervis*'.

G. tenella var. *major* *Benth.*, *Fl. Austral.* 4: 74 (1868) = ***G. tenella*** *R. Br.*

LECTOTYPE: WESTERN AUSTRALIA: Don River, *Maxwell* (K). ISOLECTOTYPE: MEL. PARALECTOTYPES: Karridale, *Herb. F. Mueller* (MEL).

G. anfracta *J. Black*, Trans & Proc. Roy. Soc. South Australia 51: 385 (1927).

HOLOTYPE: SOUTH AUSTRALIA: Cootanoorina, *R. Helms*, May 1891 (AD 96620136). AD 96845148 is probably a dissected flower from the holotype with notes and drawings.

G. coronopifolia *R. Br.*, Prodr.: 576 (1810).

LECTOTYPE: NORTHERN TERRITORY: Carpentaria Island 5 (i.e. Morgan's Island), *R. Brown*, 20–21 Jan. 1803 (BM). ISOLECTOTYPES: MEL 23310, 23312, 23309, P, K.* The specimen MEL 23311 labelled 'North Coast, 1803, *R. Brown*' may also be an isotype.

Although this name is given in Blackall & Grieve, How to Know W. Australian Wildflowers 431 (1956), it is not clear to which species it refers. Since *G. coronopifolia* is not so far recorded from the area covered by their work, it is doubtful if they were, in fact, referring to *G. coronopifolia*. Even more doubtful is the reference to this species by Christensen & Ostenfeld, Det. Kgl. Dan. Selsk., Biol. Medd., 3: 123 (1921) but I have not examined the specimen concerned, viz. Armadale, *Christensen & Ostenfeld 1121*, 20 Sept. 1914.

G. integerrima *Carolin*, sp. nov.

Herba ascendens vel decumbens usque circa 9 cm alta caulibus teretibus glabris. Folia crassa linearia usque 7 cm longa integra supra canaliculata strigosa. Flores in umbellis foliosis terminalibus dispositi pedunculis ebracteolatis circa 5 mm longis. Corolla flava sed brunnea in fauce 7 mm longa glabra extus pubescens intus in fauce. Lobi superiores corollae ala inferiore reducta auriculata. Capsula globula circa 2.5 mm diametro glabra. Semina orbicularia circa 1.5 mm diametro reticulata fumosa ala 0.3 mm lata.

HOTOTYPE: WESTERN AUSTRALIA: Lake King, *A.S. George 7291*, 3 Nov. 1965 (PERTH).

Decumbent to ascending herb to c. 9 cm. *Stems* terete, glabrous. *Leaves* thick, fasciculate, linear, to 7 cm long, 1–2 mm wide, sessile with a broadened base, acute, involute with a narrow channel on upper surface, with a few short scattered \pm appressed simple hairs. *Flowers* arranged in terminal umbels; bracts leaf-like but smaller; pedicels c. 5 mm long, with very few short scattered hairs, indistinctly articulate just below ovary; bracteoles absent. *Sepals* narrow-deltoid, c. 3 mm long and 0.6 mm wide, acute, entire, glabrous, adnate to ovary for $\frac{2}{3}$ – $\frac{3}{4}$ its length. *Corolla* yellow with brownish throat, c. 7 mm long, glabrous outside, \pm pubescent inside in throat; anterior pocket indistinct, c. $\frac{1}{2}$ as long as ovary; tube c. 2 mm long; superior lobes narrow-oblong, c. 4 mm long and 0.5 mm wide, lower wing almost obsolete above auricle; inferior lobes oblong, 2 mm long, 1 mm wide; wings c. 1 mm wide, scarcely $\frac{1}{2}$ as long as lobes; connate part of inferior lobes c. 3 mm long. *Stamen* filaments linear, 1.5 mm long; anthers elliptic, 0.8 mm long. *Ovary* glabrous; septum scarcely $\frac{1}{2}$ as long as loculus; ovules 6–8; style 2–2.5 mm long, pubescent towards top; indusium transverse-oblong, 0.8 mm long, 1.5 mm wide, brownish, villous-pubescent, with \pm concave orifice beset with white bristles c. 2 mm long. *Fruit* globular, c. 2.5 mm diam., glabrous. *Seeds* flat, dark grey-brown, orbicular, c. 1.5 mm diam., reticulate, with prominent rim; wing c. 0.3 mm wide, mucilaginous.

RANGE: Known only from type collection.

HABITAT: (Sandy) margins of salt lakes.

DISCUSSION: This species is not closely allied to any other species, but the form of the few hairs and the seeds indicate a relationship with the *G. fascicularis* group more than with any other.

Named after the entire leaves. Latin, *integerrimus* = quite entire.

G. neogoodenia *Carolin*, nom. nov.

REPLACED NAME: *Neogoodenia minutiflora* Gardner & George, J. Roy. Soc. W. Australia 46:138 (1963). The epithet '*minutiflora*' is pre-occupied by *Goodenia minutiflora* F. Muell.

G. janamba *Carolin*, sp. nov.

Herba erecta usque 60 cm. Folia plerumque basalia ascendentes anguste oblonga ad oblanceolata 5–16 cm longa fere glabra plus minusve crassa. Flores in racemis vel subumbellatum terminaliter dispositi pedunculis ebracteolatis molliter patenter simpliciter glanduloseque pubescentibus. Corolla flava 10–15 cm longa simpliciter ac glandulose pubescens extus sparse villosa intus sacco prominentissimo. Capsula globula c. 4 mm diametro. Semina orbicularia c. 4 mm diametro nitida ala albida 1 mm lata.

HOLOTYPE: NORTHERN TERRITORY: c. 10 miles (16 km) E of South Alligator River on Oenpelli road, *R.C. Carolin 6817*, 16 May 1968 (NSW). ISOTYPE: SYD.

Erect herb with short basal stock, a narrow tap root and usually many adventitious roots. *Scapes* terete, branched, to 60 cm, glabrous or nearly so. *Leaves* mostly basal, slightly thickened, narrow-oblong to oblanceolate, 5–16 cm long, 2–7 mm wide, narrowing very gradually towards base, \pm acute, with a few blunt teeth on margin, glabrous except for some simple hairs towards base. *Flowers* in terminal umbels or racemes; bracts linear, 4–7 mm long, entire, with a few scattered simple hairs; peduncles 2–5 cm long, with soft simple patent hairs and minute glandular ones especially towards top, articulate c. 1 mm below ovary; bracteoles absent. *Sepals* deltoid, c. 0.5 mm long and 0.3 mm wide, acute, entire, simple- and glandular-pubescent, adnate to ovary for c. $\frac{2}{3}$ its length. *Corolla* yellow, 10–15 mm long, simple- and glandular-pubescent outside, with some scattered villous hairs inside especially on connate part of inferior lobes, auriculate; anterior pouch very prominent, almost as long as ovary; tube 3–4 mm long; superior lobes narrow-oblong, 5–8 mm long, c. 1 mm wide; inferior lobes oblong, 3–6 mm long, 1 mm wide; wings 1 mm wide, c. $\frac{2}{3}$ as long as lobes; connate part of inferior lobes 4–5 mm long. *Stamen* filaments linear, c. 1.5 mm long; anthers oblong, c. 0.5 mm long. *Ovary* glandular- and simple-pubescent; septum c. $\frac{1}{2}$ as long as loculus; ovules 10–12; style c. 5 mm long, glabrous or nearly so; indusium obtriangular, c. 1 mm long, c. 2 mm wide, brownish, villous-pubescent especially on upper surface, with an almost straight orifice beset with short white bristles c. 0.1 mm long on upper lip and much longer (0.5 mm) on lower lip of which the longest ones are reflexed. *Fruit* globular, \pm compressed, c. 4 mm diam., glandular- and simple-pubescent, 2-valved but not to base, each valve entire. *Seeds* flat, yellowish, orbicular, c. 4 mm diam., smooth, glossy, reticulate-foveate, with a distinct rim; wing 1 mm wide, whitish.

RANGE: Darwin–Gulf District of Northern Territory and the Croydon area of Queensland.

HABITAT: Savannah woodlands on sands and stony hillsides.

SELECTED SPECIMENS (15): NORTHERN TERRITORY: Port Darwin, *M. Holtze 702*, Oct. 1888 (MEL 22261); 1 mile (1.6 km) N of Adelaide River township, *N. Byrnes NB650*, 1 May 1968 (NT 14381, SYD); Goodparla Stn., *R.C. Carolin 6789*, 15 May 1968 (SYD); c. 5 miles (8 km) E of Mary River on Oenpelli to Pine Creek road, *R.C. Carolin 6748*, 14 July 1968 (SYD); 30 miles (48 km) E of Berwick Hs., *R.C. Carolin 9362*, 21 May 1974 (SYD); 22 miles (35.2 km) from Boroloola on road to Daly Waters, *R.C. Carolin 9310*, 18 May 1974 (SYD). QUEENSLAND: 44 miles (70.4 km) E. of Croydon on Georgetown road, *R.C. Carolin 8612*, 15 April 1974 (SYD).

'Janamba' is an Aboriginal word meaning crocodile and this species is named for the South Alligator River, near which the type specimen was collected.

G. strangfordii *F. Muell.*, *Fragm.* 6: 11 (1867).

LECTOTYPE: QUEENSLAND: Lara, Flinders River, *Kennedy* (MEL 23739). PARALECTOTYPE: Upper Victoria River, *F. Mueller* (K, MEL 23744). Mueller gives 'In locis ripariis a fluvo Victoriae usque ad rivum Flindersii'. The specimen from the Flinders River at MEL agrees with the illustration accompanying the type description much better than the Victoria River specimen at Kew even to the point of possessing the rare feature in this species of a bracteolate peduncle. This is therefore selected as the lectotype.

G. pusilliflora *F. Muell.*, *Victorian Naturalist* 5: 11 (1888).

LECTOTYPE: NEW SOUTH WALES?: Junction of Murray and Darling Rivers, *Mrs. Holding*, July 1887 (MEL 23136). PARALECTOTYPES: Yorkes Peninsula, *O. Tepper* (MEL 23140, 23141, 23146); Near the Broughton River, *L. Wehl* (MEL 23154); Richardsons Creek, *Curdie* (MEL 23138); Wimmera, *D. Sullivan* (MEL 23149); Lake Coorong, *C. Walter* (MEL 23137); Looma Rapids, *Cambell* (MEL 23130); Lake Albacutya, *C. French* (MEL 23134, 23135, 23142); Edwards River, *F. Mueller* (MEL 23129?); Murrumbidgee, *Lucas* (MEL 23139?, 23147?, 23148?); Tarella, *W. Baueuerlen* (MEL); Near Flinders Range, *F. Mueller* [not located], Near Mt. Perry, *Tate* (MEL); Darling River, *Brueckner* (MEL); Lachlan River, *F. Mueller* (MEL)]. The description in *Victorian Naturalist* appears to be the first since it was published in May 1888. Mueller's description in *Bot. Centralbl.* 35: 99 (1888) is virtually a copy of it and seems to have been published later in the same year. Mueller also described this species in his *Key to the System of Victorian Plants* which was published between November and December 1888.

G. calogynoides *E. Pritzel*, *Bot. Jahrb. Syst.* 35: 560 (1905) = **G. pusilliflora** *F. Muell.*

LECTOTYPE: WESTERN AUSTRALIA: District Avon, bei Newcastle, *E. Pritzel* 550, Aug. 1901 (BM). PARALECTOTYPE: Newcastle, *Diels* 3907 (B destroyed). Despite Krause's distinction between *G. pusilliflora* and *G. calogynoides*, 'Indusium integrum' and 'Indusium bilobum' respectively, the two may not be different. In fact *G. pusilliflora* has a cleft indusium, certainly never quite entire, and Mueller himself drew attention to it '... slightly contracted in the middle so as to indicate some approach to that of *Calogyne*'.

G. phillipsiae *Carolin*, *sp. nov.*

Suffrutex erectus vel ascendens usque 30 cm. Folia caulina crassa anguste oblonga vel linearia usque 4 cm longa sessilia glabra integra. Flores in thyrsis terminalibus dispositi pedunculis bracteolatis arcuatis 15–30 mm longis. Corolla flava 10–12 mm longa extus glabra intus conferte hirsuta sacco prominenti et lobis inaequalibus late alatis. Ovarium glabrum septo loculum fere aequanti.

HOLOTYPE: WESTERN AUSTRALIA: 19 miles (30.4 km) E of Ravensthorpe, *M.E. Phillips*, 3 Nov. 1962 (PERTH).

Erect to spreading suffruticose perennial to 30 cm. *Stems* obscurely ridged to terete, glabrous. Cauline leaves thick, narrow-oblong to linear, to 4 cm long, to 3 mm wide, sessile, entire, glabrous. *Flowers* in complex terminal thyrses; bracts similar to cauline leaves but smaller; peduncles 15–30 mm long, glabrous, arcuate; bracteoles thick, linear, to 10 mm long, c. 0.5 mm wide, glabrous, acute; pedicels similar to peduncles but shorter; partial inflorescences often many-flowered. *Sepals* elliptic-lanceolate, 2 mm long, 0.5 mm wide, acute, glabrous, adnate to ovary for almost its whole length. *Corolla* yellow (?), 10–12 mm long, glabrous outside but with a dense beard inside at base of

inferior lobes and then pubescent below, scarcely auriculate; anterior pouch prominent, c. $\frac{1}{3}$ as long as ovary; tube 4.5–5 mm long; superior lobes oblong, c. 8 mm long, c. 1.8 mm wide; inferior lobes oblong, c. 6 mm long, c. 1.5 mm wide; wings c. 1.5 mm wide; connate part of inferior lobes c. 5 mm long. *Stamen* filaments c. 2.5 mm long; anthers oblong, 1.5 mm long. *Ovary* glabrous; septum almost as long as loculus; ovules 45–50; style c. 5 mm long, villous; indusium depressed-obovate, 1 mm long, 2 mm wide, pubescent at base particularly on posterior side, with a slightly curved orifice beset with white bristles c. 0.4 mm long. *Fruit* and seed unknown.

RANGE: Known only from the type collection.

HABITAT: Unknown.

DISCUSSION: A species of uncertain relationship until more is known about its morphology and distribution. The bracteolate inflorescence with arcuate peduncles and pedicels appears to be diagnostic. The beard on the corolla points to a relationship with *G. pinnatifida* but the presence of bracteoles is unusual in the group centred on that species.

Named for the late Marie E. Phillips, the collector of the holotype, formerly of the Australian National Botanic Gardens in Canberra.

G. glauca F. Muell. var. *glandulosa* Benth., Fl. Austral. 4: 77 (1868) = *G. berardiana* (Gaudich.) Carolin

LECTOTYPE: NEW SOUTH WALES: Darling River, *Dallachy* (K). PARALECTOTYPE: Goyinga Mountains, *Vict. Expl. Expedition* (MEL 24170). The lectotype is the only specimen at K labelled var. *glandulosa* which has been annotated by Bentham. The only specimen at K from the Goyinga Mountains is a specimen of *G. fascicularis*.

Calogyne linearis S. Moore, J. Linn. Soc., Bot. 45: 185 (1920) = *G. berardiana* (Gaudich.) Carolin

LECTOTYPE: WESTERN AUSTRALIA: Kununoppin, *Stoward 307* (BM). PARALECTOTYPE: Karing, *G.W. Brown ex herb. Stoward* (BM).

G. ochracea Carolin, sp. nov.

Herba decumbens stolonifera. Folia oblanceolata 2–3 cm longa pubescentes fasciculata dentata pilis glandulosis et antrorso-simplicibus. Flores in racemis foliosis dispositi pedunculis 8–15 mm longis ebracteolatis pubescentibus glandulosis. Corolla ochracea 15–16 mm longa pubescens glandulose et simpliciter extus glabra intus sacco prominenti. Stylus bifidus. Capsula globula 6 mm diametro valvis duabus dehiscens. Semina orbiculata nigra reticulata ala angustissima straminea.

HOLOTYPE: WESTERN AUSTRALIA: Shark Bay, *C.A. Gardner*, Aug. 1932 (K).

Decumbent, stoloniferous herb to 15 cm long with a short stock. *Leaves* clustered near base of scapes on stolons or stock, oblanceolate, mostly 3–6 cm long, 4–8 mm wide, tapering very gradually into an indistinct petiole, dentate, glandular-pubescent, with some antrorse simple hairs on midvein on undersurface; a few smaller leaves present on scapes. *Flowers* in racemes often with zig-zag axis; bracts narrow-oblong to narrow-elliptic, 4–7 mm long, 1–2 mm wide, glandular-pubescent, dentate to entire; peduncles 8–15 mm long, glandular-pubescent, indistinctly articulate; bracteoles absent. *Sepals* narrow-oblong to narrow-elliptic, 4–5 mm long, 1–1.5 mm wide, acute, entire, glandular-pubescent, adnate to ovary for $\frac{1}{2}$ – $\frac{2}{3}$ its length. *Corolla* 'rich' yellow,

15–16 mm long, glandular-pubescent, with some scattered simple hairs outside, almost glabrous inside, auriculate; anterior pocket prominent, as long as ovary or nearly so; tube c. 2 mm long; superior lobes narrow-oblong, c. 10 mm long, 1.5–2 mm wide; inferior lobes oblanceolate, 8–9 mm long, 2–2.5 mm wide with wings to 2 mm wide, c. $\frac{2}{3}$ as long as lobes; connate part of inferior lobes 4–5 mm long. *Stamen* filaments linear, c. 3 mm long; anthers oblong, 1.5 mm long. *Ovary* glandular-pubescent; septum scarcely $\frac{1}{2}$ as long as loculus; ovules 20; style bifid, c. 8 mm long, each branch (including indusium) c. 5 mm long; each half-indusium oblong, 1.5 mm long, with a \pm lateral orifice beset with pale-brown bristles c. 0.2 mm long. *Fruit* globular, c. 6 mm diam., glandular-pubescent, 2-valved to base. *Seeds* black, orbicular, c. 2 mm diam., reticulate-foveate, with a \pm distinct rim; wing c. 0.1 mm wide, brownish.

RANGE: Carnarvon area of Western Australia.

HABITAT: Sandy soil.

DISCUSSION: The closest relative of this species is probably *G. berardiana* but it can be distinguished quite easily by the broader sepals, much more distinct anterior pocket of the corolla and the almost obsolete wing of the seed.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: 7 miles (11.2 km) N of Quobba H.S., A.S. George 10159 (PERTH); 4 km N of Herald Bay outcamp, Dirk Hartog Island, A.S. George 11508 (PERTH).

The specific epithet refers to the colour of the corolla. Latin, *ochraceus* = ochre yellow.

***G. elongata* Labill., Nov. Holl. Pl. 1: 52 (1804).**

LECTOTYPE: WESTERN AUSTRALIA: Habitat in Capite Van Diemen, *Labillardière* (P, donné par *M. Webb*). ISOLECTOTYPE: BM, FI.*

***G. salmoniana* (F. Muell.) Carolin, comb. nov.**

BASEONYM: *Velleia salmoniana* F. Muell., Victorian Naturalist 9: 127 (1892).

HOLOTYPE: WESTERN AUSTRALIA: Gascoyne River, *Mrs Forrest*, 1889 (MEL 9812). There are two specimens at MEL (see below) but only one bears the citation as given by Mueller (the collector having become Lady Margaret Forrest in the interval between collection and description).

Mueller, in placing this species in *Velleia*, was impressed by the sepals being almost free from the inner floral whorls. However, the inflorescence is clearly that of *Goodenia* and the corolla is adnate to the ovary. Moreover, there are a number of other *Goodenia* species in which the sepals are almost free from the ovary.

***G. filiformis* R. Br., Prodr.: 578 (1810).**

LECTOTYPE: WESTERN AUSTRALIA: Inter Princess Royal Harbour and Cape Howe, Prope Portum Regis Georgii III, *R. Brown*, 18 Dec. 1801 (BM). ISOLECTOTYPE: K.*

G. filiformis var. *hirsuta* K. Krause, Pflanzenr. 54: 86 (1912) = ***G. filiformis* R. Br.**

LECTOTYPE: WESTERN AUSTRALIA: *Drummond 185* (K). ISOLECTOTYPES: BM, MEL 23640, P.*

***G. krauseana* Carolin, nom. nov.**

REPLACED NAME: *G. nana* K. Krause, Pflanzenr. 54: 80 (1912) non Vriese, Natuurk. Verh. Holl. Maatsch. Wetensch. Haarlem ser. 2 10: 132 (1854).

***G. concinna* Benth.**, Fl. Austral. 4: 76 (1868). Lectotype: Western Australia:

Eyre's Relief, *Maxwell* (K). ISOLECTOTYPE: (MEL 23674). PARALECTOTYPES: *Drummond 360* (K); Point Henry, *Oldfield* (MEL); E. Mount Barren, *Maxwell* (K); Phillips and Fitzgeralds Ranges, *Maxwell* (K, MEL 23673).

***G. micrantha* Hemsley ex Carolin, nom. et stat. nov.**

REPLACED NAME: *G. filiformis* var. *minutiflora* F. Muell. ex K. Krause, Pflanzenr. 54: 86 (1912). Mueller did not publish the varietal epithet. His statement in Fragn. 8: 245 (1874): 'G. filiformis nonnumquam varietatem minutifloram producit' is not a valid publication of this variety and therefore the first valid publication is due to Krause. Since Christensen and Ostenfeld, Vid. Selsk. Biol. Medd. 3: 124 (1921) refer only to Mueller's invalid statement when they rename it *G. micrantha* Hemsl. ined., their binomial is invalid.

***G. havilandii* Maiden & Betche**, Proc. Linn. Soc. New South Wales 38: 250 (1913) (as *G. havilandii*).

LECTOTYPE: NEW SOUTH WALES: Cobar, *F.E. Haviland*, Sept. 1911 (NSW).

***G. macropectra* (F. Muell.) Carolin, comb. nov.**

BASIONYM: *Velleia macropectra* F. Muell., Fragn. 12: 22 (1882). *Symphyobasis macropectra* (F. Muell.) K. Krause, Pflanzenr. 54: 41 (1912)

LECTOTYPE: WESTERN AUSTRALIA: Gascoyne River, *J. Forrest* (MEL). This is a similar case to that of *G. salmoniana* (see above) but, once again, the inflorescence is clearly that of *Goodenia* and the corolla is adnate to the top of the ovary. The recognition of the genus *Symphyobasis* makes the genus *Goodenia* paraphyletic (Carolin, unpub.).

***G. nicholsonii* F. Muell.**, Fragn. 1: 203 (1859). = ***G. cycloptera* R. Br.**

LECTOTYPE: SOUTH AUSTRALIA: NW interior of South Australia, *Macdougall* [sic] *Stuart* (MEL 23060 pro parte). ISOLECTOTYPE: K.* The sheet (MEL 23060) bears specimens of two entirely different species. Mueller's description applies only to the scraps of flowers, etc. on the right-hand side of the sheet. It seems probable that the best part of this specimen was retained at K. The type of *G. nicholsonii* was probably collected on the same expedition as that of *G. chambersii*.

***G. larapinta* Tate** in Spencer, Report on the work of the Horn Scientific Exploring Expedition to Central Australia 3: 189 (1896).

LECTOTYPE: NORTHERN TERRITORY: Glen Edith, *R. Tate*, June 1894 (AD). ISOLECTOTYPES: K, MEL 23785.

***G. odonnellii* F. Muell.**, Australas. J. Pharm. 1: 278 (1886).

LECTOTYPE: WESTERN AUSTRALIA: Ord River, *O'Donnell* (MEL). ISOLECTOTYPES: MEL. There are a number of sheets in MEL with this locality and I have marked one of them as the lectotype.*

***G. redacta* Carolin, sp. nov.**

Herba ascendens vel decumbens caulibus pubescentibus molliter simpliciter ac minute glandulose usque ad 15 cm longis. Folia plerumque basalia ascendentes obovata 2.5–5 cm longa dentata obtusa pubescentia pilis simplicibus dispersis versus basim in petiolum indistinctum contracta. Flores in racemis foliosis terminalibus dispositi. Pedunculi 5–10 cm longi ebracteolati pubescentes pilis antrorsis simplicibus. Corolla flava 6–7 mm longa pubescens molliter simpliciter ac glandulose minime extus. Lobi superiores corollae exalati sed auriculati. Semina elliptica 3 mm longa reticulata brunnea sordide ala membranacea albida 0.2–0.4 mm lata.

HOLOTYPE: WESTERN AUSTRALIA: Prince Regent River, *Bradshaw & Allen*, 1891 (MEL 25769).

Ascending to decumbent herb with thin tap-root and very short stock. *Stems* terete, to 15 cm long, pubescent with soft antrorse simple hairs and some minute glandular ones. *Basal leaves* arranged in an ascending rosette, obovate, 2.5–5 cm long, 10–15 mm wide, tapering very gradually towards base into a \pm distinct petiole, dentate, with some soft scattered simple hairs especially on margins and lower surface of midrib; cauline leaves smaller and becoming almost sessile. *Flowers* in terminal leafy racemes; bracts leaf-like but smaller narrower and becoming almost sessile; peduncles 5–10 mm long, pubescent with soft antrorse simple hairs and some minute glandular ones, not distinctly articulate; bracteoles absent. *Sepals* unequal in size; posterior sepal elliptic, 2–3 times as long as others; anterior and lateral sepals elliptic-oblong, 1.5–2 mm long, 0.4–0.6 mm wide, acute, entire, pubescent with soft simple hairs and minute glandular ones, adnate to ovary for c. $\frac{3}{4}$ its length. *Corolla* yellow (?), 6–7 mm long, with soft simple and minute glandular hairs outside, \pm pubescent towards base inside; anterior pocket almost obsolete; tube c. 0.8 mm long; superior lobes narrow-oblong to almost linear, 2–2.5 mm long, 0.2–0.4 mm wide, tapering towards an acute point; inferior lobes ovate-oblong, 2.5 mm long, 1 mm wide; wings on superior lobes almost obsolete except for a distinct barbulate auricle, those on inferior lobes to 1 mm wide, $\frac{1}{2}$ – $\frac{2}{3}$ as long as lobe; connate part of inferior lobes 2.5–3 mm long. *Stamen* filaments linear, c. 0.8 mm long; anthers oblong, c. 0.6 mm long. *Ovary* pubescent; septum scarcely $\frac{1}{3}$ as long as loculus; ovules 6–10; style c. 1.5 mm long, glabrous or nearly so; indusium very broad-obovate, 0.8 mm long, 0.8 mm wide, purplish with a few scattered hairs particularly at base on lower surface, biconvex, with a concave orifice beset with purplish bristles c. 0.2 mm long. *Fruit* globular, 3–6 mm diam., pubescent, 2-valved usually not quite to base. *Seeds* flat, greyish brown, elliptic, 3 mm long, 2.5 mm wide, reticulate-foveate, with a prominent rim; wing 0.2–0.4 mm wide, white, membranous.

RANGE: Gardner (Kimberley) District of Western Australia and Darwin–Gulf District of Northern Territory.

HABITAT: Woodlands and open communities.

DISCUSSION: The indumentum and seeds place this species fairly close to *G. odonnellii* F. Muell., but it is easily distinguished by the enlarged posterior sepal and the reduced superior corolla-lobes which bear scarcely any wings but for the auricle.

SELECTED SPECIMENS (7): WESTERN AUSTRALIA: Bindelong Creek, *E.M. Bennet* 1777, 19 May 1967 (PERTH); 9 km N of Drysdale Stn., *D.E. Symon* 7090, 28 May 1971 (AD).

Named from the reduced superior lobes of the corolla. Latin, *redactus* = reduced.

G. cirrifica F. Muell., Australas. J. Pharm. 1: 81 (1886).

LECTOTYPE: NORTHERN TERRITORY: On the Alligator River, *Moritz Holtze* (MEL 23683). ISOLECTOTYPES: K, MEL 23684, NT 24267 (a fragment).* There are two sheets of this species at MEL which were collected by Holtze; only one is labelled 'Alligator River', and this is selected as the lectotype.

G. armitiana F. Muell., Fragm. 10: 110 (1877).

LECTOTYPE: QUEENSLAND: Einasleigh River, *Armit* 466 (MEL 23695). PARALECTOTYPE: Tait River, Gilbert River, Lynd River, *Armit* (MEL23686). Only the paralectotype bears

the label 'Lynd River' — cited by Mueller as such in his original description. Unfortunately, it does not agree with Mueller's description in that the glandular hairs are not apparent. Furthermore, the label also bears the localities 'Tait [sic] River, Gilbert River' in addition to Lynd River. There is only one specimen on the sheet. These localities thus cover a very large area and included between the Lynd and the Gilbert Rivers is the Einasleigh River (a tributary of the Gilbert), the locality of another Armit specimen which does agree with the description. It seems that Mueller had no clear idea of the locality of MEL 23686 and there is no reason for accepting it as a holotype merely because it bears the same locality as his citation, especially since it also bears other localities. In fact it must be rejected since it does not agree with the description. MEL 23695 from Einasleigh River bears the name '*G. armittiana*' [sic] in Mueller's handwriting and since it comes from the same area as designated by Mueller, I am selecting it as the lectotype.

G. linifolia *W. Fitzg., J. & Proc. Roy. Soc. Western Australia* 3: 213 (1918).

LECTOTYPE: WESTERN AUSTRALIA: Inglis Gap, *W.V. Fitzgerald* (K). PARALECTOTYPES: Inglis Gap, King Leopold Ranges, *W.V. Fitzgerald* (NSW); Lennard River, *W.V. Fitzgerald* (NSW); Isdell River, *W.V. Fitzgerald* (NSW); Barnett River, *W.V. Fitzgerald* (NSW).

G. nuda *E. Pritzel, Bot. Jahrb. Syst.* 35: 562 (1905).

HOLOTYPE: WESTERN AUSTRALIA: Bei Spring Station, 55 km südlich von Roeburne, *Diels* 2792, April 1901 (B, destroyed). NEOTYPE: 96 miles (153.6 km) from Onslow on Mt Stuart Road, *R.C. Carolin* 7788, 10 Aug. 1970 (NSW). ISOTYPE: SYD.

G. pallida *Carolin, sp. nov.*

Herba ascendens ad 50 cm. Folia caulina anguste elliptica 5–7 cm longa crassa glauca dentata vel integra sessilia glabra. Flores in racemis brevibus vel umbellis dispositi. Pedunculi articulati ebracteolati pilis simplicibus ac glandulosus. Sepala lineari-deltaidea 1.5–2 mm longa. Corolla violacea pallide 14–16 mm longa pilis simplicibus ac glandulosus extra. Semina orbicularia biconvexa 4–4.5 mm in diametro brunnea reticulata ala membranacea fulva c. 1 mm lata.

HOLOTYPE: WESTERN AUSTRALIA: 127 miles (203 km) from Onslow on Roeburne road, *R.C. Carolin* 7845, 11 Aug. 1970 (NSW). ISOTYPE: SYD.

Herb with mostly cauline leaves. *Stems* to 50 cm long, pubescent when young with short patent simple hairs and brown-headed glandular hairs, glabrescent. *Leaves* thick, glaucous, narrow-elliptic, 5–7 cm long, 3–8 mm wide, tapering very gradually towards base, acute, dentate with narrow teeth or entire. *Flowers* in short terminal racemes or umbels; bracts linear, 3–6 mm long, 0.2–0.8 mm wide, entire, glandular- and simple-pubescent, with a prominent axillary tuft of white hairs; peduncles 3–4 cm long, glandular- and simple-pubescent, distinctly articulate 1–2 mm below ovary. *Sepals* linear-deltoid, 1.5–2 mm long, 0.2–0.3 mm wide, acute, entire, glandular- and simple-pubescent, adnate to ovary for $\frac{1}{2}$ its length. *Corolla* pale purple, 14–16 mm long, glandular- and simple-pubescent outside, with simple hairs scattered over inside in throat and tube, auriculate; anterior pocket obscure, c. $\frac{1}{2}$ as long as ovary; tube 2–2.5 mm long; superior lobes narrow-oblong-lanceolate, 7.5–8 mm long, 1.5–1.8 mm long; inferior lobes narrow-oblong, 6–6.5 mm long, 1.5 mm wide; wings to 2 mm wide, $\frac{1}{2}$ – $\frac{2}{3}$ as long as lobe; connate part of inferior lobes 5–6 mm long. *Stamen* filaments linear, 2.5 mm long; anthers oblong, 1.5 mm long. *Ovary* glandular- and simple-pubescent; septum c. $\frac{1}{2}$ as long as loculus; ovules 15–20; style 4 mm long, glabrous; indusium transverse-ovate, 1.2 mm long, 1.2 mm wide, brownish, with a few scattered simple hairs towards base, with a slightly concave

orifice beset with white silky bristles c. 0.3 mm long. *Fruit* subglobular, 6–7 mm diam., pubescent, 2-valved eventually to base. *Seeds* flat, dark brown, orbicular, 4–4.5 mm diam., reticulate-alveolate, with a distinct rim; wing 1–1.2 mm wide, yellowish brown, membranous.

RANGE: Known only from the type collection.

HABITAT: Annual grassland in *Acacia* woodland.

DISCUSSION: This is a distinct species differing from *G. nuda*, which is possibly its nearest relative, both in the indumentum and flower color.

The specific epithet refers to the pallid purple color of the corolla. Latin, *pallidus* = pallid.

***G. prostrata* Carolin, sp. nov.**

Herba prostrata caulibus simpliciter ac glandulose sparse pubescentibus sed glabrescentibus usque 30 cm longis. Folia basalia oblanceolata usque obovata 2–4 cm longa crassa dentata glabra vel sparsissime pubescentia versus basim in petiolum indistinctum contracta et in rosula disposita. Folia caulina parviora caespitis distinctissimis pilorum villosorum albidorum in axillis. Flores pedunculis 10–25 mm longis pubescentibus simpliciter et glandulose articulatis ebracteolatis in racemis foliosis terminalibus dispositi. Corolla flava signis brunneis in fauce 12–15 mm longa pubescens simpliciter ac glandulose extus. Semina elliptica 3 mm longa reticulata brunnea ala angusta brunnea mucilaginea.

HOLOTYPE: WESTERN AUSTRALIA: 22 miles (35.2 km) from Roy Hill on Wittenoom road, R.C. Carolin 7702, 7 Aug. 1970 (NSW). **ISOTYPE:** SYD.

Prostrate herb with a narrow tap-root and a short sometimes branched stock. *Stems* terete or ridged, to 30 cm long, with scattered simple hairs and some glandular and multicellular hairs especially in younger stages. Basal leaves \pm thick, oblanceolate to obovate, 2–4 cm long, 5–10 mm wide, tapering gradually towards base into an indistinct petiole, dentate, glabrous or with a very few simple hairs, with a prominent tuft of white villous axillary hairs; cauline leaves similar but usually less dentate, smaller and narrower. *Flowers* in terminal racemes or umbels leafy at base; bracts similar to upper leaves; peduncles 10–25 mm long, pubescent with simple and glandular hairs, indistinctly articulate just below ovary; bracteoles absent. *Sepals* narrow-elliptic to elliptic-lanceolate, c. 2.5 mm long, 0.5–0.7 mm wide, acute, entire, simple- and glandular-pubescent, adnate to ovary for c. $\frac{1}{2}$ its length. *Corolla* yellow with brownish markings in throat, 12–15 mm long, densely pubescent outside with simple and glandular hairs, pubescent inside below throat and extending upwards along lines of connation, auriculate; anterior pocket distinct, as long as ovary or nearly so; tube 1.5–2 mm long; superior lobes narrow-oblong, 7–8 mm long, 0.8–1.2 mm wide; inferior lobes oblong-ovate, 4.5–5 mm long, 1–1.2 mm wide; wings to 3 mm wide, as long as lobe; connate part of inferior lobes 4.5–5.5 mm long. *Stamen* filaments linear, c. 2 mm long; anthers narrow-oblong, 1 mm long. *Ovary* glandular- and simple-pubescent; septum $< \frac{1}{3}$ as long as loculus; ovules 8–12; style c. 3 mm long, with some scattered villous hairs especially towards top; indusium transverse-oblong to transverse-ovate, 1 mm long, 2 mm wide, brownish, villous on both sides, with a slightly longer beard on lower surface, with a slightly curved orifice beset with white bristles to 0.4 mm long on upper lip and slightly shorter ones on lower lip. *Fruit* globular, only slightly compressed, 4–5 mm diam., glandular- and simple-pubescent,

2-valved to base, each valve entire. *Seeds* flat, brown, elliptic, 3 mm long, 2 mm wide, reticulate-alveolate, with a prominent rim; wing 0.2 mm wide, brownish, mucilaginous.

RANGE: Keartland, Fortescue, Ashburton and Carnarvon Districts of Western Australia.

HABITAT: *Acacia* scrubs on red sandy soil.

DISCUSSION: This species is very close to *G. muelleriana*, from which it can be distinguished by the prostrate habit, the almost glabrous mature leaves, the narrower mucilaginous wing on the seed and the very short ovary and fruit septum.

SELECTED SPECIMENS (14): WESTERN AUSTRALIA: 11 miles (17.6 km) N of Roy Hill, A.C. Beaglehole 11401, 12 Aug. 1965 (SYD); Railway Crossing of Tom Price-Dampier railway and road from Wittenoom to Tom Price, R.C. Carolin 7753, 9 Aug. 1970 (SYD); c. 28 km NE of Mt. Newman, A.C. Beaglehole 48957, 19 Aug. 1974 (SYD).

Named from the prostrate habit. Latin, *prostratus* = prostrate.

G. muelleriana Carolin, sp. nov.

Herba ascendens vel erecta usque 40 cm caulibus pubescentibus simpliciter ac glandulose. Folia basalia elliptico-oblongata 3–6 cm longa, 8–20 mm lata dentata vel fere integra sparse pubescentia versus basim sensim contracta caespitis pilorum villosorum in axillis. Flores pedunculis sparse pubescentibus simpliciter ac glandulose articulatis ebracteolatis 20–35 mm longis in racemis terminalibus dispositi bracteis foliosis versus basim racemi sed minoribus et angustioris versus apicem. Pili glandulosi capitibus prominentibus brunneis multicellularibus. Corolla flava, signis brunneo-purpureis in fauce 12–15 mm longa pubescens simpliciter ac glandulose extus et pubescens intus. Semina orbicularia 2.6–3 mm diametro ala sordida 1 mm lata.

HOLOTYPE: WESTERN AUSTRALIA: 40 miles (64 km) from Tom Price on Wittenoom road, R.C. Carolin, 7761, 9 Aug. 1970 (NSW). **ISOTYPE:** SYD.

Ascending to erect herb with a narrow tap-root and a short often branched stock. *Stems* terete or ridged, to 40 cm high, \pm pubescent with scattered simple hairs and glandular hairs with multicellular heads. Basal leaves elliptic-oblongate, 3–6 cm long, 8–20 mm wide, tapering very gradually towards base into an indistinct petiole, dentate to almost entire, with scattered simple and glandular hairs and a tuft of villous axillary hairs; cauline leaves smaller narrower and less dentate. *Flowers* in a terminal raceme; bracts at base similar to leaves, becoming progressively smaller and more linear towards top; peduncles 20–35 mm long with scattered simple and glandular hairs, articulate just below ovary; bracteoles absent. *Sepals* narrow-lanceolate-oblong, c. 2 mm long, 0.2–0.3 mm long, acute, pubescent with simple and glandular hairs, adnate to ovary for $\frac{1}{2}$ – $\frac{2}{3}$ its length. *Corolla* yellow, 12–15 mm long, with brownish or purplish brown markings in throat, pubescent outside with glandular and simple hairs and pubescent inside below throat with hairs extending upwards along lines of connation, auriculate; anterior pocket distinct, $\frac{2}{3}$ to equally as long as ovary; tube 2–3 mm long; superior lobes narrow-oblong-lanceolate, 8–9 mm long, 1.2–1.5 mm long; inferior lobes ovate-oblong, 3.5–4 mm long, c. 1.5 mm wide; wings to 3 mm wide, $\frac{1}{2}$ – $\frac{2}{3}$ as long as lobes; connate part of inferior lobes 5–6 mm long. *Stamen* filaments linear, 2–3 mm long; anthers narrow-oblong 1.5 mm long. *Ovary* pubescent with glandular and simple hairs; septum c. $\frac{2}{3}$ as long as loculus; ovules 12–16; style 4–5 mm long with a very few villous hairs towards top; indusium transverse-ovate to

transverse-oblong, 1 mm long, c. 2.5 mm wide, brownish, villous hairs scattered over upper surface and a thin villous beard on lower surface, with a slightly curved orifice beset with white bristles to 0.5 mm long on upper lip and shorter ones on lower lip. *Fruit* simple- and glandular-pubescent, globular often slightly compressed, c. 6 mm diam., 2-valved to base and each valve remaining entire. *Seeds* flattened, dark grey, orbicular, 2.6–3 mm wide, colliculate with a prominent rim; wing 1 mm wide, thin dark, grey.

RANGE: Kertland, Fortescue and Canning Districts of Western Australia.

HABITAT: Shrub woodlands and *Triodia* grasslands.

DISCUSSION: This species was previously included under *G. forrestii* and is distinguished from it primarily by the much less dense indumentum.

SELECTED SPECIMENS (17): WESTERN AUSTRALIA: 56 miles (89.6 km) from Port Hedland on Broome road, *R.C. Carolin* 7593, 4 Aug. 1970 (SYD); 46 miles (73.6 km) from Marble Bar on Nullagine road, *R.C. Carolin* 7688, 6 Aug. 1970 (SYD); 96 miles (153.6 km) from Onslow on Mt Stuart road, *R.C. Carolin* 7787, 10 Aug. 1970 (SYD); 74 miles (118.4 km) from Tom Price on Yampire Gorge road, *R.C. Carolin* 7771, 9 Aug. 1970 (SYD).

Named for Ferdinand von Mueller who described so many *Goodenia* species and who, for many years in the last century, was Government Botanist in Victoria.

***G. forrestii* F. Muell.**, *Victorian Naturalist* 9: 58 (1892) (as *G. foresti*).

LECTOTYPE: WESTERN AUSTRALIA: Part of the specimen 'Yule-Fortescue and Sherlock Rivers, *Hon. Sir John Forrest*' (MEL). ISOLECTOTYPE: ?K.

There are two elements amongst the specimens cited by Mueller under this species name: one is the present species and the other is *G. muelleriana* Carolin. Moreover, Mueller's type description is cast to cover both elements and it is quite impossible to choose which element corresponds more closely to it. Since one must be selected as the lectotype, I am choosing the part corresponding to the present species as being current usage (Int. Code of Botanical Nomenclature recommendation).

***G. cusackiana* (F. Muell.) Carolin, comb. nov.**

BASIONYM: *Velleia cusackiana* F. Muell., *Victorian Naturalist* 12: 124 (1896). As in the case of *G. salmoniana*, Mueller was impressed here by the sepals being almost free from the ovary but this species has none of the other characteristics of *Velleia*. In particular the inflorescence is clearly that of a *Goodenia*.

***G. sepalosa* F. Muell. ex Benth.**, *Fl. Austral.* 4: 72 (1869).

LECTOTYPE: WESTERN AUSTRALIA: Camden Harbour, *Martin* (K). ISOLECTOTYPE: possibly MEL 23753 but no collector named on label. PARALECTOTYPES: NW Coast, *Bynoe* (MEL); Port Essington, *Armstrong* (MEL). Of the three specimens cited by Benthham, the Armstrong collection from Port Essington belongs to a species in series *Calogyne*, the Bynoe collection has practically sessile leaves and the one from Camden Harbour is the only one bearing the name in Mueller's handwriting and corresponding to the protologue. This is therefore selected as the lectotype.

***G. sepalosa* var. *glandulosa* Carolin, var. nov.**

Differt ab typo indumento glanduloso.

HOLOTYPE: WESTERN AUSTRALIA: 9 miles (14.4 km) S. of Derby, *N. Byrnes*, 24 May 1967 (NT 14200).

Differs from the type variety in that most of the hairs are glandular whilst in the type variety they are simple and coarse.

RANGE: Known only from the type collection.

HABITAT: *Acacia* woodlands.

The varietal epithet refers to the glandular indumentum. Latin, *glandulosus* = glandular.

G. arachnoidea Carolín, sp. nov.

Herba erecta vel ascendens. Folia basalia obovata 4–10 cm longa dentata obtusa petiolata pilis rigidis arcuatis instructa. Folia caulina ovata vel elliptica plus minusve similis foliis basalibus. Pedunculi ebracteolati pilis simplicibus retrorsis et arachnoideis confertis instructi. Corolla lutea 12–14 mm longa pilis arachnoideis simplicibusque extra. Capsula obovoidea 4–5 mm longa. Semina elliptica vel late elliptica 4 mm longa plana ochracea nitida.

HOLOTYPE: WESTERN AUSTRALIA: 8 km SW of Theda Stn., Kimberleys, D. Symon 7101, 29 May 1971 (AD). ISOTYPES: SYD, PERTH.

Erect to ascending herbs to 45 cm tall. *Stems* terete, pubescent with stiff retrorse simple hairs and arachnoid hairs. Basal leaves obovate, 4–10 cm long, 1.5–3.5 cm wide, tapering towards base into a distinct petiole, obtuse or with a tooth at apex, dentate, pubescent with stiff arcuate hairs on both surfaces; cauline leaves ovate to elliptic, smaller. *Flowers* in terminal and axillary racemes; bracts elliptic at base to linear near top of raceme, 1–2.5 cm long, 1–4 mm wide, sessile or tapering to a short petiole, acute, dentate, pubescent; peduncle to 4 cm long, always longer than bract, pubescent with retrorse simple hairs which are obscured by dense arachnoid hairs when young, articulate just below ovary. *Sepals* linear-deltoid, 2–5 mm long, 0.3–0.5 mm wide, entire, arachnoid-pubescent and with a few stiff simple hairs at apex, adnate to ovary for $\frac{3}{4}$ its length or more. *Corolla* yellow, 12–14 mm long, pubescent with arachnoid and stiff simple hairs outside, pubescent inside with short simple hairs becoming denser towards base and there forming a \pm complete ring, auriculate; anterior pocket obscure, scarcely $\frac{1}{4}$ as long as ovary; tube 1–1.5 mm long; superior lobes narrow-oblong, 6–7 mm long, 0.7–0.8 mm wide; inferior lobes oblong, 4–5 mm long, 1.5 mm wide; wings to 1.5 mm wide, almost as long as lobe. *Stamen* filaments linear, 2–2.5 mm long; anthers oblong, 1 mm long. *Ovary* arachnoid and simple pubescent; septum very short; ovules 5–6; style 4–4.5 mm long, glabrous or with very few simple hairs; indusium broad-ovate, 1 mm long, 1 mm wide, brownish, glabrous on upper surface, with a few long stiff white hairs on lower surface, with an almost straight orifice beset with white bristles c. 0.1 mm long on both lips. *Fruit* obovoid, 4–5 mm long, 0.3 mm wide, pubescent, 2-valved almost to base. *Seed* biconvex, brownish yellow, elliptic to broad-elliptic, 4 mm long, 2–2.5 mm wide, glossy, obscurely verrucate and thus the reticulate pattern showing more clearly; wing c. 0.1 mm wide.

RANGE: Gardner (Kimberley) District of Western Australia.

HABITAT: Woodland, mostly on sandstone.

DISCUSSION: A distinct species rather difficult to place but apparently close to the *G. sepalosa* group of species; the arachnoid indumentum distinguishes it.

SPECIMENS EXAMINED (7): WESTERN AUSTRALIA: Base of Anjo Peninsula, east of Vansittart Bay, E.A. Chesterfield 303, 22 May 1984 (SYD, MEL); 9 km SW of Amax Basecamp, Mitchell Plateau, K.F. Kenneally 7137, 9 Feb. 1979 (SYD, PERTH); King Edward River, c. 50 km NE of Mitchell River HS., E.G. Errey & A.C. Beauglehole 2853, 25 Aug. 1978 (SYD); Longini Landing, Kalumburu Mission, D.E. Symon 7112, 30 June 1972 (AD, SYD)

The specific epithet refers to the appearance of the indumentum. Latin, *arachnoideus* = cobwebby.

G. brachypoda (*F. Muell. ex Benth.*) *Carolin*, **comb. et stat. nov.**

BAIONYM: *G. sepalosa* var. *brachypoda* F. Muell. ex Benth., Fl. Austral. 4: 72 (1869).

G. leiosperma *Carolin*, **sp. nov.**

Herba ascendens vel decumbens hispida pilis simplicibus grossis et glandulosis minutis. Caules usque 60 cm longi. Folia basalia ovata vel oblongo-elliptica usque anguste oblonga vel lanceolata 5–10 cm longa dentata sessilia saepe auriculata ad basim. Flores pedunculis 4–10 cm longis ebracteolatis non articulatis in racemis foliosis terminalibus dispositi. Corolla flava 15–20 mm longa hispido-pubescentis extus pubescens intus. Capsula globosa circa 8 mm diametro duabus valvis hiantibus dehiscens. Semina elliptica 2.5–3.5 mm longa laevia nitentia fulvo-straminea ora prominenti sed ala ad hilo restricta.

HOLOTYPE: NORTHERN TERRITORY: 39 miles (62.4 km) S of Darwin, *G. Chippendale*, 18 March 1961 (NT 7776).

Ascending to decumbent short-lived herb with thin tap-root, hispid with long usually patent or spreading coarse simple hairs. *Stems* several, branched near base, slightly compressed or ridged towards top, to 60 cm long. *Leaves* basal and cauline but basal rosette very ephemeral; lower leaves ovate or oblong-elliptic to narrow-oblong or lanceolate, 5–10 cm long, mostly 13–20 mm wide, sessile, often auriculate at base, dentate; upper leaves more distinctly auriculate and smaller; basal leaves usually tapering very gradually towards base. *Flowers* in terminal leafy racemes; bracts leaf-like but smaller; peduncles 4–10 cm long, pubescent-hispid with long spreading and shorter simple hairs and minute glandular ones visible with magnification, not articulate; bracteoles absent. *Sepals* linear to linear-lanceolate, 5–6.5 mm long, 0.5–0.8 mm wide, acute, ciliate, adnate to ovary for c. $\frac{2}{3}$ its length. *Corolla* yellow, 15–20 mm long, pubescent with long simple hairs and minute glandular ones outside, pubescent inside especially in depression formed by anterior petal in upper part of connate part of inferior lobes, wrinkled or with enations in connate part of inferior lobes, auriculate; anterior pocket obscure, scarcely $\frac{1}{2}$ as long as ovary; tube 4–6 mm long; superior lobes falcate-narrow-elliptic, 10–11 mm long, 2–2.3 mm wide; inferior lobes oblong to elliptic-ovate, 6–7.5 mm long, 2.3–2.8 mm wide, anterior lobe sometimes slightly larger than anterior-lateral ones; wings 2 mm wide, dentate; connate part of inferior lobes 8–10 mm long. *Stamen* filaments linear, 3.5–4 mm long; anthers oblong, 2 mm long. Ovary pubescent-hirsute; septum scarcely $\frac{1}{3}$ as long as loculus; ovules 10–15; style 7.5–8.5 mm long, villous-pubescent towards top; indusium depressed-obovate, 2 mm long, 4.5 mm wide, convex with a straight orifice beset with white bristles c. 0.5 mm long on upper lip and much shorter ones on lower lip. *Fruit* globular, c. 8 mm diam., hirsute, 2-valved to base, gaping. *Seeds* flat, elliptic, 2.5–3.5 mm long, 1.8–2.2 mm wide, smooth, glossy, with prominent raised rim; wing absent except near hilum.

RANGE: Victoria River and Darwin–Gulf Districts of Northern Territory.

HABITAT: Sclerophyll forests and woodlands.

DISCUSSION: This species is distinguished from its closest relative, *G. hispida*, with which it has been confused in the past, by the smooth seeds, the dense pubescence on the anterior corolla-lobe where it fuses with the other inferior lobes and the shorter ovary and more globular fruit. One specimen which I

have referred here, *N. Byrnes NB666* (NT 14382) from Litchfield Station, has almost glabrous stems, glabrescent leaves and lacks the dense pubescence inside the corolla. When more collections are available for study this may prove to be distinct.

SELECTED SPECIMENS (29): NORTHERN TERRITORY: 13 miles (20.8 km) S of Darwin, *G. Chippendale*, 25 May 1958 (NT 4452); Fogg Dam area, *G. Chippendale*, 18 May 1959 (NT 6207); 2.7 miles (4.3 km) W of Burrundie, *G. Chippendale*, 16 March 1961 (NT 7649); McMinns Lagoon, *M. Holtze*, 1896 (MEL 23820); 5 miles (8 km) SW of Grove Hill, *G. Chippendale*, 17 March 1961 (NT 7669).

The specific epithet refers to the smooth seed. Greek, *leios* = smooth, *sperma* = seed.

***G. durackiana* Carolín, sp. nov.**

Herba erecta vel decumbens. Caules usque 50 cm longi porcati pilis dispersis grossis simplicibus saepe retrorsis. Folia caulina elliptica vel oblonga 3–6 cm longa dentata acuta pilis dispersis saepe glabrescentia auriculata ad basim sessilia. Flores in racemis terminalibus foliosis dispositi. Pedunculi 2–5 cm longi ebracteolati non articulati pilis simplicibus in pagina adaxiali versus apicem. Corolla flava circa 15 mm longa fere glabra extus. Capsula globosa 8–10 mm diametro duabus valvis integris hiantibus dehiscens. Semina orbicularia 3–3.5 mm diametro laevia impolita ora prominente sed sine ala.

HOLOTYPE: WESTERN AUSTRALIA: Kimberley Research Station, *M. Lazarides* 6743, 6 March 1963 (PERTH). ISOTYPE: CANB 123774.

Short-lived herb with a tap root and ephemeral basal leaf-rossette. *Stems* erect to decumbent, to 50 cm long, ridged, with scattered coarse often retrorse simple hairs. *Leaves* mostly cauline, elliptic to oblong, 3–6 cm long, 1–2.5 cm wide, ± auriculate at base with a distinct very short petiole or sessile, coarsely dentate, with scattered coarse simple hairs, often glabrescent. *Flowers* in terminal leafy racemes; peduncles 2–5 cm long with coarse simple hairs on adaxial surface near top, not articulate, diverging particularly in fruiting stage. *Sepals* narrow-elliptic, c. 7 mm long and 2 mm wide, acute, often dentate towards base, ciliate, with a few scattered coarse simple hairs towards margin, adnate to ovary for $\frac{2}{3}$ – $\frac{3}{4}$ its length. *Corolla* yellow, c. 15 mm long, almost glabrous outside but sometimes with a few long simple hairs, pubescent inside particularly in throat, auriculate; anterior pocket almost obsolete; tube c. 5 mm long; superior lobes narrow-oblong-falcate c. 7 mm long and 1 mm wide; inferior lobes narrow-oblong, c. 5 mm long and 1.5 mm wide; wings to 1.5 mm wide, as long as inferior lobe, c. 2 mm long on superior lobes; connate part of inferior lobes c. 6 mm long. *Stamen* filaments linear, c. 2 mm long; anthers narrow-oblong, c. 1.5 mm long. Ovary hirsute; septum c. $\frac{1}{3}$ as long as loculus; ovules 20–30; indusium depressed obovate, convex, 1 mm long, 4 mm wide, with some simple hairs, with a ± convex orifice beset with white bristles c. 1 mm long on both lips. *Fruit* globular, 8–10 mm diam., hirsute, 2-valved to base, each valve entire, gaping. *Seeds* flat, brown-yellow, orbicular, 3–3.5 mm wide, smooth but dull, with a fairly prominent rim; wing obsolete.

RANGE: Gardner (Kimberley) District of Western Australia.

HABITAT: Grasslands on black cracking soils.

DISCUSSION: This species differs from the other species grouped around *G. sepalosa* in having smooth, dull seeds. It is possibly closest to *G. byrnesii*, from which it differs in the smooth seeds, broader sepals and the hairs on the

peduncle almost restricted to the adaxial side. From *G. sepalosa* it differs in the coarser and less dense indumentum as well as the smooth seeds.

SPECIMEN EXAMINED: WESTERN AUSTRALIA: Ord River, *K.M. Durack*, 4 May 1945 (PERTH).

Named after the collector of one of the specimens cited here, who is the author of 'Kings in Grass Castles'.

***G. byrnesii* Carolin, sp. nov.**

Herba decumbens vel prostrata. Folia basalia fugacia autem caulina ovato-oblonga vel anguste oblonga 2–6 cm longa prasina sessilia auriculata dentata pilis paucissimis simplicibus. Pedunculi ebracteolati pilis simplicibus paucis instructi. Sepala anguste oblongo-elliptica 5–6 mm longa. Corolla lutea 17–20 mm longa. Capsula subglobosa 4–5 mm in diametro per duas valvas hiantes ad basim dehiscentia. Semina fulva plana elliptica 4 mm longa verrucosa.

HOLOTYPE: NORTHERN TERRITORY: 15 miles (24 km) SW of Elliott, *N. Byrnes 1433*, 12 March 1969 (NSW). ISOTYPE: SYD.

Decumbent to prostrate herb with thin taproot. *Stems* ± ridged above but becoming terete below, to 30 cm long, sparsely pubescent-hirsute with coarse simple hairs. Basal leaves ephemeral, oblanceolate, 3–6 cm long, 6–10 mm long, pale green, tapering gradually towards base; cauline leaves ovate-oblong to narrow-oblong, mostly 4–6 cm long, 5–10 mm wide, sessile, ± auriculate at base, dentate, sparsely villous-pubescent with coarse simple hairs. *Flowers* in terminal leafy racemes; bracts progressively smaller towards top; peduncles 3–5 cm long, with some scattered villous simple hairs, indistinctly articulate 2–3 mm below the ovary; bracteoles absent. *Sepals* narrow-oblong to elliptic, 5–6 mm long, 0.8–1 mm wide with some scattered coarse simple hairs especially on margins, acute, adnate to ovary for c. $\frac{2}{3}$ its length. *Corolla* yellow, 17–20 mm long, villous-pubescent outside with coarse simple hairs and some minute glandular ones, pubescent inside especially towards base, auriculate; anterior pocket almost obsolete; tube 3.5–4 mm long; superior lobes falcate-narrow-oblong, 9–10 mm long, 1 mm wide; inferior lobes ovate, 6–7 mm long, 2.5–2.8 mm wide; wings c. 1.5 mm wide, dentate, c. $\frac{1}{2}$ as long as lobes; connate part of inferior lobes, 8–9 mm long. *Stamen* filaments linear, 3–4 mm long; anthers oblong, c. 1 mm long. *Ovary* villous-pubescent; septum scarcely $\frac{1}{3}$ as long as loculus; ovules c. 10; style 6–7 mm long, pubescent towards base; indusium transverse-oblong to depressed-obovate, 2 mm long, 4 mm wide, slightly convex above, glabrous or nearly so above, pubescent below, with an almost straight orifice beset with white hairs 0.5 mm long on upper lip and much shorter ones on lower lip. *Fruit* sub-globular, 4–5 mm diam., villous-hirsute, 2-valved for $\frac{3}{4}$ its length, gaping, each valve entire. *Seeds* flat, greyish-yellow, elliptic, 4 mm long, 1.8 mm wide, verrucate and granulose, with a distinct rim; wing obsolete except close to hilum.

RANGE: Dampier and Gardner (Kimberley) Districts of Western Australia; Victoria River, Barkly Tablelands and Darwin–Gulf Districts of Northern Territory; Burke District of Queensland.

HABITAT: Blacksoil plains.

SELECTED SPECIMENS (20): WESTERN AUSTRALIA: Bloodwood Creek, Mt Anderson, *H.F. Broadbent 624*, 28 Jan. 1953 (PERTH). NORTHERN TERRITORY: Leila Lagoon, *R.C. Carolin 9294*, 17 May 1974 (SYD); 42 miles (67.2 km) W of Wave Hill Police Stn., *R.A. Perry 2278*, 27 June 1949 (NT 18734); Powells Creek, *M. Holtze 73*, 1894 (MEL 22222).

QUEENSLAND: Flinders River Lara Stn., *Kennedy* (MEL 23762); Saxby River Crossing on Wundoola Road, *R.C. Carolin 8807*, 22 April 1974 (SYD); 6 miles (9.6 km) S. of Magoura, *R.C. Carolin 8817*, 23 April 1974 (SYD); Gregory Downs Road, *R.C. Carolin 8872*, 26 April 1974 (SYD).

Named for the collector of the holotype, who was a botanist in the Darwin Herbarium and subsequently at the Queensland Herbarium.

G. campestris Carolin, sp. nov.

Herba ascendens vel decumbens. Folia basalia fugacia autem caulina ovata ad lanceolata 1–7 cm longa dentata pilis paucis grossis simplicibus in marginibus atque pagina inferiora. Pedunculi glabri vel pilis paucissimis simplicibus ebracteolati. Corolla lutea 7–8 mm longa pilis simplicibus antrorsis extra. Capsula globosa vel ovoidea 5 mm longa per duas valvas hiantes ad basim dehiscentia. Semina plana elliptica 3.5 mm longa verrucosa.

HOLOTYPE: NORTHERN TERRITORY: c. 35 miles (56 km) S of Timber Creek, *R.C. Carolin 6667*, 10 May 1968 (NSW). ISOTYPE: SYD.

Decumbent to ascending herb with thin taproot. *Stems* compressed or obscurely ridged above but becoming terete towards base, to 50 cm long, glabrous or nearly so. *Leaves* mostly cauline but with a few ephemeral basal leaves; basal leaves obovate-oblong 1–3 cm long, 4–10 mm wide, tapering very gradually towards base; cauline leaves ovate to lanceolate, 1–7 cm long, 5–10 mm wide, sessile, \pm auriculate at base, dentate, with very few coarse simple hairs especially on margins and lower surface of mid-rib. *Flowers* in terminal racemes; bracts leaf-like, progressively smaller towards top; peduncles 4–7 cm long, glabrous or with few short closely appressed simple hairs, very obscurely articulate 1–2 mm below ovary; bracteoles absent. Sepals lanceolate to narrow-oblong, 1–2 mm long, 0.3–0.5 mm wide, with few coarse simple hairs particularly on margin, adnate to ovary for $\frac{3}{4}$ its length. *Corolla* yellow with purplish veins, 7–8 mm long, pubescent outside with antrorse simple and minute glandular hairs, pubescent inside towards base, wrinkled on connate part of inferior lobes, auriculate; anterior pocket scarcely $\frac{1}{4}$ as long as ovary; tube 2–2.5 mm long; superior lobes falcato-narrow-oblong, c. 4 mm long, 1–1.2 mm wide; inferior lobes ovate, 2 mm long, 1.2–1.5 mm wide; wings 1–2 mm wide, c. $\frac{1}{2}$ as long as lobes; connate part of inferior lobes c. 4 mm long. Stamen filaments 1.5–1.8 mm long; anthers oblong, 1.2 mm long. *Ovary* pubescent with coarse simple hairs; septum scarcely $\frac{1}{4}$ as long as loculus; ovules 6–8; style 4 mm long, glabrous or nearly so; indusium transverse-oblong, 1 mm long, 2 mm wide, flat or slightly convex above, with few scattered hairs particularly on lower surface, with an almost straight orifice beset with long (0.2 mm) white bristles on upper lip and shorter ones on lower lip. *Fruit* globular-ovoid, 5 mm long, 3.5–4.5 mm wide, glabrescent 2-valved, entire, gaping. *Seeds* flat, yellowish, elliptic, 3.5 mm long, 1.5–1.8 mm wide, verrucate, granulose, with a prominent rim; wing almost obsolete.

RANGE: Gardner District (Kimberley) of Western Australia.

HABITAT: Grassy plains on black soils.

DISCUSSION: This species is similar to *G. hispida* but differs in its habitat, the much smaller corolla, the inferior lobes which are shorter than the connate part of the inferior lobes, and in the very short septum of the fruit with many fewer seeds.

SPECIMENS EXAMINED: NORTHERN TERRITORY: Skull Creek, *R.C. Carolin* 6659, 10 May 1968 (SYD); 5 miles (8 km) W of Victoria River Crossing, *N. Byrnes* NB740, 10 May 1968 (NT 14575, NSW 87995).

Named for the open grassy plains in which this species grows. Latin, *campestris* = pertaining to plains.

G. malvina Carolin, sp. nov.

Herba decumbens vel prostrata. Folia basalia fugacia autem caulina lanceolata ad lineari-lanceolata vel ovata 2.5–7 cm longa dentata vel laciniata sessilia plus minusve auriculata pilis grossis sparsis. Corolla malvina 12–14 mm longa pilis simplicibus ac glandulosis extra. Pedunculi glabri sine bracteolae. Semina plana elliptica 3.5 mm longa papillosa rugosa.

HOLOTYPE: WESTERN AUSTRALIA: Kununurra, *M. Lazarides* 6780, 7 March 1963 (CANB 123779).

Decumbent to prostrate herb with thin taproot. *Stems* ± compressed but becoming terete towards base, to 50 cm long, glabrous. *Leaves* mostly cauline but with an ephemeral group of basal leaves; basal leaves obovate to oblanceolate, c. 2 cm long, tapering very gradually towards base; cauline leaves, lanceolate to linear-lanceolate or occasionally ovate, 2.5–7 cm long, 5–13 mm wide, sessile, ± auriculate, acute, dentate to lacinate or narrowly pinnate-lobed, sparsely pubescent with coarse simple hairs and sometimes minute glandular ones. *Flowers* in terminal racemes; bracts leaf-like, progressively smaller towards top; peduncles 2–5 cm long, glabrous, ± articulate 1–2 mm below ovary; bracteoles absent. *Sepals* lanceolate to narrow-oblong, 3–4 mm long 0.6–0.8 mm wide, acute, with simple hairs especially along margins, sometimes with few minute glandular hairs, adnate to ovary for c. $\frac{3}{4}$ of its length. *Corolla* mauvish sometimes ± yellow towards top or pinkish, mostly 12–14 mm long, simple-pubescent outside with some minute glandular hairs, pubescent inside especially towards base, auriculate; anterior pocket almost obsolete; tube 2.5–3 cm long; superior lobes falcate-narrow-elliptic, 6.5–7.5 mm long, 1–1.2 mm wide; inferior lobes narrow-elliptic; wings to 1.5 mm wide, lacinate, c. $\frac{2}{3}$ as long as lobes; connate part of inferior lobes 3–4 cm long. *Stamen* filaments linear, c. 2 mm long; anthers oblong, c. 1 mm long. *Ovary* hirsute-pubescent with coarse simple hairs; septum scarcely $\frac{1}{4}$ as long as loculus; ovules 8–10; style 6–7 mm long with few scattered long hairs; indusium transverse-oblong, 1 mm long, 3 mm wide, with some scattered simple hairs on both surfaces, convex above with an almost straight orifice beset with white bristles c. 0.5 mm long on upper lip and much shorter (0.1–0.2 mm) ones on lower lip. *Fruit* ± compressed, ovoid 5–6 mm long, 3–4 mm wide, glabrescent, 2-valved for c. $\frac{3}{4}$ s of its length, gaping, each valve entire. *Seed* flat, yellowish, elliptic, c. 3.5 mm long, 1.8 mm wide, verrucate, granulose, with a prominent rim; wing almost obsolete.

RANGE: Gardner (Kimberley) District of Western Australia; Victoria River District of Northern Territory.

HABITAT: Grasslands on black cracking clay soils.

DISCUSSION: This species differs from *G. hispida*, which appears to be its nearest relative, in the corolla colour, the glabrous stems and peduncles, and the much less pubescent, usually more lacinate narrower leaves. The specimens from Arnhem Land show some very distinct differences from those collected further west, the corolla in particular is much smaller, the sepals shorter and the leaves are not decurrent.

SELECTED SPECIMENS (8): WESTERN AUSTRALIA: Ord River, *E. Langfield*, 1948 (PERTH); Ord River, *K.M. Durack*, 4 May 1945 (PERTH). NORTHERN TERRITORY: 29.9 miles (47.8 km) E of Newry, *G. Chippendale*, 10 May 1959 (NT 6000); 16.9 miles (27 km) NE of Beetaloo HS., *G. Chippendale*, 10 April 1959 (NT 5470).

Named for the mauve colour of the corolla. Latin *malvina* = mauve.

G. hispida R. Br., Prodr.: 577 (1810).

LECTOTYPE: NORTHERN TERRITORY: Carpentaria, Point S, [i.e. Point Blane], *R. Brown*, 28 Jan. 1803 (BM). ISOLECTOTYPE: K.*

G. chthonocephala Carolín, sp. nov.

Herba annua radice fibrosa. Flores sessiles in axillis foliorum basium lineari-lanceolatorum atque sic in capitulo super terra dispositi. Sepala linearia. Corolla 1–1.5 mm longa exalata. Semina orbiculata verrucata c. 0.2 mm diametro.

HOLOTYPE: NORTHERN TERRITORY: Cox River Station, *P.K. Latz* 7176, 2 July 1977 (NT 574444).

Small annual with fibrous root system and condensed stems. *Leaves* all basal, linear-lanceolate, to 8 cm long, to 3 mm wide, tapering gradually towards base, entire, pubescent when young with simple hairs, glabrescent. *Flowers* sessile in leaf axils and thus arranged in a pubescent head at ground level; bracteoles absent. *Sepals* linear, c. 0.5 mm long, acute, pubescent, adnate to ovary nearly to its summit. *Corolla* reddish when dry, 1–1.5 mm long, pubescent, with long simple hairs outside, almost glabrous inside; anterior pocket almost obsolete; tube c. 0.5 mm long; lobes \pm equal, triangular, 0.5–1.0 mm long, less than 0.5 mm wide, acute; wings obsolete. *Stamen* filaments c. 0.5 mm wide; anthers subglobular, c. 0.1 mm diam. *Ovary* densely pubescent with simple and multicellular hairs; septum almost as long as loculus; ovules 30–40; style c. 0.5 mm long, pubescent; indusium broad-elliptic, c. 0.2 mm wide, flat, with \pm curved orifice beset with very short bristles. *Fruit* ellipsoid, 3 mm long, pubescent with simple and multicellular hairs, distinctly 10-veined, 2-valved, each valve entire and separating from base not through a distinct articulation but where the tissue is weak. *Seeds* flat, reddish brown with a paler border, orbicular, c. 0.2 mm diam., verrucate; wing scarcely differentiated.

RANGE: Known only from the type collection.

HABITAT: Damp places.

DISCUSSION: This species is closest to *G. subauriculata*, from which it differs in the smaller flowers which are grouped into a head at ground level.

The specific epithet refers to the tight groups of flowers at ground level. Greek, *chthonos* = earth, *cephale* = head.

G. armstrongiana Vriese, Natuurk. Verh. Holl. Maatsch. Wetensch. Haarlem ser. 2, 10: 138 (1854).

HOLOTYPE: NORTHERN TERRITORY: Raffles Bay, *Armstrong*, Aug. 1846 (K).* There are two sheets of Armstrong's collection from Port Essington but only one bears the full labelling given by de Vriese. Since he states 'Unicum specimen vidi in Hookeri' this specimen, which agrees with his description and figure, must be the holotype.

G. argillacea Carolín, sp. nov.

Herba caule principali erecto ac ramis decumbentibus ad 70 cm longis. Folia anguste oblonga ad linearia 2–4.5 cm longa dentata sessilia glabra. Flores

pedicellis gracilis ebracteolatis ad 2.5–4 cm longis in racemis disposita. Corolla 10–12 mm longa pubescens. Capsula obovoidea 3–3.5 mm longa per duas valvas ad basim dehiscens. Semina elliptica 3 mm longa laevigata impolita.

HOLOTYPE: NORTHERN TERRITORY: 8 miles (12.8 km) NE of Mainoru River crossing on Bulman Road, R.C. *Carolin* 9403, 23 May 1974 (NSW). ISOTYPE: SYD.

Herb with an erect main stem and weak decumbent branches to 70 cm long. *Leaves* narrow-oblong to linear, 2–4.5 cm long, 2.5–6 mm wide, sessile and sometimes slightly auriculate, obscurely dentate with blunt teeth, with slightly recurved margins, glabrous. *Flowers* in leafy racemes; bracts similar to lower leaves but usually narrower and often longer; pedicels 2.5–4 cm long, slender, glabrous, not articulate; bracteoles absent. *Sepals* lanceolate, 2.5 mm long, 0.5 mm wide, acute, glabrous but for some simple hairs terminating the marginal denticles, adnate to ovary for $\frac{3}{4}$ its length. *Corolla* brownish-yellow (becoming pale purple on drying), 10–12 mm long, pubescent outside with \pm appressed simple hairs, with very few simple hairs inside, auriculate; anterior pocket obsolete; tube 3 mm long; superior lobes narrow-oblong, 4–5 mm long, 0.7–0.8 mm wide; inferior lobes oblong-ovate, 2.5 mm long, 0.8 mm wide; wings c. 1 mm wide. *Stamen* filaments linear, 1.5 mm long; anthers narrow-oblong, 1 mm long. *Ovary* with a few strigose hairs; septum scarcely $\frac{1}{4}$ as long as loculus; ovules 6–8; style pubescent especially towards base, c. 5 mm long; indusium depressed-obovate, 1 mm long, 2.5 mm wide, glabrous on upper surface, pubescent on lower surface, with a slightly concave orifice beset with white bristles c. 0.3 mm on upper lip and shorter ones on lower lip. *Fruit* obovoid, 3–3.5 mm long, 2–2.5 mm wide, 2-valved almost to base, each valve entire. *Seed* elliptic, 3 mm long, 2.5 mm wide, minutely reticulate-alveolate or smooth and dull to naked eye, with a prominent rim; wing obscure except near the funicle.

RANGE: Only known from the type collection.

HABITAT: *Melaleuca* scrub on calcareous clays.

The specific epithet refers to the heavy clays on which the type collection was growing. Latin, *argillaceus* = pertaining to clay.

G. potamica *Carolin*, sp. nov.

Herba decumbens vel ascendens ad 20 cm. Caules pilis simplicibus arcuatis obtecti. Folia basalia oblanceolata ad obovata 2–8 cm longa dentata pubescentia pilis simplicibus grossis. Flores in racemis herbaceis vel umbellis ac in pedunculis glandulosis 10–15 mm longa dispositi. Pili glandulosi capitibus nigris vel fuliginosis. Sepala pilis glandulosis conferte obtecta. Corolla flava 11–15 mm longa. Semina plana elliptico-obovata 2–3 mm longa verrucata exalata.

HOLOTYPE: 24 m W Liverpool River crossing, *J. Must* 1069, 27 June 1972 (NT).

Decumbent to ascending herb to 20 cm. Stems to 40 cm, pubescent with arcuate simple hairs. *Basal leaves* in an ephemeral rosette, tapering gradually towards base into an indistinct petiole, obtuse, dentate to almost entire, with coarse simple hairs; cauline leaves smaller, often broader and quite sessile, sometimes with a large basal lobe on one side only. *Flowers* in leafy racemes or condensed into umbels or rarely axillary in the basal leaves; bracts similar to cauline leaves but smaller and narrower; peduncles 10–15 mm long, pubescent with black- or dark brown-capped glandular hairs and some simple hairs, ebracteolate, not articulate. *Sepals* oblong, 1–1.5 mm long, c. 0.5 mm wide,

pubescent as peduncles, acute, adnate to ovary almost to its summit. *Corolla* yellow with brownish throat, 11–15 mm long, glandular pubescent outside, simple pubescent in throat, auriculate; anterior pouch obsolete; superior lobes oblanceolate to narrow-oblong, 5–6 mm long, 1 mm wide; wings 1–1.5 mm wide; inferior lobes oblong, 2.5–3 mm long, 0.6–0.8 mm wide; connate part of inferior lobes 4–5 mm long. *Stamen* filaments linear, 3 mm long; anthers narrow-oblong, 3 mm long. *Ovary* glandular pubescent; septum very short; ovules 8–10; style 4–5 mm long, pubescent; indusium semi-orbicular, 4 mm diam., yellowish brown, with a straight orifice beset with white bristles c. 0.3 mm long. *Fruit* ellipsoid to globular, 3–5 mm long; valves 2, entire, gaping to the base. *Seeds* flat, elliptic-obovate, 2.5 mm long, verrucate, with a distinct rim; wing obsolete except close to funicle.

RANGE: Arnhem Land.

HABITAT: River flats possibly extending into the forests on sandy soils.

DISCUSSION: Shows a close resemblance to those species originally included in the genus *Calogyne* particularly to *C. holtzeana* but the unbranched style clearly distinguishes it.

SPECIMENS EXAMINED: NORTHERN TERRITORY: Liverpool River, *F. Duncan*, 1975 (SYD); 45 km upstream from the mouth of the Liverpool River, *F. Duncan* 803, 2 May 1975 (SYD).

The specific epithet refers to the river flats in which this species grows. Latinised Greek *potamicus* = pertaining to a river.

***G. porphyrea* (Carolin) Carolin, comb. nov.**

BASIONYM: *Calogyne porphyrea* Carolin, *Brunonia* 2: 4 (1979).

***G. pilosa* (R. Br.) Carolin, comb. nov.**

BASIONYM: *Calogyne pilosa* R. Br., *Prodr.*: 579 (1810).

***G. neglecta* (Carolin) Carolin, comb. nov.**

BASIONYM: *Calogyne neglecta* Carolin, *Brunonia* 2: 7 (1979).

***G. heteroptera* (F. Muell.) Carolin, comb. nov.**

BASIONYM: *Calogyne heteroptera* F. Muell., *Fragm.* 10: 43 (1876).

***G. holtzeana* (Specht) Carolin, comb. nov.**

BASIONYM: *Calogyne holtzeana* Specht, American-Australian Scientific Expedition to Arnhem Land 3: 309 (1958).

***G. heppleana* (W. Fitzg.) Carolin, comb. nov.**

BASIONYM: *Calogyne heppleana* W. Fitzg., J. & Proc. Roy. Soc. Western Australia 3: 214 (1918).

***G. symonii* (Carolin) Carolin, comb. nov.**

BASIONYM: *Calogyne symonii* Carolin, *Brunonia* 2: 12 (1979).

***G. purpurea* (F. Muell.) Carolin, comb. nov.**

BASIONYM: *Calogyne purpurea* F. Muell., *Fragm.* 8: 57 (1873).

***G. quadrifida* (Carolin) Carolin, comb. nov.**

BASIONYM: *Calogyne quadrifida* Carolin, *Brunonia* 2: 15 (1979).

G. kakadu *Carolin*, sp. nov.

Herba prostrata rosulifera stolonifera. Folia 6–15 mm longa anguste oblongo-elliptica ad oblanceolata glabrescentia plerumque acuta attenuata ad basim. Flores solitaires in axillis foliorum. Sepala inaequalia. Corolla porphyrea 3 mm longa lobis aequalis. Ovarium obconicum.

HOLOTYPE: NORTHERN TERRITORY: Kakadu National Park, Site 80, *L.A. Craven 6176*, 30 May 1980 (CANB 309160). ISOTYPE: SYD.

Prostrate herb with rosettes of leaves and stolons to 18 cm long. *Leaves* thick, narrow-oblong, c. 3 mm wide, tapering very gradually towards base, mostly acute, pubescent with soft fine simple hairs when young but glabrescent when mature, with a tuft of silvery axillary hairs. *Flowers* solitary in leaf axils; bracteoles absent; peduncles to 12 mm long, pubescent. *Sepals* narrow-deltoid to ovate, pubescent; anterior sepal c. 1.5 mm long, the others c. 0.5 mm long. *Corolla* red, to 2 mm long, pubescent outside with simple hairs; lobes equal, ovate, c. 1 mm long, darker towards base; wings and auricles absent. *Stamen* filaments linear, c. 1 mm long; anthers narrow-oblong, c. 0.5 mm long. *Ovary* obconic, acute towards base, 2–3 mm long; septum very short, extended into a free-central placenta bearing about 30 ovules irregularly arranged; style c. 1 mm long, glabrous; indusium globular with a few very short bristles on lips. *Seeds* not seen.

RANGE: Known only from the type collection.

HABITAT: Damp places in sandy-organic soil.

DISCUSSION: This is a species with a superficial resemblance to *G. pumilio* but in *G. kakadu* the leaves taper gradually towards the base, the hairs are simple and not stellate and the ovary is attenuate at the base.

The species is named for its locality and the epithet is an undeclinable Aboriginal word.

Excluded names

G. glandulifera Vriese, *Natuurk. Verh. Holl. Maatsch. Wetensch. Haarlem ser. 2, 10: 129* (1854). = *Diaspasis filifolia* R. Br.

LECTOTYPE: In solo turfoso inter frutices prope urbiculam Albany, 4 Oct. 1840, *L. Preiss 2032* (LD 0447). ISOLECTOTYPE: L903,311-. . .297. De Vriese thought that *Preiss 2032* was a mixed collection. He referred part to *G. armeriaefolia* DC. and part to *G. glandulifera* Vriese. This collection appears to be homogeneous. It is not possible to determine which part he refers to which species.

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Register of type specimens of mosses in Australian herbaria

General introduction and Part I. Special collections at NSW: Lord Howe Island, Vanuatu (New Hebrides)

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Abstract

Ramsay, Helen P.¹, Julie Seur², Peter G. Wilson² and Tracey Goodwin¹ (¹School of Biological Science, University of New South Wales, Kensington 2033 NSW Australia; ²National Herbarium of New South Wales, Royal Botanic Gardens, Sydney 2000 NSW Australia) 1990. Register of type specimens of mosses in Australian herbaria. General introduction and part 1. Special collections at NSW: Lord Howe Island, Vanuatu (New Hebrides). *Telopea* 3(4): 571–592. This is the first of a series of papers forming a register of type specimens in Australian herbaria. Here we deal with Lord Howe Island and Vanuatu (New Hebrides) mosses named by Brotherus & Watts (1915a, b). The register is a specimen-based approach detailing the basionym, reference, label data for each type specimen held, if more than one, the category of type and where possible the location of the holotype or lectotype if known. Included is data from recent studies, revised names or notes on action required such as lectotypification if this has not been done.

General introduction

The need for access to type specimens by monographers is well understood but the difficulties in locating such specimens can often make the work very time-consuming. Koponen (1982) outlined methods for recording the data required for a TYPE specimen register as used at the Botanical Museum, University of Helsinki (H). S. W. Greene (1984) put forward a proposal for a new approach to the production of type registers not on a **specimen-based** but on a **literature-based** approach. The **specimen-based** approach locates 'putative types' in the herbarium followed by a literature search to confirm the status of each specimen. Even when the specimen is found to agree with the details, the location of duplicates may not be known hence the status as holotype, isotype etc. may not be clear or easy to determine.

Early bryologists rarely designated a holotype, often naming many syntypes, making later lectotypification necessary. This latter requirement in modern taxonomy poses problems when recording 'types' from many unrelated species, as the total literature for all will not be known. Monographers are helping to improve the situation in recent revisions, e.g. Koponen (1979), Iwatsuki and Crosby (1979), Lewinsky (1984), Vitt and Ramsay (1985).

Some examples of published registers or catalogues for bryophytes are those of Hattori and Noguchi (1960), Clarke (1973), Shetler et al. (1973), Walther & Martienssen (1975), Grolle (1976), Pocs (1977), Ireland & Ley (1984).

Early botanists in Australia always sent specimens for identification to Europe where taxonomists were active and the unusual flora attracted great attention. As Australia was a colony of Britain, plant specimens were largely deposited at Kew or the British Museum. Whilst representative collections were sometimes

retained in Australia the type descriptions were usually based on specimens sent to the European specialists and the holotype retained there. In many cases duplicates were not retained in Australia. Early descriptions of Australian bryophytes were made by Carl Müller, Brotherus, Mitten, Dixon, and the holotypes were retained in their herbaria now located at Helsinki (Brotherus), New York (Mitten), British Museum (Dixon) while the Carl Müller herbarium was largely destroyed in Berlin in 1943.

The proposal of S.W. Greene (1984) to produce a **literature-based** catalogue for these latter types would enable the isotypes and syntypes in herbaria throughout the world to be sought. W.W. Watts, who made extensive collections in Australia (New South Wales, N. Queensland, Victoria and Lord Howe Island), sent his collections to Brotherus for identification. Brotherus and Brotherus & Watts published lists and descriptions of new species [in the majority of cases Brotherus wrote the description, but Watts did sometimes provide him with an outline] based on material at H-BR, and these would therefore be the types (see Ramsay 1980). In most cases a series of specimens, collected at different times and from different localities (syntypes), were listed with the description and no holotype designated. Although the National Herbarium of New South Wales contains the bulk of Watts' collections most are duplicates of the various types and syntypes held at H-BR. Consequently, there are very few holotypes present in NSW, and most of the syntypes are isosyntypes.

The type method as understood today was not practised widely in bryology until recently (Koponen 1982). Bryology in Australia is in the early stages of revival (since the 1970s) as cryptogams were generally sadly neglected in the main herbaria until fairly recently (Ramsay & Seur in press). Within the last ten years the situation has greatly improved and bryophytes are now being actively curated in all major Australian herbaria. There are, as yet, only two people appointed with research interests in bryophytes in charge of these collections in Australian herbaria: Streimann (CBG), and Bell (AD), curation being an organisational rather than a research activity. In spite of this, the collections are now much more accessible for loan and study by monographers.

The following study was undertaken to determine what collections of moss-types were held here in Australia. Exchange between early Australian and overseas workers resulted in a number of isotypes or syntypes for exotic species being deposited here in Australian herbaria, particularly at NSW and MEL. Types for both Australian and exotic specimens lodged in Australian Herbaria (exotics only in NSW) are being studied and the results will appear as a series of publications.

Data collection

The register has been compiled from those specimens located in Australian herbaria which were annotated as type or sp. nov. i.e. 'putative types'. Recent revisions and descriptions of new species have enabled typification for some specimens to be clearly stated. A survey of literature based on data from Index Muscorum (Wijk, Margadant and Florschütz 1959–1969) and supplements (Crosby 1977, 1979; Crosby and Bauer 1981, 1983, 1987; Bauer and Crosby 1986) has enabled others to be classified. The register lists the original name given (basonym) and is arranged alphabetically with cross-referencing for name changes. The work, begun in 1973 as an extension of studies for a Census of New South Wales Mosses (Ramsay 1984), follows closely the format used by

Clarke (1973), (i.e. details on the original packet such as name, dates and locality, collector, herbarium number) and remarks added later. In addition, the present status of the specimen, by reference to literature and to collections in major overseas herbaria, is given when known or suggested when not. Many names have been absorbed into synonymy by later revisions and the most recent references are included together with the original one. In addition, latitudes and longitudes have been included for the localities, to assist overseas workers.

Specimens from the following herbaria have been studied: AD, BRI, CANB, CBG, HO, MEL, MELU, NSW, PERTH, SYD, and the private herbaria of I. G. Stone and D. G. Catcheside whose type specimens will be or have been deposited in MEL, MELU (Stone) and AD (Catcheside). A survey of literature relevant to the specimens in Australia has identified the great dearth of types for Australian species in Australian herbaria.

The data were entered and collated using dBaseIII program and the following format for continued access and analysis.

Type Specimens Register

1. Original name attached to the specimen [BASIONYM]
2. Reference to original description [REF]
3. Specimen Label Data [LABEL]
4. Specimen(s) cited in Protologue [PROTO]
5. Herbaria holding types
 - A. Australian [AUSTR]
 - B. Non-Australian [NON]
6. Present name, reference to recent treatment [REC]

Entry of data

BASIONYM: The names are arranged alphabetically according to genus and species.

REF: Journal reference to protologue is given. A complete list of references appears at the end of the Register.

LABEL: Label data are given for each specimen located with this name. Where two specimens have identical data this is noted at the end of the data entry. Where labels differ, even in minor ways, each is entered separately. Each entry is numbered sequentially 1, 2, 3 where multiple entries occur.

PROTO: Specimen citations from the protologue are given in inverted commas exactly as in the original publication with misspellings etc. If there are no locality details in the protologue but they appear elsewhere in the text they are included in square brackets. If misspelling of a locality is confusing or incomplete, clarification is given in square brackets.

AUSTR: The herbarium in Australia holding type specimens is given. The status of the type is indicated when known. Collector's numbers are listed for each herbarium holding specimens.

NON: Where holotypes or syntypes from which the protologue was derived were most likely to be held in overseas herbaria, the information was sent to the relevant herbarium (e.g. Brotherus names to H-BR) for confirmation.

REC: Where a new name has been published for the taxon, the new name is listed and the original one is recorded as a synonym. The presently accepted name or new combination is listed together with the reference. If the combination is a later homonym, the earlier name is given and the reference cited if it refers to a non-Australian collection. Where based on an Australian collection, the details will be found alphabetically in the Register. Where lectotypification is required this is stated. Other relevant information not included elsewhere such as latitude and longitude of the type locality, is recorded here.

The location of some types, thought to be in Australia, cannot be determined, e.g. Vitt and Ramsay (1985) have been unable to locate types for some *Macromitrium* species all thought to be at MEL. The Register has not included names *in schedis*, but *nomina nuda* are appended, for clarification only, as a separate list.

Presentation of data

The register has been prepared in the hope that it will be of value to workers wishing to trace types. If there are any errors or misinterpretations it would help if the senior author could be notified quickly to enable rapid circulation of the corrections.

The senior author accepts responsibility for all errors and misjudgments. Entry of the manuscript into the computer (thanks to Tracey Goodwin, Julie Seur) will enable lists to be circulated to individual herbaria in return for their assistance.

The work will appear in several parts as listed below, compiled by the senior author with assistance from others.

Register of Type Specimens held in Australian Herbaria

- Part I. Special collections at NSW: Lord Howe Island, Vanuatu (New Hebrides).
- Part II & III. Australian mosses.
- Part IV. Specimens at NSW determined as *sp. nov.* by Carl Müller.
- Part V & VI. Exotic mosses at NSW: (to be arranged and published in geographical regions: New Zealand, Papua New Guinea, Asia, Pacific Islands, Europe, Africa, America N & S.)

A separate publication 'Hepatic types in the National Herbarium of New South Wales (NSW) and the Ray Herbarium, Sydney (SYD)' is being prepared.

Acknowledgements

The authors gratefully acknowledge assistance given by G.A.M. Scott from notes on types at H-BR made whilst there on leave in 1980 and F. Ramsay for assistance in recording some data. The project and most of the recording was carried out by the senior author.

We gratefully acknowledge a grant from the Australian Biological Resources Study that enabled P. Wilson to check literature and to sort and record some

specimen data. The Royal Botanic Gardens Trust provided assistance during 1984–1987 for Julie Seur to check and locate type specimens, assist with literature and sort the moss collections at NSW. June Sawyer provided label information for collections held at BRI. R. Filson & P. Volleberg assisted with information on types in MEL and R. Orchard at HO. Help was also given by D.G. Catcheside who examined the Flecker Herbarium, Cairns which was then housed at Atherton, Qld but has now been absorbed into the Australian National Herbarium (CANB). Heinar Streimann kindly helped with information from CBG and literature from his Catalogue of Australian Mosses (in press). The co-operation of the Directors and staff of all the Herbaria visited has been greatly appreciated. It would have been impossible to provide the data on specimen numbers in H-BR without the effort in time by Dr P. Isoviita and Mr M. Piironen. We are particularly indebted to them for their help. Marshall Crosby (MO) kindly provided lists of Carl Müller's Australian types, a list of names based on types recorded for Australia extracted from the world list in the up-to-date computer files for Index Muscorum held at MO. This has proved of value for cross-checking names and authors.

Part I. Special collections at NSW: Lord Howe Island and Vanuatu (New Hebrides)

The collections listed in this section are based primarily on specimens cited in publications by Brotherus & Watts (1915a, 1915b) and held at NSW. All the Lord Howe specimens were collected by W.W. Watts in 1911 whereas those from Vanuatu (formerly New Hebrides) were not collected by Watts but sent to him, mainly by Dr W. Gunn, whilst he was Curator of Bryophytes at the National Herbarium of New South Wales (Ramsay 1980). The specimens were incorporated into his herbarium and given a number by him.

The numbering system used by W.W. Watts needs to be understood by those referring to his specimens. Each geographical area, (e.g. Lord Howe Island, New Hebrides, New South Wales) where he collected or from which he obtained specimens, was given its own set of numbers. Thus numbers related to Lord Howe Island specimens should be recognised as LHI 530 whereas those from North Queensland would be NQ 530, New Hebrides (Vanuatu) NH 530 and so on. Specimens from other collections were also given numbers by him. Understanding his system will prevent confusion when the same number appears on different specimens. Watts sent specimens from his collections to many overseas herbaria on exchange. Those related to his publications with Brotherus went to Helsinki (H-BR) and duplicates were retained at NSW while some duplicates were sent also to other herbaria. As holotypes were not designated in their publications and the herbarium holding not cited, it has been assumed here that the specimen examined by Brotherus and held in H-BR will be the holotype if a single specimen is cited. Where a series of syntypes were cited and no lectotype has been chosen this has been noted. Thus in most cases the collections at H-BR take priority over those at NSW, but where there is any doubt, as Watts examined all specimens, the specimen at NSW has been named as lectotype.

Register of Type Specimens at NSW: Lord Howe Island

(The latitude and longitude for Lord Howe Island as represented by Mt Gower is 31°36'S 159°05'E ; for convenience Lord Howe Island is abbreviated as LHI in label data in this study)

***Bryum aequicollum* Broth. & Watts (1915a: 372)**

LABEL:

1. Second open gully, S. of King's, LHI, *W.W. Watts 213a*, 15.vii.1911.
2. Mt Gower, LHI, *W.W. Watts 360*, 1-4.viii.1911
3. Open gully just S of King's, LHI, *W.W. Watts 147d*,
4. Rocks S. of King's, LHI, *W.W. Watts 207*, 15.vii.1911.
5. Mt Gower, LHI, *W.W. Watts 408*, 1-4.viii.1911.

PROTO: 'Among rocks one mile south of King's (n 207); open gully south of King's (n 147d, 213a); Mt Gower (n 360, 408); also Northern Hills and sea cliff, Middle Beach.'

ISOSYNTYPE: NSW (*Watts 147d, 207, 213a, 360, 408*)

SYNTYPE: H-BR (*Watts 147d, 207, 213a, 360, 408*)

REC: [= *B. dichotomum* Hedw., based on specimens cited by Ochi (1970: 17): *Watts 147d, 213a, 360* from H. Not lectotypified by Ochi.]

***Bryum diversinerve* Broth. & Watts (1915a: 371)**

LABEL:

1. Sea cliffs, Middle Beach (to south), LHI, *W.W. Watts 105*, 7.vii.1911.
2. Second open gully S. of King's, LHI, *W.W. Watts 190*, 15.vii.1911.
3. Northern Hills, LHI, *W.W. Watts 283*, vii.1911.

PROTO: 'Sea cliff, Middle Beach (n 105); Northern Hills (n 283); gully, south of King's (n 190).'

SYNTYPE: NSW (*Watts 190*); **ISOSYNTYPE:** NSW (*Watts 105, 283*)

SYNTYPE: H-BR (*Watts 105, 283*)

REC: [= *B. erythrocarpoides* C. Muell.: specimens cited by Ochi are *Watts 283, 105* and *Watts 332* as *B. howeanum* from H; not lectotypified by Ochi (1970: 29). Annotated = *B. erythrocarpoides* C. Muell., T. Seki 1975 on H-BR collections]

***Bryum howeanum* Broth. & Watts (1915a: 373).**

LABEL:

1. North Head, LHI, *W.W. Watts 500*, viii.1911.
2. North Head, LHI, *W.W. Watts 503*, viii.1911.
3. North Head, LHI, *W.W. Watts 501=500* viii.1911. (second specimen 501 not annotated=500).
4. North Head, LHI, *W.W. Watts 510*

PROTO: 'North Head. (n 500, 501, 503, 510).'

ISOSYNTYPE: NSW (*Watts 500, 501, 503, 510*)

SYNTYPE: H-BR (*Watts 500, 501, 503, 510*)

REC: [= *B. campylothecium* Tayl.: specimens cited by Ochi (1970: 51) are *Watts 485, 500, 500a, 510, 522*, all from H; not lectotypified by Ochi.]

***Bryum leptothecioides* Broth. & Watts (1915a: 374)**

LABEL:

- * 1. S. of Robins', LHI, *W.W. Watts 100*, 6.vii.1911
2. North Head, LHI, *W.W. Watts 491*, viii.1911

3. North Head, LHI, *W.W. Watts 494*, viii.1911 (2 specimens).
4. North Head, LHI, *W.W. Watts 506?a*, viii.1911.
5. Northern Hills, LHI, *W.W. Watts 284a*, vii.1911.
6. Northern Hills, LHI, *W.W. Watts 235a*, 21.vii.1911.
7. Blenkinthorp's Beach, LHI, *W.W. Watts 489*, viii.1911. Syntype.
8. Gully S. of King's, LHI, *W.W. Watts 180*, 15.vii.1911. Syntype.
9. Open gully just S of King's, LHI, *W.W. Watts 176*, 13.vii.1911 or 15.vii.1911
10. Open gully just S. of King's (Mt. Lidgbird), LHI, *W.W. Watts 162*, 13.viii.1911. Syntype.
11. Open gully above King's, LHI, *W.W. Watts 151*, 13.vii.1911.
12. Rocks and soil beyond G. Wilson's, LHI, *W.W. Watts 66*, 5.vii.1911 Syntype.

PROTO: 'Rock by sliprails south of Robin's farm (n 100); gully south of King's, base of Mt. Lidgbird (n 151, 152, 162, 176, 180); Blenkinthorp's Beach (n 489, 526); Northern Hills (n 235a, 284a); rock & soil back of Gower Wilson's (n 66); North Head (n 491, 494, 506a).'

SYNTYPE: NSW (*Watts 151*); ISOSYNTYPE: NSW (*Watts 66, 100, 162, 176, 180, 235a, 284a, 491, 494, 506?a*).

SYNTYPE: H-BR (*Watts 66, 100, 162, 176, 180, 235a, 284a, 489, 491, 494, 506a*)

REC: [= *B. capillare* L. ex Hedw., no specimens mentioned by Ochi (1970: 48). Not lectotypified by Ochi]

***Bryum limbifolium* Broth. & Watts (1915a: 373)**

LABEL:

1. In drip of fall, Head of 'Dinner Run', LHI. *W.W. Watts 332*, 29.vii.1911 Type

PROTO: 'Growing in drip of a waterfall at the head of the 'Dinner Run' on the eastern side of Mt. Lidgbird' [No number given].

ISOTYPE: NSW

HOLOTYPE: H-BR

REC: [= *B. erythrocarpoides* Ochi (1970: 17). Note on specimen in H-BR 'No.332 determined as *B. howeanum* Broth. & Watts n. sp. rev. Ochi 14.1.1968 = *B. curvicollum* Broth'. The specimen at NSW was not so annotated but called *B. limbifolium* by Watts and needs checking against the H-BR specimen]

***Bryum philonotideum* Broth. & Watts (1915a: 372)**

LABEL:

1. Blenkinthorp's Beach, LHI, *W.W. Watts* viii.1911.

2. Rocks, Blenkinthorp's Beach, LHI, *W.W. Watts 526* viii.1911.

PROTO: 'Rocks, Blenkinthorp's Beach (n 526)'

ISOTYPE: NSW; PARA: NSW (*Watts* no number)

HOLOTYPE: H-BR

REC: [= *B. dichotomum* Hedw.; Ochi (1970: 17) cites specimen in H as Type. Specimen 1 above is missing the number 526 but is otherwise identical and is therefore determined here as a paratype]

***Ectropothecium howeanum* Broth. & Watts (1915a: 379–380)**

LABEL:

1. Gully, back of 'The Pines', LHI, *W.W. Watts 530*

2. 'The Pines', LHI, *W.W. Watts 533*

3. Gully, back of 'The Pines', LHI, *W.W. Watts 533* 19.vii.1911.

PROTO: 'on rocks in deep gully at back of 'The Pines' July 1911 (n 530, 533)'

ISOSYNTYPE: NSW (*Watts 530, 533*)

SYNTYPE: H-BR (*Watts 530, 533*)

REC: [Although all specimens do not have full label data the locality and numbers are correct. Not yet lectotypified]

***Echinodium parvulum* Broth. & Watts (1915a: 376)**

LABEL:

1. 'Run' above 'Scaly Bark' LHI, *W.W. Watts 517* viii.1911

PROTO: "In 'Run' above 'Scaly Bark', Mt. Lidgbird (n 517)."

ISOTYPE: NSW

HOLOTYPE: H-BR

REC: [= *E. umbrosum* (Mitt.) Jaeg. var. *umbrosum* Churchill, (1986: 128); specimen in H-BR annotated as Holotype on packet by G. Scott 11.5.1976]

***Fissidens amblyothallioides* Broth. & Watts (1915a: 366)**

LABEL:

1. Gully S. of King's, LHI, *W.W. Watts 153* 13.vii.1911

2. Open paddock beyond G. Wilson's, LHI, *W.W. Watts 78* 5.vii.1911

3. Edge of sideling on way to King's, LHI, *W.W. Watts 102* 6.vii.1911

4. Gully beyond King's, LHI, *W.W. Watts 145* 13.vii.1911

5. Open gully S. of King's, LHI, *W.W. Watts 157* 13.vii.1911

6. Open gully just S. of King's, LHI, *W.W. Watts 163 =157* 13.vii.1911

7. Open gully beyond King's, LHI, *W.W. Watts 178 =157* 15.vii.1911

8. Dinner 'Run', LHI, *W.W. Watts 327* 29.vii. 1911

9. North Head, LHI, *W.W. Watts 494* viii.1911

PROTO: 'Gully, south of King's (n 153, 157, 178, 145, 163); North Head (n 494 ex p.); edge of sideling on way to King's (n 102); paddock. at north end of Island (n 78); Dinner 'Run' (n 327).'

ISOSYNTYPE: NSW (*Watts 78, 102, 145, 153, 157, 163, 178, 327, 494*)

SYNTYPE: H-BR (*Watts 78, 102, 145, 153, 157, 163, 178, 327, 494*)

REC: [Data for *Watts 78* in NSW differs from protologue in mention of G. Wilson's but specimen is annotated type. A lectotype needs to be chosen]

***Fissidens arcuatulus* Broth. & Watts (1915a: 368)**

LABEL:

1. Ground on way to Johnson's from Robin's, LHI, *W.W. Watts 118* 8.vii.1911

PROTO: 'On ground beyond Robin's farm (n 118)'

ISOTYPE: NSW

HOLOTYPE: H-BR

REC: [no additional information]

***Fissidens longiligulatus* Broth. & Watts (1915a: 367)**

LABEL:

1. Mt Gower, LHI, *W. W. Watts 382* 1-4.viii.1911 [mixed with *Echinodium hispidum*] sent to Brotherus as possibly *sp. nov.*

PROTO: 'On trees, Mt Gower n. 382, 525.'

ISOSYNTYPE: NSW (*Watts 382*)

SYNTYPE: H-BR (*Watts 382, 525*) [annotated by I.G. Stone (1988) in pencil = *F. asplenioides*, but the combination is not yet published]

Fissidens subtenellus *Broth. & Watts* (1915a: 366)

LABEL:

1. By well at back of G. Wilson's, LHI, *W.W. Watts* 60 (=56) 4.vii.1911 det. Broth.
2. Track above sugar cane, back of Paton's, LHI, 1 *W.W. Watts* 56 4.vii.1911 det. Broth.

PROTO: 'Track above sugarcane back of Paton's (n. 56); back of Gower Wilson's (n. 60 ex p.)'

ISOSYNTYPE: NSW (*Watts* 56, 60)

SYNTYPE: H-BR (*Watts* 56, 60)

REC: [Lectotype needs to be chosen]

Fissidens tenelliformis *Broth. & Watts* (1915a: 367)

LABEL:

1. Northern Hills, LHI, *W.W. Watts* 221 21.vii.1911 det. Broth.
2. Northern Hills, LHI, *W.W. Watts* 223 21.vii.1911
3. Northern Hills, near top, *W.W. Watts* 209 20.vii.1911

PROTO: 'On earth, Northern Hills (n. 209, 221, 223).'

ISOSYNTYPE: NSW (*Watts* 209, 221, 223)

SYNTYPE: H-BR (*Watts* 209, 221, 223)

REC: [Lectotype needs to be chosen]

Fissidens watsii *Broth.* (1915a: 368)

LABEL:

1. Northern Hills, I, *W.W. Watts* 224 21.vii.1911 det. Broth. 1913
2. Stone, Intermediate Hill, LHI *W.W. Watts* 136 (=515) 10.vii.1911 det. Broth. 1913
3. Run, scaly bark, LHI, *W.W. Watts* 518.viii.1911 det. Broth. 1913
4. Run, scaly bark, LHI, *W.W. Watts* 515.viii.1911 det. Broth. 1913
5. Dinner Run, LHI, *W.W. Watts* 337 (=209) 29.vii.1911 det. Broth. 1913

PROTO: 'Northern Hill (n. 224); Dinner Run (n.337); 'Run', Scaly Bark (n.515, 518); Stone, Intermediate Hill (n. 136).'

ISOSYNTYPE: NSW (*Watts* 136, 224, 337, 515, 518)

SYNTYPE: H-BR (*Watts* 136, 224, 337, 515, 518)

REC: [Lectotype needs to be chosen]

Holomitrium perichaetiale (*Hook.*) *Brid. var. robustum* *Broth. & Watts* (1915a: 364–5)

LABEL:

1. Saddle Back, LHI, *W.W. Watts* 449 5.vii.1911

PROTO: 'Saddle Back (no. 449)'

HOLOTYPE: NSW

? : H-BR (no specimen located)

REC: [see comments in Ramsay, (1986: 311)]

Isopterygium howeanum Broth. & Watts (1915a: 380–1)

LABEL:

1. Hillside back of Johnson's, LHI, *W.W. Watts 112* 8.vii.1911

PROTO: 'on rotten log, back of Johnson's (n 112)'

HOLOTYPE: NSW

ISOTYPE: H-BR

REC: [no additional information]

Macromitrium peraristatum Broth. (1893: 45)

LABEL:

1. Mt Gower LHI, *T. Whitelegge ix.1887* Type [Hb. NSW M12734]

2. LHI, *T. Whitelegge 2 viii.1887*

3. On branches of trees, Mt Gower, LHI, viii-ix 1887 *T. Whitelegge 2B* (2 specimens)[in Whitelegge's handwriting]

4. LHI *T. Whitelegge* Sept 1887 [Watts' handwriting, thus data transferred from original when duplicate made]

PROTO: 'Lord Howe Island, Mt Gower, ubi ad ramulos arborum m. Sept. 1887. legit T. Whitelegge (n 2)'

ISOTYPE: NSW (*Whitelegge 2*, Sept 1887); PARATYPE: (*Whitelegge 2B*)

HOLOTYPE: H-BR (*Whitelegge 2*)

REC: [Name confirmed Vitt & Ramsay, (1985: 425). Whitelegge collected a series of specimens in August-September, 1887. According to the protologue *Whitelegge n2* was collected on Mt Gower in September, but the specimen held at NSW (n.2) gives only Lord Howe Island as the locality and the date as *August*. but is listed here as an isotype. The specimen annotated type at NSW is not numbered but fits the date and locality (=isotype) as does specimen 4 above. Only two specimens, *Whitelegge 2B*, are annotated as in the protologue, but the date on these is viii-ix 1887. These are named here as paratypes. The single specimen held at H-BR is the holotype.]

Macromitrium subbreviceale Broth. & Watts (1915a: 371)

LABEL:

1. Rocks, cliff, North Head, LHI, *W.W. Watts 478* viii.1911

2. North Head, LHI, *W.W. Watts 507* viii.1911

3. Sea cliff, Northern Hills, LHI, *W.W. Watts 239* 21.vii.1911

4. North Head, LHI, *W.W. Watts 504* viii.1911

5. Seacliff, Top of Northern Hills, LHI, *W.W. Watts 236* 21.vii.1911

6. Seacliff, top of Northern Hills, LHI, *W.W. Watts 21*.vii.1911

PROTO: 'Growing mostly on cliffs at North Head and on the Northern Hills (n 236, 239, 478, 504, 507).'

ISOLECTOTYPE: NSW (*Watts 239*); SYNTYPE: NSW (*Watts 236, 478, 504, 507*); PARATYPE: NSW (*Watts* no number)

LECTOTYPE: H-BR (*Watts 239*) Vitt & Ramsay, 1985; SYNTYPE: H-BR (147d, 207, 360, 408)

REC: [= *M. breviceale* (Besch.) Broth. Vitt & Ramsay, (1985: 381–2) Specimen 6 above without collection number is selected here as a paratype since data match protologue]

Rhaphidostegium subfalcatulum Broth. & Watts (1915a: 381–2)

LABEL:

1. Back of Henderson's, LHI, *W.W. Watts 131* 10.vii.1911

2. Intermediate Hill, LHI, *W.W. Watts 134* 10.vii.1911

3. Above Johnson's, LHI, *W.W. Watts* 122 8.vii.1911
4. Mt. Gower, LHI, *W.W. Watts* 364a viii.1911
5. Intermediate Hill, LHI, *W.W. Watts* 135 10.vii.1911
6. Mt. Gower, LHI, *W.W. Watts* 370 1-4.vii.1911 (2 specimens)
7. Mt. Gower, LHI, *W.W. Watts* 400 viii.1911

PROTO: 'on rotten log, Intermediate Hill (n 134, 135); creek above Johnson's (n 122); gully at back of Henderson's (n 131); Mt. Gower (n 370, 400); top of Mt. Gower (n 364a).'

ISOSYNTYPE: NSW (122, 131, 134, 135, 364a, 370, 400)

SYNTYPE: H-BR (122, 131, 134, 135, 364a, 370, 400)

REC: [=? *Rhaphidorrhynchium subfalcatulum* (Broth. & Watts) Broth.- listed as *Pungentella subfalcatulum* (Broth. & Watts) C.Muell. in Ramsay (1984: 556). Lectotype not yet chosen]

***Rhynchostegiella campyloides* Broth. & Watts (1915a: 383)**

LABEL:

1. Second open gully, south of King's, LHI, *W.W. Watts* 201 15.vii.1911

PROTO: 'swampy ground, open gully, south of King's (n 201)'

ISOTYPE: NSW

HOLOTYPE: H-BR

REC: [no additional information]

***Rhynchostegium tenuifolium* (Hedwig) Reichardt. var. *howeanum* Broth. & Watts (1915a: 383)**

LABEL:

1. Back of G. Wilson's, LHI, *W.W. Watts* 50 4.vii.1911

PROTO: 'very plentiful at back of Gower Wilson's; also found in Robin's swamp.'

LECTOTYPE: NSW (*Watts* 50)

ISOLECTOTYPE: H-BR

REC: [No number was cited in the protologue. As the NSW specimen *Watts* No. 50 has var. *howeanum* written on it but those in H-BR do not, the specimen at NSW has been chosen here as the lectotype]

***Thuidium trachypodioides* Broth. & Watts (1915a: 379)**

LABEL:

1. 'The Pines' LHI, *W.W. Watts* 293 19.vii.1911
2. Gully, back of 'The Pines', LHI *W.W. Watts* 287 (=438) 19.vii.1911 det. Broth. 1913. Lectotype (duplicate), Haak (1983).
3. Gully at back of 'The Pines' LHI, *W.W. Watts* 537 20.vii.1911 det. Broth. Syntypotype Haak (1983).
4. Gully, back of 'The Pines', LHI, *W.W. Watts* 289 19.vii.1911. det. Broth. Syntypotype, Haak (1983).

PROTO: 'On coral rocks, gully behind 'The Pines' (n 287, 289, 293, 537); south of King's, open gully (n 164) and creek (n 171) top of Mt. Gower (n 389)'

ISOLECTOTYPE: NSW (*Watts* 287); ISOSYNTYPE: NSW (*Watts* 289, 293, 537)

LECTOTYPE: H-BR (*Watts* 287, *Touw & Haak* (in press)); SYNTYPE: H-BR (*Watts* 289, 293, 537)

REC: [Wijk et al 1959-1969 cite this as *hom. illeg.* In recent studies *Touw & Haak* (in press) have checked specimens *Watts* 164, 171, 389 and identified them as *T. sparsum*.

The lectotype chosen for *T. trachypodioides* as *Watts 287*, Only the collections from the gully behind 'The Pines' belong to this taxon. The species is known only from these type collections.]

***Tortella subflavovirens* Broth. & Watts (1915a: 369–370)**

LABEL:

1. Ground above beach near Flagstaff, LHI, *W.W. Watts 300* 24.vii.1911
2. Rocks, beach near Wilson's, LHI, *W.W. Watts 84* 5.vii.1911
3. Middle beach, LHI, *W.W. Watts 106* 7.vii.1911
4. Rocks by sea, west side, near Johnson's, LHI, *W.W. Watts 108* 8.vii.1911
5. Sea cliff near landing place, LHI, *W.W. Watts 174* 14.vii.1911
6. LHI, ex. p. *W.W. Watts 502* (In literature, location is 'stone-border, Wilson's garden').
7. Blenkenthorp's Beach, LHI, *W.W. Watts 524* viii.1911
8. Rocks by Wilson's boatshed, LHI, *W.W. Watts 83* 5.vii.1911
9. North Head, LHI *W.W. Watts 488* viii.1911

PROTO: 'Sandy cliff by Flagstaff (n 300, 174); rocks near Wilson's (n 84, 83); Blenkenthorp's Beach (n 524); rocks by sea, Johnson's (n 108); stone-border, Wilson's garden (n 502 ex.p.); on rocks, Middle Beach (n 106) etc.'

ISOSYNTYPE: NSW (*Watts 83, 84, 106, 108, 174, 300, 502, 524*)

SYNTYPE: H-BR (*Watts 83, 84, 106, 108, 174, 300, 502, 524*)

REC: [Lectotype not yet chosen]

***Trachyloma wattsii* Broth. (Broth. & Watts 1915a: 377)**

LABEL:

1. Mt Gower, LHI, *W.W. Watts 357* 1–4.vii.1911

PROTO: 'Mt Gower (n 357)'

ISOTYPE: NSW

HOLOTYPE: H-BR

REC: [Specimen in H-BR is annotated as holotype by G. Scott 17.5.1976, conf. N. Miller & M. Manuel 1982]

Invalid Names

***Bryum whiteleggei* Broth. (1892: 277)**

LABEL:

1. LHI, *T. Whitelegge* 14.ix.1887
2. LHI 5

REC: [Specimen cited without valid description — *nom. nud.* see Brotherus & Watts 1915a: 384]

***Fissidens howeanus* Broth. ex Whitelegge (1892: 277)**

LABEL:

1. Near Capt. Nicholl's farm, LHI, *T. Whitelegge 19B* viii.1887

REC: [Accepted as valid species in Index Muscorum. *B. howeanus* was listed in Whitelegge & Brotherus (1892: 277) but without description -*nom. nud.*: see Brotherus & Watts (1915a: 384)]

Register of Type Specimens at NSW: Vanuatu (New Hebrides)

(Relevant latitudes and longitudes are Aneityum Is. 20°14'S 169°51'E ; Futuna Is. 19°32'S 170°12'E; Epi Is. 16°50'S 168°20'E; Paama Is. 16°25'S 168°15'E; Espiritu Santo Is. 15°31'S 167°E.)

Barbula aneitensis Broth. & Watts (1915b: 136-7)

LABEL:

1. S.W. side Aneityum Island c. Gunn v-vi. 1913, *Watts* 416 Aneityum Island 19°32'S 170°32'E.

PROTO: 'Aneityum: Gunn May-June 1913 (Hb Watts 416)'

ISOTYPE: NSW

HOLOTYPE: H-BR

REC: [=*B. subcomosa* Broth. det. D.H. Norris. Annotated lectotype on packet at H-BR by D.H. Norris ix.1985 but this is neither validly published nor necessary]

Callicostella frateri Broth. & Watts (1915b: 145-6)

LABEL:

1. Paama Island. Dr. Gunn and Rev. Frater 1912. Hb. *Watts* 259

PROTO: 'Paama: Gunn & Frater 1912 (Hb. Watts 259)'

ISOTYPE: NSW

HOLOTYPE: H-BR

REC: [Annotated as lectotype by D.H.Norris Nov. 1982 and det. as =*C. papillata* (Mont.) Mitt. xii.1986). This has not been published and lectotypification is not necessary]

Campochaete prolongata Broth. & Watts (1915b: 144)

LABEL:

1. Aneityum Island, Dr. Gunn 1912 ex Herb. Rev. D. Lillie

PROTO: 'Aneityum: Gunn 1912 (Hb. Lillie 749)'

PARATYPE: NSW

HOLOTYPE: H-BR

REC: [NSW specimen fits protologue but no number is given hence this is named here as paratype.]

Chaetomitrium aneitense Broth. & Watts (1915b: 146)

LABEL:

1. Aneityum Island per Dr. Gunn vii-viii.1913. *Watts* 474

PROTO: 'Aneityum: Gunn 1913 (Hb Watts 474)'

ISOTYPE: NSW

HOLOTYPE: H-BR

REC: [Annotated on packet as lectotype by D.H. Norris ix.1986. This was not published nor is it necessary]

Clastobryum hebridense Broth. & Watts (1915b: 144-5)

LABEL:

1. Aneityum Island Dr. Gunn ii.1913 *Watts* 387

PROTO: 'Aneityum: Gunn Feb. 1913 (Hb Watts 387)'

ISOTYPE: NSW

HOLOTYPE: H

REC: [This number occurs in the main Herbarium (H) Brotherus No. R11468 and not in the Brotherus Herbarium (H-BR). As he must have seen this specimen it is most likely the holotype]

Ectropothecium aneitense *Broth. & Watts* (1915b: 149)

LABEL:

1. Aneityum Island, Gunn ii.1913 Hb. *Watts 379*
2. Aneityum Island Gunn ii.1913 Hb. *Watts 382*
3. Aneityum Island, Dr Gunn 1912 ex Hb. Rev. D. Lillie.

PROTO: 'Aneityum: Gunn 1912 (Hb. Lillie 760, 761) Feb. 1913 (Hb. Watts 379, 382b).'

ISOSYNTYPE: NSW (Watts 379, 382)

PARATYPE: NSW (Hb Lillie)

SYNTYPE: H-BR (Watts 379, 382; Hb. Lillie 760, 761)

REC: [Specimen 3 above does not have a number but as the rest of the data fit it is named here as a paratype. Lectotype needs to be chosen]

Ectropothecium bowiei *Broth. & Watts* (1915b: 149)

LABEL:

1. Santo, F.G.Bowie xi.1909 Hb. *Watts 53*.
2. F.G.Bowie 1909 Hb. *Watts 106*.

PROTO: 'Santo: Bowie 1909 (Hb. Watts 53, 106)'

ISOSYNTYPE: NSW (Watts 53, 106)

SYNTYPE: H-BR (Watts 53, 106)

REC: [Needs to be lectotypified]

Ectropothecium brachyphyllum *Broth. & Watts* (1915b: 150)

LABEL:

1. SW side of Aneityum Island Dr Gunn v-vi.1913 Hb. *Watts 425* (3 specimens)
2. Aneityum Island, Dr. Gunn v-vi.1913 Hb. *Watts 458* (2 specimens)

PROTO: 'Aneityum: Gunn May-June 1913 (Hb Watts 425, 458)'

ISOSYNTYPE: NSW (Watts 425, 428)

SYNTYPE: H-BR (Watts 425, 428)

REC: [A lectotype needs to be chosen]

Ectropothecium gunnii *Broth. & Watts* (1915b: 150)

LABEL:

1. Aneityum Island comm. natives Dr. Gunn ii. 1913 Hb. *Watts 383*
2. Aneityum Island comm. natives, Dr. Gunn ii. 1913 Hb. *Watts 393*
3. Aneityum Island Dr Gunn v-vi 1913 Hb. *Watts 404*
4. Aneityum Island Dr. Gunn v-vi 1913 Hb. *Watts 459*

PROTO: 'Aneityum: Gunn (Hb. Watts 383, 393, 404, 459)'

ISOSYNTYPE: NSW (Watts 383, 393, 404, 459)

SYNTYPE: H-BR (Watts 383, 393, 404, 459)

REC: [Needs to be lectotypified]

***Epiphygium vanuatuicum* H.A. Miller (1988: 133–7)**

LABEL:

1. Vanuatu: Ambrym Island, east fork of Woala River, in narrow gulch, 1700–1900 ft. alt. H.A. Miller 19389, 23 September 1985, ex Hb. Harvey A. Miller

PROTO: 'Vanuatu, Ambrym Island, East fork of Woala River, 550m, in deep gulch, 23 Sep 1985, H.A. Miller 19389'

ISOTYPE: NSW

HOLOTYPE: MU

REC: [recently described — Miller (1988: 133–137)]

***Euptychium assimile* Broth. & Watts (1915b: 140)**

LABEL:

1. Futuna Island Dr. Gunn x.1910 Hb. *Watts 208*

PROTO: 'Futuna: Gunn 1910 (Hb Watts 208, Hb Lillie 530) Aneityum: Gunn 1611 (Hb Watts 181)'

ISOLECTOTYPE: NSW (Watts 208)

LECTOTYPE: H (?Hb Watts 208 or ? Hb. Lillie 530) During (1977: 69), [not clear which was chosen]; ISOLECTOTYPE: BM (specimen not cited); FH (specimen not cited); JE (specimen not cited); ISOLECTOTYPE: H-BR (?Watts 208 or Hb. Lillie 530); SYNTYPE: H-BR (Watts 181)

REC: [Specimens in H-BR annotated = *E. setigerum* (Sull.) Broth. subspecies *setigerum* (det. During 1976). Lectotypified by During (1977: 69) but not clear which of two specimens *Watts 208* or *Hb. Lillie 530* was chosen hence clarification needed to confirm validity of lectotype. During did not examine the collections from NSW]

***Euptychium gunnii* Broth. & Watts (1915b: 140–1)**

LABEL:

1. Aneityum Island Dr. Gunn 1911 Hb. *Watts 145* Det. Broth. (2 specimens)
2. Aneityum Island Dr. Gunn ii.1913 Hb. *Watts 358* conf. Broth.
3. Aneityum Island, Dr. Gunn ii.1913 Hb. *Watts 366* confd. Broth.
4. S.W. side Aneityum Island Dr. Gunn v-vi.1913 Hb. *Watts 422* (3 specimens)
5. S.W. side Aneityum Island Dr. Gunn v-vi.1913 Hb *Watts 462*. Confd. Broth.
6. Aneityum Island Dr. Gunn iii.1911 Hb. *Watts 225* (3 specimens)
7. S.W. side Aneityum Island, comm. Gunn v-vi 1913 Hb. *Watts 424* Det. Broth.
8. S.W. side Aneityum Island comm. Gunn v-vi.1913 Hb. *Watts 435* Det. Broth.
9. Aneityum Island, Natives comm. Dr. Gunn ii.1913 Hb. *Watts 358* Det. Broth.

PROTO: 'Aneityum: Gunn 1911 (Hb. Watts 145, 225 cfr 'Hb. Lillie 536') Feb. 1913 (Hb. Watts 358, 366) May-June 1913 (Hb. Watts 422, 424, 435, 462)'

ISOLECTOTYPE: NSW (Watts 145); ISOSYNTYPE: NSW (Watts 225, 358, 366, 422, 424, 435, 462)

LECTOTYPE: H-BR (Watts 145) During (1977:69); ISOLECTOTYPE: BM (Watts 145); SYNTYPE: H-BR (Watts 225cfr, 358, 366, 422, 424, 435, 462; Hb. Lillie 536)

ISOSYNTYPE: BM (Watts 225); JE (Watts 225)

REC: [All specimens at H-BR were determined as = *E. setigerum* subspecies *setigerum* by During 1976. Lectotypified by During (1977: 69). None of the specimens in NSW were examined by During.]

***Fissidens scabrisetus* Broth. & Watts (1915b: 132)**

LABEL:

1. Paama: Dr Gunn & Frater vi.1912 Hb. *Watts 255*

PROTO: 'Paama: Gunn & Frater, June 1912 (Hb. Watts, 215)'

ISOTYPE: NSW

HOLOTYPE: H-BR

Hyophila microphylla *Broth. & Watts* (1915b: 136)

LABEL:

1. Aneityum Island Dr. Gunn Hb. *Watts* 192. Det. Broth.
2. Aneityum Island, comm. Gunn, ii.1913 Hb. *Watts* 353. (3 specimens).
3. Aneityum Island, W, Gunn 1912 ex. Hb. Lillie.

PROTO: 'Aneityum Island: Gunn Oct. 1911 (Hb. Watts 192, Hb. Lillie 699) 1912 (Hb. Lillie 741) Feb. 1913 (Hb. Watts 353)'

ISOSYNTYPE: NSW (Hb. Watts 192, 353); PARATYPE: NSW (ex Hb. Lillie)

SYNTYPE: H-BR (Hb. Watts 192, 353; Hb. Lillie 699, 741)

REC: [On specimen 3 above the data fits although number missing and the specimen is named here as a paratype. Lectotype needs to be chosen]

Hypnodendron flagelliferum *Broth. & Watts* (1915b: 156)

LABEL :

1. Aneityum Island, Gunn 1911. Hb. *Watts* 144, Det. Broth.
2. N. side Aneityum Island, Dr. Gunn v-vi.1913 Hb. *Watts* 402, Hb. NSW M36
3. S.W. side Aneityum Island, Gunn. v-vi.1913 Hb. *Watts* 417.

PROTO: 'Aneityum: Gunn 1911(Hb. Watts 144, Hb. Lillie 689) 1912 (Hb Lillie 746); May-June 1913 (Hb. Watts 402, north side & 417 south-west side).'

ISOSYNTYPE: NSW (Gunn 144=689, Watts 402, 417); LECTOTYPE: H-BR (Hb. Lillie 746, Touw 1971:152);

ISOLECTOTYPE: BM (Hb. Lillie 746); L (Hb. Lillie 746); SYNTYPE: H-BR (Watts 402, 417, Hb. Lillie 689)

ISOSYNTYPE: H-BR (Hb. Watts 144)

REC: [No additional information]

Hypopterygium bowiei *Broth. & Watts* (1915b: 147)

LABEL:

1. Tagoa, Santo F.G. Bowie 1906 comm. Murdoch x.1911 Hb. *Watts*

PROTO: 'Santo: Bowie (Hb Watts 73 Comm. Murdoch)'

PARATYPE: NSW

HOLOTYPE: H-BR

REC: [Specimens at H-BR on loan for revision elsewhere, no details available. Specimen at NSW is missing its number although other data are correct and is named here as a paratype]

Isopterygium gunnii *Broth. & Watts* (1915b: 151)

LABEL :

1. Futuna Island, Dr Gunn, x.1910. Hb. *Watts* 209.
2. Futuna Island.

PROTO: 'Futuna: Gunn, Dec. 1910 (Hb Watts 209, Hb Lillie 519)'

ISOSYNTYPE: NSW (Watts 209)

SYNTYPE: H-BR (Watts 209, Lillie 519)

REC: [Specimen 2. above only gives Futuna Is. but fits locality, possibly a syntype or paratype. Species not yet lectotypified]

Leucobryum aneitense *Broth. & Watts* (1915b: 130–1)

LABEL :

1. Aneityum Island Dr Gunn, iii.1911 Hb. *Watts 241* Det. Broth. (2 specimens)
2. Aneityum Island, Dr. Gunn, ii.1911 Hb. *Watts 230*.
3. Aneityum Island. Natives, Dr. Gunn 1913. Hb. *Watts 357a* Det. Broth. (3 specimens).

PROTO: 'Aneityum: Gunn, 1911 (Hb Watts, 241, 230, ex p.), 1912 (Hb Lillie, 736), 1913 (Hb Watts, 357a). Det. Broth. Hb Watts 241'

ISOSYNTYPE: NSW (Watts 241, 357a); SYNTYPE: NSW (Watts 230)

SYNTYPE: H-BR (Watts 241, 357a, Lillie 736)

REC: [Not yet lectotypified]

Leucobryum gunnii *Broth. & Watts* (1915b: 130)

LABEL :

1. Aneityum Island, Gunn v-vi.1913 Hb. *Watts 454a* (3 specimens)
2. Aneityum Island, comm. Gunn, ii.1913 (2 specimens) Hb. *Watts 357c*.
3. Futuna Island, Natives, Gunn. x.1912, Hb. *Watts 303*.

PROTO: 'Futuna: Gunn Oct. 1913. (Hb Watts, 303); Aneityum: Gunn, 1913 (Hb Watts 357c, 454a).'

ISOSYNTYPE: NSW (Watts 303, 357c, 454a)

SYNTYPE: H-BR (Watts 303, 357c, 454a)

REC: [Not yet lectotypified]

Leucoloma subtenuifolium *Broth. & Watts* (1915b: 128–9)

LABEL:

1. Aneityum Island, Gunn, viii. 1912. Hb. *Watts 271*, det. Broth.
2. Aneityum Island, natives, comm Gunn ii.1913 Hb. *Watts 344* Det. Broth. (2 specimens).
3. North side Aneityum Island, comm. Gunn v-vi.1913 Hb. *Watts 407* det. Broth.
4. Aneityum Island, S.W. side, comm. Gunn, v-vi. 1913 Hb. *Watts 421* (3 specimens).

PROTO: 'Futuna: Gunn, March-April, 1910 (Hb. Lillie, 523).; Aneityum: Gunn, 1911 (Hb. Lillie, 544, 694), Aug. 1912 (Hb. Watts, 271, Hb. Lillie, 728), Feb 1913 (Hb. Watts, 344), May-June, 1913 (Hb. Watts, 407, 421).'

ISOSYNTYPE: NSW (Watts 271, 344, 407, 421)

SYNTYPE: H-BR (Hb. Lillie 523, 544, 694, 728, Hb. Watts 271, 344, 407, 421)

REC: [not yet lectotypified]

Papillaria pellucida *Broth. & Watts* (1915b: 141–2)

LABEL:

1. Futuna Island. Dr Gunn, 28.xii.1910 Hb *Watts 212*
2. Aneityum Island, Dr. Gunn, iii.1911. Hb. *Watts 236*
3. Aneityum Island, Dr. Gunn, iii.1911. Hb. *Watts 239–240* Det. Broth.
4. Futuna Island, Comm. Gunn. x.1912 Hb. *Watts 295* .

PROTO: 'Futuna: Gunn, Dec., 1910 (Hb Watts, 212, 236, 239); 1911 (295); Aneityum: GUNN, MARCH, 1911 (240).'

ISOSYNTYPE: NSW (212, 236, 239–240, 295)

SYNTYPE: H-BR (specimens on loan)

REC: [*Watts 295* has correct number but year in protologue is 1912 not 1911— may be an error in protologue; *Watts 236* has correct number but year is 1911 whereas in protologue it is 1910— may be an error in protologue; not yet lectotypified]

Rhynchostegium oblongifolium Broth. & Watts (1915b: 156)

LABEL :

1. Santo. F.G. Bowie, 1909. Hb *Watts 116*
2. *Futuna Island. Comm. Dr. Gunn x.1912 Hb. Watts 302.* Det. Broth.

PROTO: 'Santo: Bowie 1909 (Hb Watts, 116). *Futuna*: Gunn, Oct., 1912 (302).'

SYNTYPE: NSW (Watts 116, 302)

REC: [No specimens located in H-BR. Needs to be lectotypified]

Sematophyllum glabrifolium Broth. & Watts (1915b: 154)

LABEL: S-W side Aneityum Island. Gunn v-vi.1913. *Watts 436a*

PROTO: 'Aneityum, south-west side; Gunn, May-June, 1913 (Hb Watts 436a)'

ISOTYPE: NSW (Watts 436a)

HOLOTYPE: H-BR (Watts 436a)

REC: [Specimen at H-BR must be the Holotype; =*Aptychella glabrifolia* on folder in H-BR]

Sematophyllum serricalyx Broth. & Watts (1915b: 154-5)

LABEL:

1. Aneityum Island. Comm. Dr Gunn, v-vi. 1913. *Watts 457.*
2. Santo, F.G. Bowie xi.1909 Hb. *Watts 63* Det. Broth.
3. Aneityum, Gunn v-vi.1913

PROTO: 'Santo: Bowie, 1909 (Hb Watts, 56 e.p., 63 c.fr.). Epi: Riddle, Jan., 1911 (135); Aneityum: Gunn, 444, 447, 457); *Futuna*: Gunn, Oct., 192 (329) [192=1912].'

ISOSYNTYPE: NSW (Watts 63, 457)

SYNTYPE: H-BR (Watts 63cfr, 135, 282, 444, 447, 457)

REC: [Needs lectotypification; Location of *Watts 56 e.p.*, 329 unknown]

Symphysodon gunnii Broth. & Watts (1915b: 140)

LABEL:

1. Aneityum Island, Dr. Gunn iii.1911, Hb. *Watts 221*
2. *Futuna Island. Natives comm. Dr. Gunn x.1912. Hb. Watts 296* Det. Broth. (3 specimens)
3. *Futuna Island, Dr. Gunn x.1910, Hb. Watts 202*
4. *Futuna Island, Dr. Gunn, seen by Watts 28.x.1910. Hb. Watts 202.*
5. Epi Island, T.E. Riddle, i.1911, Hb. *Watts 131* Det. Broth. (2 specimens).
6. Epi Island, T. E. Riddle, i.1911 Hb. *Watts 142*

PROTO: 'Futuna: Gunn, 1910 (Hb Watts, 202), Oct. 1912 (296, forma *viridis*); Aneityum 1911, Gunn, (221); Epi: Riddle, Jan., 1911 (Hb. Watts, 131, c.fr, and 142)'

ISOSYNTYPE: NSW (Watts 131, 202, 296); SYNTYPE: NSW (Watts 142, 221)

SYNTYPE: H-BR (Watts 131 c.f.r., 202, 296)

REC: [Specimen 5. above may be part of type, but data incomplete and number differs, *Watts 296* det. as *S.gunnii* f. *viridus* by V.F. Brotherus. Location of *Watts 142* unknown. Not yet lectotypified]

Synodontia aneitensis *Broth. & Watts* (1915b: 129–130)

LABEL:

1. Aneityum Island (5 specimens) Comm. Gunn ii.1913. Hb. *Watts* 375.
2. Aneityum Island, Comm. Gunn ii.1913 Hb. *Watts* 377a.

PROTO: 'Aneityum: Gunn, 1911 (Hb. Lillie 701), Feb. 1913 (Hb. Watts, 375, 377a).'

ISOSYNTYPE: NSW (Watts 377a); SYNTYPE: NSW (Watts 375)

SYNTYPE: H-BR (Watts 377a)

REC: [Not yet lectotypified]

Syrhropodon diversiretis *Broth. & Watts* (1915b: 134)

LABEL:

1. Aneityum Island, natives, comm. Gunn ii.1913. Hb. *Watts* 352a.
2. Aneityum Island, SW side. Comm. Gunn v-vi.1913, *Watts* 434. (4 specimens).

PROTO: 'Aneityum: Gunn, Feb., 1913 (Hb. Watts, 352a); S.W. side, May-June, 1913 (Hb. Watts, 434).'

ISOTYPE: NSW (Watts 352a); SYNTYPE: NSW (Watts 434)

LECTOTYPE: H-BR (352a)

REC: [*Watts* 352a at H-BR labelled syntype by W.D. Reese; =*S. japonicus* (Besch.) Broth. W.D. Reese (1984); cited as lectotype and *syn. nov.* under *S. japonicus* Reese & Mohamed, (1985: 227). Specimens at NSW were not cited in publication but have been seen by W. D. Reese and determined by him in 1987 — *Watts* 434 and *Watts* 352a are syntypes = *S. japonicus*]

Syrhropodon lilliei *Broth. & Watts* (1915b: 133)

LABEL:

1. Aneityum Island, Comm. Gunn ii. 1913, Hb. *Watts* 350 (4 specimens)

PROTO: 'Aneityum: Gunn, 1912 (Hb. Lillie, 740), Feb. 1913 (Hb. Watts, 350)'

ISOSYNTYPE: NSW (Watts 350)

SYNTYPE: H-BR (Watts 350)

REC: [Location of specimen *Lillie* 740 not known; =*S. trachyphyllus* Mont. as *syn. nov.* Mohamed & Reese, (1985: 243) who do not specify the precise nature of the type; they examined a specimen from NY which would be a syntype, the specimen at H-BR should be chosen as the lectotype. Specimens at NSW were not seen by W. D. Reese until 1987 when he confirmed *Watts* 350 as syntype =*S. trachyphyllus*]

Syrhropodon perarmatus *Broth. & Watts* (1915b: 133–4)

LABEL:

1. Santo, F.G. Bowie 1909. Hb *Watts* 89 (2 specimens).
2. Aneityum Island, Dr. Gunn x.1911, Hb. *Watts* 193 Det. Broth. (2 specimens)
3. Aneityum Island, N. side. Comm. Gunn iii.1913. Hb. *Watts* 410 (3 specimens)
4. Futuna Island, Natives, comm. Gunn x.1912. Hb. *Watts* 292 Det. Broth. 1912

PROTO: 'Santo: Bowie, 1909 (Hb. Watts, 89); Aneityum: Gunn, Oct., 1911 (Hb. Watts 193, Hb. Lillie, 697), May-June, 1913 (Hb. Watts, 410); Futuna: Gunn, Oct. 1912 (Hb. Watts, 292).'

SYNTYPE: NSW (Watts 89, 193, 410);

ISOTYPE: NSW (Watts 292)

SYNTYPE: H-BR (Watts 292, Hb. Lillie 697).

REC: [Not yet lectotypified. *Watts* 292 in H-BR designated syntype by W. D. Reese 1984; specimen Hb. Lillie, H-BR labelled syntype in pencil but no specimen in NSW has

this number. H. Mohamed & W. D. Reese (1985) retain *S. perarmatus* Broth. & Watts as a species closely allied to *S. spiculosus*; specimens at NSW not examined by W. D. Reese until 1987 when the following were confirmed as syntypes, *Watts 89, 193, 292, 410*]

***Syrhropodon tenuinervis* Broth. & Watts (1915b: 135)**

LABEL: Futuna Island, Natives, Comm. Dr. Gunn x.1912, Hb. *Watts 318* 'Futuna: Gunn, Oct., 1912 (Hb Watts 318)'

ISOTYPE: NSW (Watts 318)

HOLOTYPE: ?

REC: [no specimen located at H-BR, this species not mentioned in H. Mohamed & W. D. Reese (1985); specimens seen by W.D. Reese in 1987 designated as isotype = *S. japonicus* (Besch.) Broth.; location of the holotype is not known]

***Taxithelium annandii* Broth. & Watts (1915b: 152)**

LABEL:

1. Tangoa, Santo Dr. Annand xiii.1903. Hb. *Watts 10*.

2. Tangoa, Santo Dr. Annand xiii.1903 Hb. *Watts 17*

3. Tangoa, Santo Dr. Annand xiii.1903 Hb. *Watts 21*.

PROTO: 'Tangoa, Santo: Annand, Dec, 1903 (Hb. Watts 10, 17, 21 e.p.)'

ISOSYNTYPE: NSW (Watts 10, 21e.p.); SYNTYPE: NSW (Watts 17)

SYNTYPE: H-BR (Watts 10, 21)

REC: [Not yet lectotypified]

***Trichosteleum gunnii* Broth. & Watts (1915b: 153)**

LABEL:

1. Aneityum Island Comm. Gunn ii.1913 Hb. *Watts 384* (4 specimens)

2. Aneityum Island, Comm. Gunn ii.1913 Hb. *Watts 382c*

3. Aneityum Island, W. Gunn 1912, ex. Hb. D. Lillie. (2 specimens)

PROTO: 'Gunn, 1912 (Hb. Lillie, 755), Feb., 1913 (Hb Watts, 384, 382c).'

ISOLECTOTYPE: NSW (Watts 382c, 384)

SYNTYPE: H-BR(Watts 382c, 384, Hb. Lillie 755)

REC: [Not yet lectotypified. Specimens 3 above ex Hb. Lillie but without number, but must represent isosyntypes, or paratypes]

***Trichosteleum subtile* Broth & Watts (1915b: 153)**

LABEL: Paama: Dr. Gunn & Rev. Frater vi. 1912. *Watts 256* (2 specimens)

PROTO: 'Paama: Gunn & Frater, June, 1912 (Hb. Watts, 256, 258)'

ISOSYNTYPE: NSW (Watts 256)

SYNTYPE: H-BR (Watts 256, 258)

REC: [Not yet lectotypified]

Missing Type Specimens

No type specimens were located at NSW for the following species described in Brotherus & Watts (1915a,b):

***Syrhropodon anietensis* (Hb. Lillie 688)**

Invalid Names

Barbula crispatula C. Muell. (1897: 104)

LABEL: Santo, New Hebrides, F.G. Bowie, 1909. Hb. *Watts* 88.

REC: [nom. inval. in synonym. err. pro. *Syntypetrichia crispatula* C. Muell. Listed only for AM2 in Wijk et al. 1959) = *Calyptopogon mnioides* (Schwaegr.) Broth. *fid. Salm. J. Bot.* 41: 3 (1903)]

Floribundaria pseudo-floribunda Fleisch. var. *tenuiramea* Broth. & Watts (1915b: 143)

LABEL: Futuna Island Dr Gunn iii-iv.1911 Com. D. Lillie

PROTO: 'Futuna: Gunn 1911 (Hb Lillie)'

REC: [This is the specimen referred to but without valid description — *nom. nud.*]

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SHORT COMMUNICATION

Rediscovery of *Haloragodendron lucasii* (Haloragaceae)

In my revision of the genus (Orchard 1975) I suggested that *Haloragodendron lucasii* might be extinct. No collections had been made for 50 years, and earlier records were all from the vicinity of Hornsby, New South Wales, in an area largely swallowed up by suburban development.

Happily, my gloomy suggestion has been proven false, with not one but two separate rediscoveries of the species. One population is from Barra Brui, not far from previous records in the Central Coast subdivision of NSW, the other is from Yarramun Creek near Mount Wilson in the Central Tablelands, representing a major extension of range.

Both collections are in flower and fruit. The Barra Brui collection agrees quite well with earlier specimens, although it is smaller in several of its measurements. The fruits are only semi-mature, but are winged, as previously described. The Yarramun Creek collection agrees also in most respects, but has a bluntly angled rather than winged fruit. It has been suggested (Peter G. Wilson, pers. comm.) that this specimen could represent a fourth species of the genus for New South Wales. While this is possible, and could be resolved by further field study or cultivation (particularly of seedlings), for the time being I am inclined to consider it as merely a variant of *H. lucasii*. It agrees with that species in all essential respects except fruit shape, a character that is known to be variable in this family, (Orchard 1975) — see for example *Haloragis acutangula*, *Haloragis odontocarpa*, *Haloragis aspera* and *Glischrocaryon aureum*.

An expanded description incorporating the new collections is given below.

***Haloragodendron lucasii* (Maiden & Betche) Orchard**, Bull. Auckland Inst. Mus. 10: 146–148 (1975).

Erect multistemmed shrub 1(–3) m tall, older stems with smooth grey bark, younger stems green to reddish, arranged decussately, 4-winged or -angled. Leaves decussate, sessile, oblanceolate, 2.3–3.0(–5.0) cm long, 0.4–0.6 cm wide, widest about two-thirds of the way to the acute apex, coriaceous, darker green above than beneath, serrate (rarely slightly biserrate) with 10–24 short teeth per leaf, mainly in the distal $\frac{1}{2}$ to $\frac{2}{3}$; midrib channelled above, prominent below, lateral veins not visible.

Inflorescence terminal on young stems. Axis terminated by a simple dichasium, with simple dichasia in the axils of the upper 3–4 pairs of primary bracts. Lateral inflorescences, similar to the terminal one but extending over only 1–3 nodes, are borne in the axils of the 3–6 (sometimes more) pairs of leaves immediately below the terminal inflorescence. Within each inflorescence the terminal flower of the terminal dichasium develops first, followed by the terminal flowers of the two lowest dichasia. The terminal flowers of the intermediate dichasia then open in basifugal order. The lateral flowers of each dichasium abort. Primary bracts similar in size and shape to upper leaves. Secondary bracts green to brown, opaque, lanceolate, \pm 2–3 mm long, 0.4 mm wide, entire, deciduous before anthesis. Tertiary bracts extremely minute, deciduous early with lateral flowers of the dichasium.

Flowers mostly hermaphrodite, sub-sessile on a pedicel 0.3 mm long. Sepals 4, broadly deltoid, 1–2 mm long, 1.5–1.7 mm wide, erect. Petals 4, creamy white, strongly twisted in bud, very shallowly navicular (almost planar) in flower, lanceolate, (7–)9.5–12(–14) mm long, 1.8–2.5 mm wide, becoming twisted again before abscission. Stamens 8, filaments 1.5–2.5 mm long; anthers yellow with reddish connective, narrowly sagittate, (4.0–)5.5–7.0 mm long, 0.5–0.6 mm wide at base, somewhat compressed, tapering to a blunt point at the apex. Styles 4, conical at first, later capped with a saddle-shaped fimbriate stigma. Ovary glabrous, ellipsoid, 4.2 mm long, 2.5 mm wide including the 4 longitudinal antipetalous wings 0.5 mm wide. Lower flowers of the inflorescence sometimes functionally male; as for the hemaphrodite flowers, but a little smaller, on pedicels 2 mm long, styles and ovary vestigial.

Fruit on pedicels up to 3 mm long, usually winged, body of fruit at least 5 mm long, 4–5 mm wide (incl. wings), but not seen fully mature. Fruit of the Yarramun Creek collection ovoid, 4-angled instead of winged, 6–7 mm long, 4 mm wide, endocarp woody, septa membranous and pushed aside by the developing 1 (or 2) seeds.

ECOLOGY: The collectors described the Barra Brui plants as being locally frequent on a south-facing sandstone hillside with *Eucalyptus gummifera*, *E. piperita*, *Elaeocarpus reticulatus*, *Banksia oblongifolia*, *Leptospermum trinervium*, *Hakea teretifolia* etc. in a *Gleichenia dicarpa* thicket at an altitude of 110 m. The Yarramun Creek collection was growing on a creek bank in *Eucalyptus oreades* open forest with *Ceratopetalum apetalum*, *Logania albiflora*, *Todea barbara*, *Gahnia* sp. and *Prostanthera* sp. at 730 m.

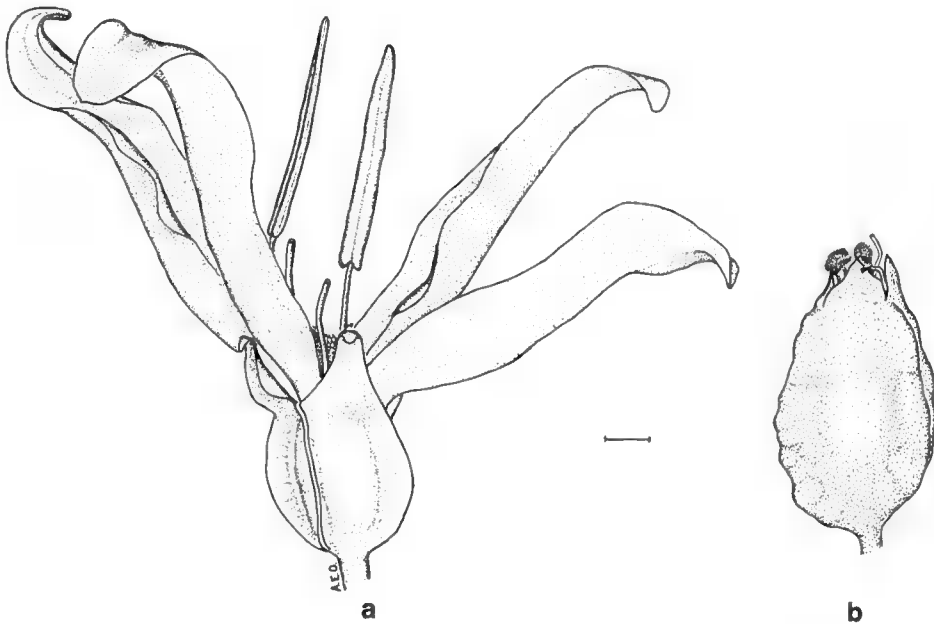


Fig. 1. *Haloragodendron lucasii*. a old hermaphrodite flower/young fruit, showing the development of wings on the ovary. b fruit of Yarramun Creek collection, with 4 irregular longitudinal angles instead of wings. (a from Coveny 12368 *et al.*, b from Lembit NSW 17100423. Scale represents 1 mm for both illustrations).

SPECIMENS EXAMINED: NEW SOUTH WALES: Central Coast: Barra Brui near Scout Hall, *Coveny 12368 et al.*, 22 Oct. 1986 (HO). Central Tablelands: Yarramun Creek, 7 km NNW of Mount Wilson, *Lembitt NSW 171423*, 7 Dec. 1986 (HO). (Original collections of both in NSW, n.v.)

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SHORT COMMUNICATION

***Indigofera psammophila* (Fabaceae), a new species from arid Australia**

This species is described here to make the name available for the Flora of New South Wales. It has often been referred to as *I. brevidens* but is not closely related to that species. *I. brevidens* sens. str. is a shrubby species that occurs in the central west of Queensland and in a few places in the north of the North Western Slopes and Plains of N.S.W., generally in drier areas on gravelly soils; it is most closely related to *I. australis* and *I. adesmiifolia*. The new species, on the other hand, is a perennial herb or subshrub of deep sands and is more closely related to *I. georgei*.

***Indigofera psammophila* Peter G. Wilson, sp. nov.**

[*I. brevidens* auct. aust. non Benth.: Jacobs & Pickard, Plants of New South Wales (1981); Cunningham et al., Plants of Western New South Wales: 397, photo (1981); Weber, Flora of South Australia: 579, fig. 307A (1986).]

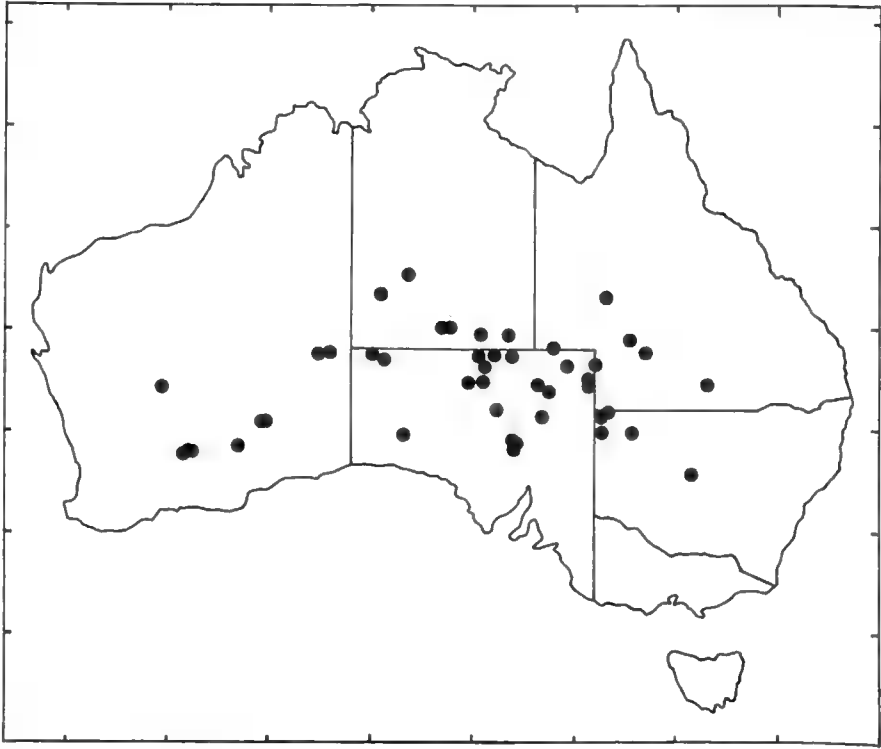
I. georgei affinis sed ramis procumbentibus, foliolis plus numerosis, cinerascensibus (vice canis) et petalis subroseis vel malvinis differt.

HOLOTYPE: NEW SOUTH WALES: North Far Western Plains: 15.1 km E of Fortville Gate, Sturt National Park, *Wilson 115*, 29.10.1986 (NSW). ISOTYPES: AD, BRI, CBG.

Perennial herb or subshrub to 0.5 m high with a woody root-stock; young stems and leaves grey with fine, appressed to spreading equally biramous hairs. *Leaves* pinnate, (5–)7–11(15)-foliolate, 3–8 cm long; rachis grooved above; stipellae small, c. 0.5 mm long; leaflets opposite or subopposite, obovate to cuneate, obtuse and mucronate or emarginate, 3–15 mm long, 1.5–7 mm wide, green to grey, discolorous but more or less equally hairy on both surfaces. *Stipules* narrowly triangular to linear, 1–3.5 mm long. *Inflorescence* exceeding the leaves, an axillary raceme 10–29 cm long when fully developed; bracts linear, 1.5–3 mm long; pedicels 1–2 mm long. *Calyx* 2.5–3 mm long, grey-pubescent, the lobes approximately equal to the tube. *Corolla* pink to mauve, sparsely hairy on the back of the standard and the distal end of the keel; standard broadly elliptical, 5.5–7 mm long, 3.5–5 mm wide, apex obtuse and emarginate or mucronate; wings spathulate, 5–8.5 mm long, 1.5–2 mm wide; keel 5.5–7 mm long, 1.5–2 mm deep, margins ciliate, apex often beaked. *Stamens* 9+1, tube 3–4.5 mm long; anthers apiculate. *Ovary* pubescent; style glabrous; stigma capitate. *Pod* terete, 1.5–3 cm long, 2–3.5 mm wide, white-pubescent; endocarp with light to dark brown spots. *Seeds* 4–10, cuboid, 1.5–2 mm long.

HABITAT AND DISTRIBUTION: widespread throughout central Australia in desert regions, mainly in the Simpson and Great Victoria Deserts, on sand dunes, but with outliers in other areas on sand-plains or alluvial deposits. (Map 1)

SELECTED SPECIMENS EXAMINED: NEW SOUTH WALES: North Western Plains: Sandy Creek, 'Lachlan Downs', *Cunningham & Milthorpe 1475*, 17.11.1973 (NSW). North Far Western Plains: 'Tero Creek' Station, *Martensz 67/107*, 1.4.1967 (NSW). QUEENSLAND: Gregory North: 10 km SSW of 'Brighton Downs', *Purdie 1323*, 17.6.1978 (BRI); Gregory South: 24 km SE of Betoota, *Purdie 1145*, 18.9.1977 (AD, BRI). SOUTH AUSTRALIA: North-western: c. 18 km NE of Mt Kintore summit, *Donner 6626*, 10.9.1978 (AD); Lake Eyre Basin: Warburton River, near new Kalamurina, *Jackson 1975*, 9.3.1972 (AD); Nullarbor: Golf Course, Maralinga, *Turner s.n.*, 23.9.1960 (AD97604554); Gairdner-Torrens Basin: 7 km NE of Twelve Mile Dam, *Fatchen 246*, 4.3.1981 (AD). WESTERN



Map 1. Distribution of *Indigofera psammophila*.

AUSTRALIA: Giles District: 2 miles (c. 3.2 km) W of Cavenagh Range, *George 8738*, 16.7.1967 (CANB, PERTH); Coolgardie District: Cundelee, *Boswell R69*, 9.1967 (PERTH). NORTHERN TERRITORY: Central South: Ehrenberg Range, *Butler 69*, 5.1967 (PERTH); 4 miles (c. 6.4 km) N of Connor Well, *Chippendale 4678*, 22.7.1958 (AD, NSW).

This species has been confused with *I. brevidens* but differs from that species in having inflorescences exceeding the leaves, calyx teeth all distinct, different habit and indumentum, and in habitat. In these features it more closely resembles *I. georgei*, but it differs from that species in having more numerous grey-green, rather than canescent, leaflets, a more procumbent habit and paler corolla.

There are a number of specimens collected from coastal sand-masses in Western Australia near Carnarvon and Exmouth. These approach *I. psammophila* in general aspect but differ in indumentum and fruit shape; their status is yet to be determined.

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SHORT COMMUNICATION

Amphibromus nervosus (Poaceae), an earlier combination and further synonyms

Arthur Chapman, Bureau of Flora & Fauna, Canberra, has kindly pointed out to me that the combination *Amphibromus nervosus* (J. D. Hook.) Baillon had been made in 1893, earlier than the combination made by G. C. Druce reported in our revision of the genus *Amphibromus* in Australia (Jacobs and Lapinpuro 1986). Baillon's combination had been overlooked by Index Kewensis and by the Chase Index (Chase and Niles 1962). The full citation is: *Amphibromus nervosus* (J. D. Hook.) Baillon, Histoire des Plantes 12: 203 (1893).

BASIONYM: *Danthonia nervosa* J. D. Hook., Fl. Tasm. 2: 121, pl. 163A (1858). Hooker based his combination on the illegitimate *Avena nervosa* R. Br. (see Jacobs and Lapinpuro 1986 for further comment).

Amphibromus nervosus (J. D. Hook.) G. C. Druce then becomes a superfluous combination and is added to the synonymy.

Arthur Chapman also kindly pointed out a synonym that to the best of my knowledge has not been used beyond its initial publication. This synonym is:

Avenastrum nervosum Vierh., Verhandlungen der Gesellschaft Deutscher Naturforscher und Artze 85. Versammlung zu Wien (Leipzig) 1: 672 (1913). This name was based on the illegitimate *Avena nervosa* R. Br. and the protologue apparently does not mention *Danthonia nervosa* J. D. Hook. (A. Chapman pers. com.) so Vierhapper's name is new and dates from his publication and this name has the same type as *Avena nervosa* R. Br.

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SHORT COMMUNICATION

Notes on Australian grasses (Poaceae)

Some new combinations and clarification of some names are required for the next edition of Wheeler et al. (1982).

1. *Austrofestuca*

Alexeev (1976) established the genus *Austrofestuca* based on the single Australasian species *A. littoralis* (Labill.) Alexeev. Edgar and Connor (1983) have taken up the name but it has not yet been formally used in Australia although Simon (1986) does provide a new combination for *A. pubinervis* (Vickery) B. Simon, a segregate of *A. littoralis*. Alexeev (1987) found an earlier epithet applicable to *A. pubinervis* and made the combination *A. triticoides* (Trin.) Alexeev. Clayton and Renvoize (1986) accepted *Austrofestuca* but found that the characters used to delimit it required the inclusion of three more Australasian species.

Alexeev (1985) established the new genera *Festucella* and *Hookerochloa* for two of these species, *Festuca eriopoda* and *F. hookeriana* respectively. These genera were distinguished from *Austrofestuca* by: (i) *Festucella* having filiform as opposed to folded leaves, and (ii) *Hookerochloa* having awned lemmas.

The characters that have been used by the authors mentioned above to distinguish *Austrofestuca* from *Festuca* include:

- (i) lemmas keeled throughout;
- (ii) ovary glabrous;
- (iii) caryopsis with a short oval hilum (linear to oblong in *Festuca*);
- (iv) lodicules pubescent;
- (v) lowest lemma 5-11-nerved (3-5-nerved in *Festuca*), and
- (vi) callus shortly pubescent.

The first two of these characters are quite consistent in all four species although the second is easily visible only in material at an appropriate stage of development. The hilum character (iii) is useful but mature caryopses are not common on herbarium specimens. The hairiness of the lodicules is also reasonably consistent but not easy to observe; occasionally there are only a few hairs. The nervation of the lemma and the degree of pubescence of the callus are less consistent, the type species frequently having a glabrous callus. On the basis of the first four characters *Austrofestuca*, as delimited by Clayton and Renvoize (1986), should be accepted.

Festucella Alexeev is based on a leaf character that is not qualitative. The character basically is leaf width as even the diagram in Alexeev (1987) shows a trans-section of a folded leaf. The number of nerves also cited as a secondary character is likewise related to leaf width, as are the few anatomical characters mentioned. Leaf width is not an appropriate generic character and *Festucella* here is treated as a synonym of *Austrofestuca*.

Hookerochloa Alexeev is distinguished from *Austrofestuca* by the former having awned lemmas and glabrous lodicules. Awned lemmas are not a consistent character on one inflorescence in this taxon, and many plants have no awns, so it is not an appropriate generic character. Neither *F. hookeriana* (*Hookerochloa*)

nor *F. eriopoda* (*Festucella*) have glabrous lodicules; in both species they are more sparsely hairy than in *A. littoralis* or *A. triticoides* but they do have hairs. *Hookerchloa* is also treated here as a synonym of *Austrofestuca*.

The two new combinations required are:

Austrofestuca eriopoda (*J. W. Vickery*) *S. W. L. Jacobs*, **comb. nov.**

BASIONYM: *Festuca eriopoda* *J. W. Vickery* (1939: 10–11).

SYNONYM: *Festucella eriopoda* (*J. W. Vickery*) *Alexeev* (1985: 104).

Austrofestuca hookeriana (*F. Muell.*) *S. W. L. Jacobs*, **comb. nov.**

BASIONYM: *Festuca hookeriana* *F. Muell.* in *Hook. f.* (1858: 127, t. CLXV).

SYNONYMS: *Poa hookeriana* (*F. Muell.*) *F. Muell.* (1873: 131). *Schedonorus hookerianus* (*F. Muell.*) *Benth.* (1878: 656). *Hookerchloa hookeriana* (*F. Muell.*) *Alexeev* (1985: 106).

The third species occurs only in New Zealand; I am leaving the appropriate combination to authors more familiar with that species.

2. *Australopyrum*

The literature concerning the classification of the Triticoid grasses is voluminous and has been reviewed by West et al. (1988). There is still much diversity of opinion on the circumscription of genera and their relationships. The endemic Australian species formerly included in *Agropyron* have been treated by Löve (1984) who included them in his genus *Australopyrum*, and Clayton and Renvoize (1986) who maintained them in *Agropyron*. Löve excludes from *Australopyrum*, *Elymus scaber* which occurs also outside Australia and which was formerly included in *Agropyron*.

The genomic data (Löve 1984) and the shortly pedicellate spikelets of our native species indicate that they are best excluded from the now restricted *Agropyron* (Barkworth and Dewey 1985). Löve made new combinations for our taxa but, without explanation, he reduced *Agropyron velutinum* Nees (1840) to a subspecies of *Australopyrum retrofractum* (*J. W. Vickery*) *A. Löve* (*Agropyron retrofractum* *J. W. Vickery*, 1950). *A. retrofractum* is more closely related to *A. pectinatum* than to *A. velutinum*. Simon (1986) made the combination *Australopyrum velutinum* (Nees) *B. Simon* and also treated *A. retrofractum* as a synonym of *A. pectinatum*. Wheeler et al. (1982) recognised the three species as distinct and plan to do so again in the new edition.

There is, however, still one problem remaining in using the name *A. retrofractum*. When forming the combination *Australopyrum retrofractum* (*J. W. Vickery*) *A. Löve*, Löve united two species and failed to use the earlier epithet *Agropyron velutinum* Nees. The combination for *Australopyrum retrofractum* at specific rank as made by Löve (1984) is incorrect but the basionym is legitimate and, in accordance with article 63.3 of the Code, Löve's combination can be used if *Australopyrum velutinum* is treated as a separate species.

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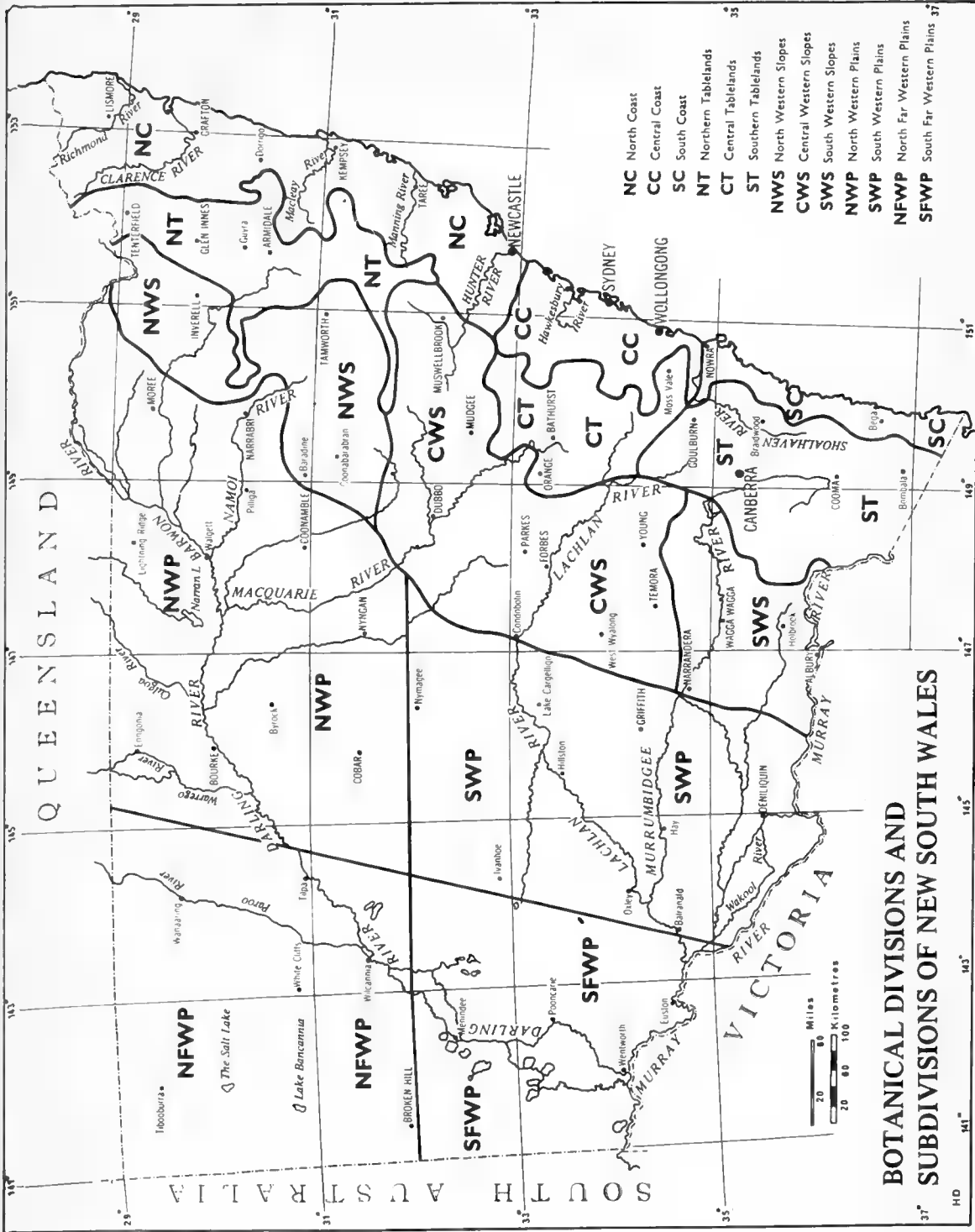
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For explanation and description of the Botanical Divisions and Subdivisions of New South Wales see R.H. Anderson (1961) Introduction. *Contr. New South Wales Natl Herb., Flora New South Wales* Nos. 1-18: 1-15.



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