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# A revision of the Australian species of *Hybanthus* Jacquin (Violaceae)

By Eleanor M. Bennett

## Abstract

A taxonomic treatment is presented of the Australian species of *Hybanthus*. The history of the genus and the morphology and anatomy are discussed. The Australian species all belong to the subgenus *Ionidium* Schulze, two being in the Section *Suffruticosi* Schulze and the other nine in the new Section *Variabiles* proposed here. The following new taxa and new combinations are proposed: *H. enneaspermus* (L.) F. Muell. subsp. *stellarioides* (Domin) stat. nov., *H. floribundus* (Lindl.) F. Muell. subsp. *adpressus* subsp. nov., *H. floribundus* subsp. *curvifolius* subsp. nov., *H. volubilis* sp. nov. and *H. vernonii* (F. Muell.) F. Muell. subsp. *scaber* subsp. nov.

Chromosome counts are given for 8 of the 11 Australian species and the cytology is discussed. Distribution maps for all taxa are given.

## Introduction

The name *Hybanthus* was published by Jacquin in 1760. It was based on the single species *H. havanensis*, which is therefore the type. St. Hilaire (1824, n.v.), united *Hybanthus* with *Ionidium* Vent. (1803), as the latter name was in current use and a renaming under *Hybanthus* would have caused too much confusion. In 1876 Mueller transferred the then accepted Australian *Ionidium* species to *Hybanthus*.

At the Vienna Congress in 1905 the name *Hybanthus* Jacq. (1760) was conserved against its earlier synonym *Calceolaria* Loeffl. (1758). This conservation was later considered to be unnecessary as it was thought that the latter name was invalid being unaccompanied by a description, but Dandy (1969) pointed out that a generic description was provided. Therefore *Calceolaria* Loeffl. must remain on the list of nomina rejicienda.

According to Airy Shaw (1966) there are 150 species of *Hybanthus* in North America, South America, Australia, Malaysia, South Africa and Asia. Eleven species occur in the mainland states of Australia, none being recorded in Tasmania.

## Morphology of the Australian species

### Habit

All the Australian species of *Hybanthus* develop secondary thickening, most being shrubs ranging from a height of 50 cm in the bushlets of *H. epacroides* to 2 m in the inland form of *H. floribundus*. One species, *H. epacroides*, develops spinescent branches. The American species *H. havanensis* also develops these spines, a feature comparatively rare in the Violaceae.

*Hybanthus calycinus*, *H. debilissimus*, *H. volubilis* and *H. monopetalus* are perennial herbs developing aerial growth from an underground rhizome. With age the rhizome and base of the stems develop a white pithy bark. This bark also develops on the stems of *H. aurantiacus* where it becomes noticeably fissured with age.

### Leaves

The leaves of most species are alternate, but *H. monopetalus* has opposite leaves at the upper nodes in addition to the alternate leaves of the lower nodes. *H. bilobus* and *H. epacroides* have leaves clustered at the nodes.

Typically the margins are entire, exceptions being the denticulate margins in *H. aurantiacus* and crenate margins in some plants of *H. enneaspermus* subsp. *stellarioides*. The teeth and leaf apices are all tipped with a deciduous ovoid gland.

A pair of stipules is generally found at the base of each leaf. These may persist but are usually deciduous. One species, *H. debilissimus*, has no stipules.

#### *Inflorescence*

This is one of the most variable structures within the Australian species of *Hybanthus*. Some species have solitary flowers, others have cymes or racemes.

Schulze (1936) believed that the single axillary flowers of *Hybanthus* species arose through the gradual reduction of an axillary cymose inflorescence. This is the view commonly accepted and is illustrated by Lawrence (1951) and Rickett (1944, 1955).

In the Australian species the inflorescence types range from single flowers in the axils of leaves through cymes to racemes. Generally the inflorescence is axillary but occasionally it may be terminal. *H. cymulosus* has present on the same plant dichasial inflorescences as well as various modifications but the flowers are never solitary. *H. floribundus* shows variation from a dichasium to a solitary flower. In several plants the first division is dichasial, but in many of the subsequent bracts only one of the pair will develop a flower, the other bract containing an undeveloped bud. If further growth is monochasial (racemose) a short cincinnus is produced.

#### *Peduncle and Pedicel*

The peduncle of a solitary flower is in this paper considered to be the length of the flowering stalk occurring below the pair of bracts, and the pedicel is the portion above the bracts. These vary in relation to each other in length and pubescence.

The modified leaves on the flowering stalk are therefore correctly called bracts as they terminate the peduncle. They occur in pairs but one of the pair is situated slightly higher than the other. The flower buds are in the axils of the bracts.

#### *Anterior Petal*

This petal in the Australian species is distinctly spurred and is much larger than the lateral petals.

The lamina is typically suborbicular varying from ovate to reniform, and is generally blue-violet, except in *H. aurantiacus* and *H. enneaspermus* subsp. *stellarioides* which have yellow flowers. Veining of a darker colouration is present in the blue-violet flowering species.

The petal is distinctly clawed and the claw may be equal to or less than the length of the lateral petals. Generally the claw is white with pale blue or yellow areas. Two parallel raised ridges extend the length of the claw and into the proximal part of the lamina.

Between the ridges are varying amounts of white pubescence which may extend into the spur. The presence of the ridges and pubescence probably helps to prevent the loss of the secretion from the nectaries which are at the base of the anterior anthers.

#### *Lateral Petals*

There are two pairs of differently shaped petals of approximately equal length. The two outer petals are usually 1-nerved and narrower than the two inner petals which may be 3-nerved as in *H. vernonii* or 5-nerved as in *H. calycinus*.

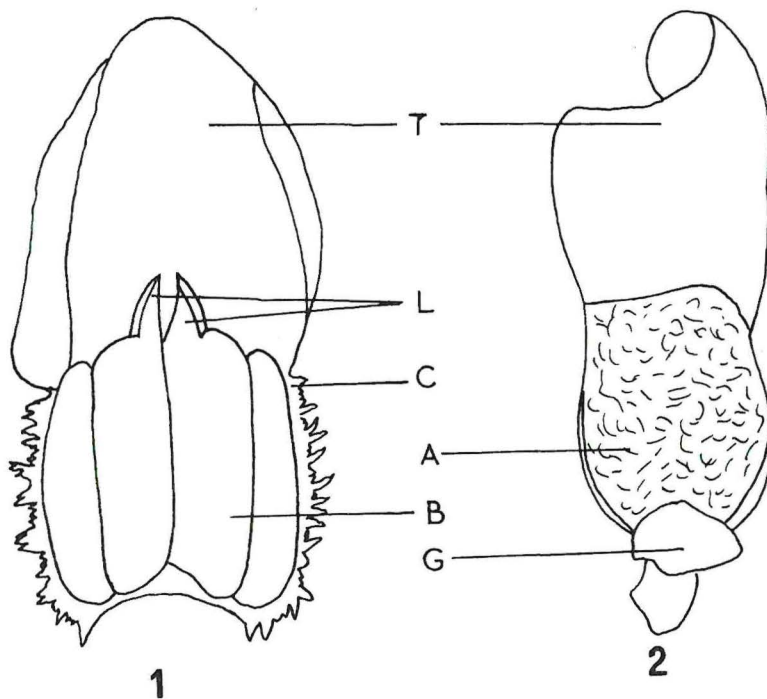


Figure 1—Anther structure (diagrammatic). 1—Under surface of posterior anther. 2—Upper surface of anterior anther. T = terminal connective appendage; L = loculi appendages; C = connecting tissue; B = bilocular anther; A = anther surface which may be glabrous or have varying degrees of pubescence; G = basal gland.

The petals of the outer pair are typically narrow-oblong and entire. The petals of the inner pair show numerous variations in shape between the species, but typically they are up to 0.5 mm longer than the outer petals.

#### *Androecium*

All five stamens are free with the edges of the anthers apparently united by connecting tissue. All have conspicuous terminal connective appendages (Figure 1) which are imbricate making the anthers appear to be connate into a tube. In all species the stamens are shorter than or equal to the lateral petals.

In all species the anterior pair of stamens bear at the base spur appendages which are nectaries. These nectaries may be sessile and glabrous as in *H. monopetalus*, glabrous and stalked as in some forms of *H. enneaspermus*, stalked with a tuft of hairs at the tip as in other forms of *H. enneaspermus*, or densely pubescent as in *H. aurantiacus*.

Apical loculi appendages (Figure 1) are found in some species or in some forms within a species. These appendages are narrow-triangular and always less than 0.5 mm long.

#### *Gynoecium*

The ovary, composed of three carpels, is regular and unilocular. It is distinctly 3-angled and in young fruit appears to be 3-keeled. In all species the ovary is ovoid-globose and glabrous. The style is two to three times as long as the ovary, beak shaped, and orientated towards the front of the flower.

### Capsule

The capsule is thick-walled, coriaceous and distinctly 3-sided. It dehisces by splitting elastically from the apex into the three carpel constituents, the seeds being shot out. Some capsules of *H. calycinus* when left in the laboratory catapulted seeds up to a distance of one metre.

### Seeds

The seeds of most species are ovoid-ellipsoidal and dark brown, ranging in size from 1.5 mm in *H. debilissimums* to 5 mm in *H. calycinus*. However, the seeds of *H. enneaspermus* and *H. aurantiacus* are elongate-ellipsoidal and yellowish in colour.

When soaked in water the seeds of *H. enneaspermus* and *H. aurantiacus* exude a mucilaginous substance. This was not seen when seeds of the other species were immersed in water.

The seeds of all species develop a thick, white, fleshy arillus, which, according to Raju (1958), originates as a small lump on the raphe as a result of divisions in the epidermal and hypodermal layers.

Following the definitions given by Martin (1946) the embryos of *H. enneaspermus* and *H. aurantiacus* are regarded as being spatulate whereas the embryos of the other species are linear. Martin found that in *Viola eriocarpa* and *Hybanthus concolor* the embryos were also spatulate. In *H. enneaspermus* and *H. aurantiacus* the embryo represents approximately half unit volumetric proportion of embryo to endosperm, whereas in the other species the embryo represents approximately one quarter unit.

### Chromosome numbers (Table 1)

Chromosome counts have been made of 8 of the 10 Australian *Hybanthus* species including 7 of the 10 subspecies recognised. Most counts were obtained from pollen-mother cells which were fixed in acetic alcohol, stored in absolute alcohol and stained in acetic orcein. A few counts were obtained from root and shoot tip material, this previously having been treated with 0.1 per cent colchicine and macerated in HCl-alcohol before staining in acetic orcein.

The chromosomes at metaphase I in *Hybanthus monopetalus* are much larger than in any other species, but no mitotic material was available. Generally the mitotic material examined was unsatisfactory for karyotype analysis, for the chromosomes are so small that differences in appearance or size cannot be detected.

The chromosome numbers found are  $n=4, 6, 8, 12, 24$ . The base numbers of  $x=4$  and  $x=6$  must be accepted for the genus. Four species have the base number  $x=4$ . Two of these, *H. enneaspermus* and *H. aurantiacus*, are included in the section *Suffruticosi* and the other two, *H. monopetalus* and *H. volubilis*, are in the section *Variabiles*, this separation being based on morphological and anatomical features.

*Hybanthus floribundus* has a wide range of haploid numbers ( $n=6, 12, 24$ ). The plants with  $n = 24$  occur as a small population in which only about 6 plants were found. They cannot be distinguished morphologically from  $n = 12$  plants collected from other localities. Development and settlement in the area has probably affected distribution and this polyploidy may well be a result of isolation. No work was carried out to see if the plants in this population are apomitic or inbreeding.

Although chromosome numbers of  $n = 6$  and  $n = 12$  occur in plants of *H. calycinus*, there appear to be no morphological distinctions between the cytotypes.

**TABLE 1**  
Chromosome number of *Hybanthus* species.

Species	Locality	n	2n	Collection Number
<i>Subgenus Ionidium</i>				
<i>Section Suffruticosi</i>				
<i>H. enneaspermus</i> ....	King River ....	8		EMS 1731
subsp. <i>enneaspermus</i> ....	Darwin ....	8		NB 595
	Broome ....		16	L 6001
<i>H. aurantiacus</i> ....	Durack River ....	8		EMS 1822
	Broome ....		16	EMS 1925
	Walter James Range ....	8		ASG 8887
<i>Section Variabiles</i>				
<i>Group I</i>				
<i>H. floribundus</i> ....	Parkerville ....	24		EMB 2207 (x2), 2801
subsp. <i>floribundus</i> ....	Brookton Highway ....	12	24	EMS 532
	W. of Merredin ....	12		EMB 2141 (x3)
	S. of Salmon Gums ....	12		EMB 2156 (x3)
	*Ravensthorpe ....	12	24	EMB 2190
	S. of Pingrup ....	12		EMB 2199 (x2)
	Kalgarin ....	12		EMB 2201
	E. of Kondinin ....	12		EMB 2202 (x2)
	W. of Kondinin ....	12		EMB 2203
	E. of Corrigin ....	12		EMB 2204
	Geraldton ....	12		EMB 2241 (x5)
	Perenjori-Paynes Find	12		EMB 2243 (x4)
	Warriedar Station ....	12		EMB 2245
	Dongara ....	12		EMB 2216
	Kalbarri ....	12		PGW 6725
	E. of Southern Cross	6	12	EMB 2151, 2803
<i>H. floribundus</i> ....	Norseman ....	6	12	EMB 2152 (x3)
subsp. <i>curvifolius</i> ....	Balladonia ....	6		PGW 7738
	S. of Coolgardie ....		12	EMB 2804 (x2)
<i>H. floribundus</i> ....	E. of Ravensthorpe ....	6		EMB 2181 (x2)
subsp. <i>adpressus</i> ....	Ravensthorpe ....	6	12	EMB 2187 (x5), 2455, 2541
	Ravensthorpe ....		12	RAS 512
	Hopetoun Road ....	6		EMB 2195 (x2)
	S. of Ravensthorpe ....	6		EMB 2189
<i>H. cymulosus</i> ....	Mt. Singleton ....	6		EMB 2246-2249
<i>Group II</i>				
<i>H. monopetalus</i> ....	Culoul Range ....	4		NSW 99494
	Ocean Beach ....	4		NSW 112261
<i>H. calycinus</i> ....	Wyadup ....	12		EMS 1640
	Busselton ....	12		EMB 2266
	Cape Naturaliste ....	12	24	EMB 2269
	S. of Mandurah ....	12	24	EMB 2254-2257
	Naval Base ....	12		ASG 9190
	Manning ....	12		EMB 2253 (x2)
	South Perth ....	12	24	OAB
	Yallingup ....	12		EMS 1642, 1645
	Gnangara ....	12		EMS 538
	Yanchep ....	12		EMS 510, 551, 523, 525
	Lancelin ....	12		EMS 1332
	Moore River ....	12		TEHA 3068
	Hill River ....	12		TEHA 3069
	Dongara ....	12		EMB 2214 (x2), 2215 (x2)
	Dongara ....	12	24	TEHA s.n.
	N. of Northampton ....	6		ASG 9182
	NW Coastal Highway	6		EMB 2233 (x4)
	N. of Northampton ....	6		EMB 2236 (x4)

Species	Locality	n	2n	Collection
Group III				
<i>H. volubilis</i> ....	Osmington ....		8	EMB 2815
<i>H. epacroides</i> ....	W. of Merredin .... S. of Salmon Gums ....	12 12		EMB 2139 (x3), 2140 EMB 2166
<i>H. bilobus</i> ....	N. of Esperance .... Salmon Gums .... E. of Esperance ....	12 12 24		EMB 2167 (x3) EMB 2168 PGW 8076

*Extra-Australian Numbers*

Species	Number		Country	Researcher	Source of Reference
	n	2n			
Subgenus <i>Ionidium</i> Section <i>Suffruticosi</i> <i>H. parviflorus</i> ....	12	24	South America	Heilborn ....	Darlington and Wyle (1955)
<i>H. enneaspermus</i> ....		32	Tropical Africa	Mangenot, S. & G. Mangenot	Ornduff (1967)

\* Large white-flowered plant growing among n = 6 plants of subsp. *adpressus*.

The count of 2n=32 for the tropical collection of *Hybanthus enneaspermus* indicates that it is a tetraploid if compared with the Australian forms of the species. A count of 2n=24 has been obtained for the South American species *Hybanthus parviflorus* (Darlington and Wylie 1955). This agrees with the base number x=6 obtained for some of the Australian species.

*Pollen*

The tetrads of *Hybanthus calycinus*, *H. floribundus*, *H. cymulosus*, *H. epacroides*, *H. enneaspermus* subsp. *enneaspermus* and *H. monopetalus* are decussate or tetrahedral. All cells have four developing pollen grains, but many also contain one or two microcytes.

The pollen fertility shows no correlation with chromosome number. *Hybanthus calycinus* and *H. floribundus*, irrespective of whether n=6, 12 or 24, record fertility of up to 95 per cent, whereas other species record a high sterility.

In *H. calycinus* and *H. floribundus* the pollen of n=12 plants is significantly larger than the pollen of n=6 plants, but the n=24 plants have pollen well within the size range of the n = 12 plants.

*Anatomy*

The material for anatomical work was fixed in FAA and sectioned with a hand-operated bench microtome. Several samples were also embedded in wax before cutting sections with a rotary microtome. The prepared sections were stained in safranin in 50 per cent alcohol, and in fast green in clove oil. Leaves for examination were cleared using the lactic acid technique.

*Crystals*

Calcium oxalate crystals occur in the leaves of all the Australian species.

Borodin in Solereder (1908) distinguished eight different cases (type and position) of crystals in the Violaceae. Examples of *Viola* type and Ionidium type have been found in the species examined. The northern species *Hybanthus aurantiacus* and *H. enneaspermus* have the Ionidium crystal type, consisting of clinorhombic crystals scattered along the veins of the leaves.

All the other Australian species have the *Viola*-type of crystals in which the scattered cells contained clustered crystals of druses. These crystals are scattered in the mesophyll of leaves and in the parenchyma of stem, root and rhizome.

#### Hairs

Unicellular hairs occur on some plants of most species, mainly as epidermal cells of the leaf and young stem. Multicellular hairs occur on the stem of *H. floribundus* subsp. *adpressus*. The unicellular hairs vary among species mainly in the relation of hair length to cell size.

#### Leaf Anatomy

The leaves of all species are dorsiventral and have a thin cuticle. The epidermis is one-layered except in *H. enneaspermus* where there are layers over the midvein. The epidermal cells of this species contain mucilage. In all species stomata, mainly of the cruciferous type, occur on both the upper and lower epidermis.

In *H. enneaspermus* and *H. aurantiacus* the rectangular crystals are distributed along the veins. In all the other species the crystals are druses scattered throughout the mesophyll.

#### Stem

In all the species examined the stem structure is that of a typical dicotyledon. With age the epidermis of the stems develops a bark layer of several rows of periderm cells.

In all the Western Australian species except *H. volubilis* the parenchyma cells of the cortex have scattered included crystals. Phloem fibres are developed in all species. These are not conspicuous in young stems but in the older stems they develop as a band several layers thick. *H. volubilis* in cross section appears to have a triangular stem with a bundle of fibres well developed below the angles which continue as a 1-or 2-celled layer around the remainder of the stele.

In all species the central pith layer consists of parenchyma cells; some of these have included crystals which do not, however, occur in *H. volubilis*. The vessels are spirally thickened and have opposite bordered pits. In *H. epacroides* and *H. bilobus* the pits are simple. The perforation plates are simple and the intervacular pitting is opposite. The fibres are septate with simple pits in *H. epacroides* and *H. bilobus*, and with bordered pits in the other species.

#### Nectaries

Only the sessile nectaries in the *Hybanthus* species from the South-West Land Divisions were examined. Scattered stomata occur on the nectary surface, particularly towards the base. The outer cells of the nectary are smaller than the remaining secretory cells. Covering the cells is a cuticle. The remainder of the gland consists of numerous secretory cells closely packed together in a dense mass.

#### Citation of Specimens

In the citation, the districts in Western Australia are those given by Diels (1904). For most species only a few of the herbarium specimens seen have been cited. The abbreviations used for herbaria follow the Index Herbariorum pt.

1 ed. 5 (1964), with the addition of GAUBA for the Department of Botany, the School of General Studies, Australian National University, Canberra, and UWA for the Department of Botany, University of Western Australia.

### HYBANTHUS

- Hybanthus* Jacq., Enum. Plant. Carib. 2:17 (1760), nom. cons. Type: *H. havanensis* Jacq.  
*Calceolaria* Loeffl., Iter Hisp. 183 (1758), nom. rej. Type: *C. calceolatia* Loeffl.  
? *Pombalia* Vand., Fasc. Pl., 7 (1771). Type: *P. ipecacuanha* (L.) Vand. ex L.  
*Solea* Spreng. in Schrader, Journ. Fur die Bot. 2:192 (1802). Type: *S. verticillata* (Orteg.) Spreng.  
*Ionidium* Vent., Jard. Malmaison t. 27 (1803). (nom. illeg., nomenclatural synonym of *Solea* Spreng.) Type: *I. polygalaefolium* Vent.  $\equiv$  *I. verticillata* (Orteg.) Roem. et Schult.  
? *Cubelium* Raf., Catalog. 13 (1824). Type: *C. concolor* (T. F. Forster) Raf.  
*Pigea* Ging. in DC., Prodr. 1:307 (1824). Type: *P. filiformis* Ging. in DC.  
*Ionia* Pers. ex Steud., Nom. Bot. ed 1, 1:433 (1821)  $\equiv$  *Ionidium*  
*Vlamingia* De Vr. in Lehmann, Pl. Preiss. 1:398 (1845). Type: *V. australasiaca* De Vr.  
? *Acentra* Phil., Sert. Mendoc. alt. 3 (1871). Type: *A serrata* Phil.  
*Clelandia* J. M. Black, Journ. and Proc. Roy. Soc. S. Austral. 56:46 (1932). Type: *C. con-vallis* J. M. Black  
? *Orthion* Standl. et Steyerl., Publ. Field Mus. Nat. Hist., Bot. Ser. 22:249 (1940). Type: *O subsessile* (Standl.) Standl. et Steyerl.

Not all the above generic names have been applied to Australian *Hybanthus* species. However, Australian species have been described or included in *Calceolaria*, *Solea*, *Ionidium*, *Pigea*, *Vlamingia* and *Clelandia*. These six genera I consider to be synonyms of *Hybanthus*, an opinion arrived at from the study of the type species or of their descriptions.

It is impossible for me to draw conclusions about the synonymy of the other genera, particularly as there is disagreement in recent literature. Melchior (1925) included the first eleven genera under *Hybanthus*. Hutchinson (1967) considered *Cubelium* to be a distinct genus, but all the other genera he regarded as synonyms of *Hybanthus*. Airy Shaw (1966) regarded *Clelandia* and *Orthion* as separate genera, but all the other genera, including *Cubelium* he regarded as synonyms of *Hybanthus*.

*Perennial herbs*, undershrubs or semi-creepers. White pithy bark developed on underground rhizome of perennial herbs and on tap roots of undershrubs. *Stems* branching at base or above, smooth or ribbed from leaf bases and stipules, glabrous to densely pubescent, developing thin or pithy bark with age. *Leaves* alternate or clustered, occasionally opposite, sessile or shortly petiolate, linear to lanceolate, glabrous or with scattered to dense pubescence of simple hairs, sometimes tomentum disappearing with age, flat to conspicuously revolute; margins entire or crenate or dentate; tip acute or obtuse. *Stipules* present or absent, terete or flat and linear to lanceolate, entire or divided, white or grey or green, all tipped with prominent usually deciduous gland. *In-florescence* axillary, cymose or racemose, or flowers solitary. Peduncle and pedicel approximately equal in length; bracts, coriaceous or hyaline, glabrous to densely pubescent or ciliate along margins, green, or grey or white. Flowers zygomorphic. Sepals 5, free, subequal, linear to ovate, blue to green, margins entire or ciliate, apex recurved or appressed to petals. *Corolla* of 5 free petals, violet to purple, or yellow to orange. Anterior petal distinctly spurred and prominently clawed between lamina and spur; claw with two parallel ridges which extend into both the spur and into the prominently veined lamina. Lateral petals of dissimilar pairs; 2 outer petals linear, prominently 1-3 nerved: 2 inner petals broader, lanceolate, ovate or falcate-oblique, prominently nerved. *Stamens* 5: filaments short; anthers free (but appearing united by apical and lateral connecting tissues), narrow ovate, erect, bilocular, introrse, dehiscing in longitudinal slits, glabrous or penicillate with long white hairs, or with scattered to dense short white pubescence, sometimes bearing orange or white subulate loculi-appendages; nectaries at base of two anterior anthers.

Ovary superior, ovoid-globose, tricarpellate, unilocular, placentation parietal, ovules 3-15; style simple, sigmoid; stigma expanded above, orientated towards front of flower. *Fruit* a thick-walled coriaceous capsule, splitting in three at dehiscence, subtended by persistent perianth. *Seeds* 1-12, globose to oblong, surface reticulate, foveate, ribbed or smooth. Embryo spatulate or linear, endosperm copious, dark brown or yellow.

TABLE 2  
Comparative features of the Sections Suffruticosi and Variabiles.

Section	<i>Suffruticosi</i>	<i>Variabiles</i>
Distribution	Northern Australia	Southern Australia
Flower colour	blue, yellow, orange	mauve to white
Seed colour	yellowish white	dark brown
Testa surface	ribbed, foveate or smooth	smooth, foveolate or reticulate
Nectaries	<i>H. enneaspermus</i> , elongated, glabrous or penicillate; <i>H. aurantiacus</i> sessile, hirsute	sessile, glabrous
Ovules	12+	6 or less
Embryo	spatulate	linear
Chromosome number	n = 8	n = 4, 6, 12, 24
Crystal shape distribution	rectangular, along veins	druses, scattered in leaf, mesophyll, root and stem parenchyma
Venation	close reticulate	open reticulate

#### *Infrageneric divisions*

Schulze (1936) divided the American species of *Hybanthus* into the two subgenera *Euhybanthus* and *Ionidium*, the former having the filaments and to a lesser extent the anthers connate into a tube whilst in the latter they are free. All the Australian species have free anthers and so are included in the subgenus *Ionidium*.

This subgenus he divided into four sections, three of which are not applicable to the Australian species but the section *Suffruticosi* includes the two northern Australian species *H. enneaspermus* and *H. aurantiacus*. Schulze recognised that a new section was required to provide for the remaining eight Australian species. This section I propose to call *Variabiles* due to the variation in the inflorescence forms found within the group. A comparison of the sections *Suffruticosi* and *Variabiles* is given in Table 2.

The *Variabiles* are characterised by the following features—

- (i) shrubs or perennial herbs.
- (ii) leaves alternate, although one species has opposite leaves in the upper part of the plant.
- (iii) base of anterior petal distinctly gibbous.
- (iv) nectaries at the base of the anterior stamens flat and sessile.
- (v) ovules 6 or less in the ovary.

The section can be further divided into three groups on the form of the inflorescence.

- Group I. Inflorescence dichasial: *H. floribundus* and *H. cymulosus*.  
 Group II. Inflorescence a raceme: *H. monopetalus*, *H. debilissimus* and *H. calycinus*.  
 Group III. Flowers solitary: *H. vernonii*, *H. volubilis*, *H. epacroides* and *H. bilobus*.

### Key to the Australian Hybanthus species

1. Flowers solitary, subtended by one pair of bracts.
  2. Inner lateral petals lanceolate falcate.
    3. Gland at base of anterior anthers elongated, glabrous or tipped with tuft of long hairs
      1. *H. enneaspermus* ✓
      2. *H. aurantiacus* \*
    3. Gland at base of anterior anthers sessile, usually densely hirsute
      8. *H. volubilis* WA
      9. *H. vernonii* ↓
  2. Inner lateral petals oblong.
    4. Anterior petal 6 mm long or longer.
      5. Plant twining
        4. *H. floribundus* ↓
      5. Plant a shrublet, never twining
        10. *H. epacroides* ↓
    4. Anterior petal 3-5 mm long.
      6. Plant glabrous or with few scattered hairs
        11. *H. bilobus* WA
      6. Plant densely hirsute.
        7. Leaves linear; sepals glabrous or sparsely pubescent
          7. *H. calycinus* \*
        7. Leaves obovate to bilobed; sepals densely hirsute along margins and veins
          6. *H. debilissimus* WA
          3. *H. cymulosus* WA
1. Flowers not solitary (or if solitary several pairs of sterile bracts present below flower).
  8. Inflorescence racemose.
    9. Inner lateral petals lanceolate-falcate
      5. *H. monopetalus* \*
    9. Inner lateral petals oblong.
      10. Stipules triangular, prominent. Racemes about 20 cm long
        7. *H. calycinus* \*
      10. Stipules absent or very small. Racemes 2-3 cm long
        4. *H. floribundus* ↓
    8. Inflorescence dichasial or branched.
      11. Stipules flat. Anterior petal 9 mm or more long
        3. *H. cymulosus* WA
      11. Stipules terete. Anterior petal less than 9 mm long
        4. *H. floribundus* ↓

Subgenus **Ionidium** G. K. Schulze, Bot Jb 67: 453 (1936). *Ionidium* Vent., Jard. Malmaison t. 27 (1803). Type: *I. polygalaefolium* Vent. (nom. illeg.) ≡ *I. verticillata* (Orteg.) Roem. et Schult.

Section **Suffruticosi** G. K. Schulze, Bot. Jb. 67: 453 (1936). Schulze described only South American species and as I have not seen any of these species I feel incompetent to choose a lectotype for the section.

#### 1. *Hybanthus enneaspermus* (L.) F. Muell., Fragm. 10:81 (1876).

*Viola enneasperma* L., Sp. Pl. 2: 937 (1753). Type from Ceylon, Hermann (holo.: BM, photo seen).

For synonymy see Tennant 1962. From a study of the photographs of the types of *Viola suffruticosa* L. and *Viola enneasperma* L., and because of the variability noticeable within the species, I have decided to follow Tennant and to regard them as being conspecific.

Perennial spindly *herb* or compact *shrub* to 60 cm tall. *Stems* glabrous or with ± scattered hairs. *Leaves* alternate, subsessile; lamina (5x1) 40x2 (90x5) mm, linear to lanceolate, margins entire to crenate, glabrous or with scattered pubescence; stipules linear to subulate, 1-7 mm long, glabrous, grey-white. *Flowers* solitary. *Sepals* lanceolate, 3-4 mm long, acute, ± prominently carinate, glabrous or with ± scattered pubescence (especially along keel), green. *Anterior petal* 8-15 mm long; lamina violet or pale yellow. *Lateral petals* of dissimilar pairs; 2 outer linear-oblong, 3-4 mm long; 2 inner lanceolate-falcate, 4.5-5.5 mm long. *Stamens*: filaments dimorphous, 3 posterior short, 2 anterior ± equal in length to anthers and bearing elongated glabrous nectaries tipped with a dense tuft of hairs; anthers oblong-elliptic, loculi appendages absent. *Capsule* 4-9 mm long; seeds 5-12, ovoid-ellipsoidal, 2-3 mm long, longitudinally ribbed, ± pitted between ribs, yellowish-white.

### Key to subspecies

1. Stipules long (up to 4 mm). Margins of leaf closely revolute, usually glabrous, but if pubescent then hairs spreading. Flower blue subsp. *enneaspermus*
1. Stipules short ( $\pm$  1 mm). Margins recurved, leaves up to 5 mm wide, hairs always antrorse. Flowers yellow subsp. *stellarioides*

#### subsp. *enneaspermus*

*Pigea banksiana* Ging. in DC., Prodr. 1:307 (1824). Type: "in Nova-Cambria austr. Viola angustifolia Banks herb. (DC. vs. in h. Banks)." (holo: BM, photo seen).

*Ionidium banksianum* (Ging. in DC.) Steud., Nomen. Bot. Ed. 2. 1:813 (1840).

*Hybanthus enneaspermus* var. *communis* f. *angustifolia* Domin, Biblioth. Bot. 89:982 (1928).

Type: Lower Victoria River, F. Mueller, May 1856 (lecto: K, photo seen).

*Hybanthus enneaspermus* var. *banksianus* (Ging.) Domin, l.c.

Flowers blue. Leaves entire or crenate, margins closely revolute occasionally flat;  $\pm$  pubescent with spreading hairs, dark green on upper surface, paler underneath. Stipules up to 4 mm long, scarious, opaque, midvein  $\pm$  prominent.

*Distribution:* This subspecies is found in the north of Western Australia, the Northern Territory, Queensland and Northern New South Wales (Figure 2). In addition it is found in Malaysia, South and East Africa, India and Ceylon. 272 collections were seen from Australia and South Africa.

*Western Australia:* Gibb River, C. A. Gardner 9991 (PERTH); Kimberley District, 1888, E. Giles (MEL); King River, October 1906, W. V. Fitzgerald (NSW); Karunjie Station, 6 Feb. 1959, J. B. Ritson (CANB).

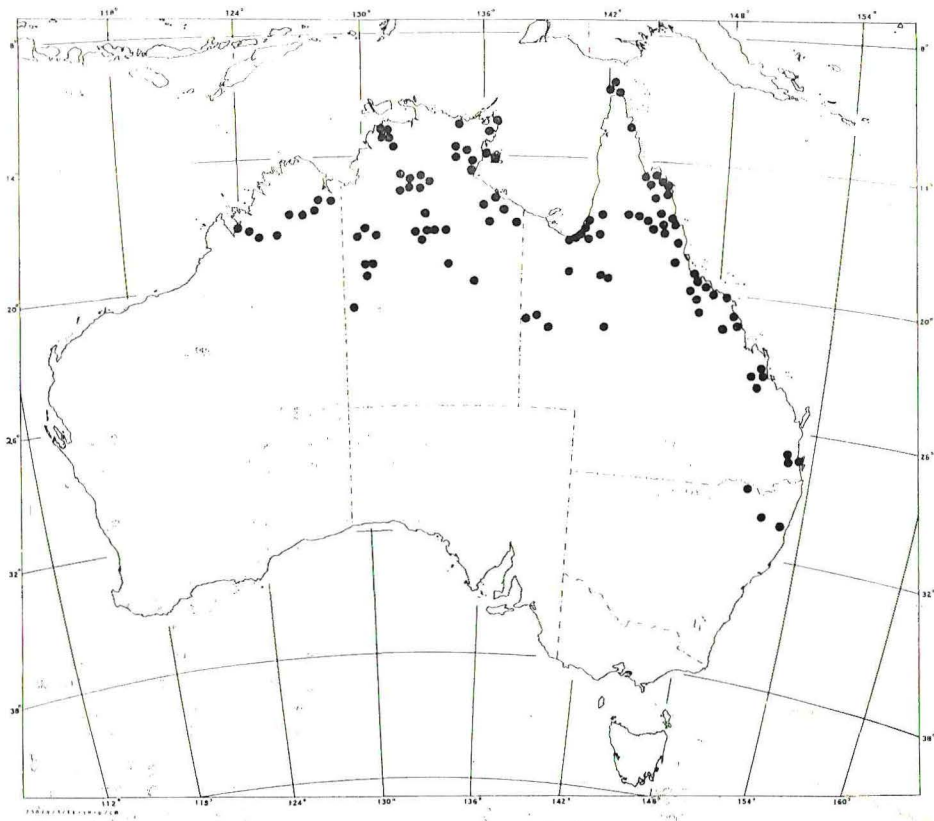


Figure 2—Distribution of *Hybanthus enneaspermus* (L.) F. Muell. subsp. *enneaspermus*.

Northern Territory: South Bay, Bickerton Island, *R. L. Specht* 519 (AD); 64.7 miles SE Top Spring Store, *G. Chippendale* 5815 (PERTH); Stoward Springs, 5 Apr. 1958, *W. McKay* (BRI); Port Darwin 1883, *Foelsch* (MEL); 14 miles SE Mountain Valley, *D. J. Nelson* 234 (NT).

Queensland: 2 miles E of Normanton Township, 5 Mar. 1954, *M. Lazarides* (NT); Cooktown, 1877, *A. W. Persietz* (MEL); between Cloncurry and Camooweal, June-December 1899, *R. C. Barton* (BRI); Townsville, August 1901, *E. Bettle* (NSW); Bloomfield, *W. L. Jones* 1564 (CANB); vicinity of Nicholson River, 1886, *Dietrich* (AD); Alva Beach, Ayr, *R. Carolin* 4620 (SYD).

New South Wales: New England near Armidale, *Bishop Twiner* (MEL).

subsp. *stellarioides* (Domin) E. M. Bennett stat. nov.

*H. enneaspermus* var. *stellarioides* Domin, Biblioth. Bot. 89:983 (1928). Type: In rupibus collis apud. opp. Yarraba, alt, cca 550 m s.m. *K. Domin* 6794, January 1910 (holo: PR).

*H. enneaspermus* var. *communis* f. *flavus* Domin, l.c. Type: "Keppel Bay, *R. Brown* Iter Australiense 1802-05 No. 4949 als *Pombalia flava*." (holo: K, photo seen).

*H. enneaspermus* var. *communis* f. *pubescens* Domin, l.c. Type: "Northumberland Islands, *R. Brown* No. 4949 als *Pombalia flava* f. *mollis*." (holo: n.v.).

Flowers yellow. Leaves entire or crenate, ± pubescent on margins, hairs antrorse, dark green on upper surface, paler beneath. Stipules short, adpressed against stem, short, scarious, opaque, margins pubescent.

*Distribution*: This subspecies is found close to the east coast of Queensland and New South Wales (Figure 3). 132 collections were seen.

Queensland: Mt. Cotton, *S. L. Everist* 1019 (BRI); Broadsound and Heads of the Isaacs, *R. Brown* 155 (MEL); Brammo Bay, Dunk Island, July 1917, *E. J. Banfield* (NSW); "The Rocks" Ayr, 13 Mar. 1952, *F. H. Kleinsmidt* (CANB).

New South Wales: Moona River, Walcha, Dec. 1884, *A. R. Crawford* (MEL); Hathead Mt. Korogora Pt., 19 Jan. 1953, *E. F. Constable* (NSW); Kew, Autumn 1917, *J. B. Cleland* (AD); Kendall, Feb. 1950, *T. M. White* (SYD).

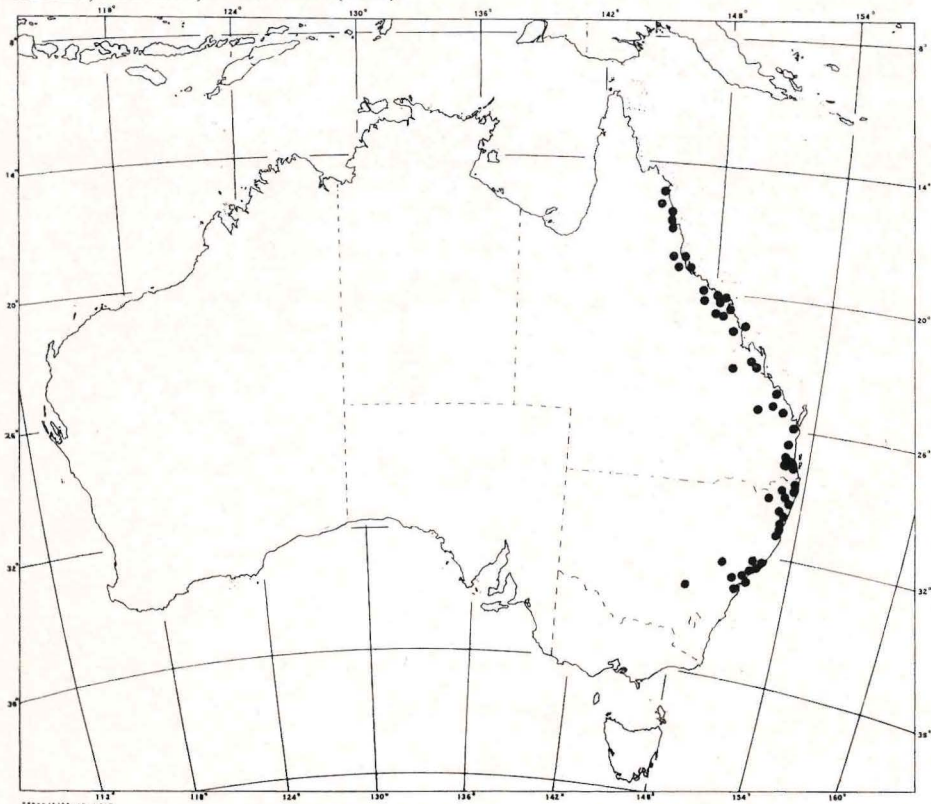


Figure 3—Distribution of *Hybanthus enneaspermus* (L.) F. Muell. subsp. *stellarioides* (Domin) stat. nov.

2. *Hybanthus aurantiacus* (F. Muell. ex Benth.) F. Muell., Pl. North West Austr.: 5 (1881)

*Ionidium aurantiacum* F. Muell. ex Benth., Fl. Austr. 1:102 (1863). *Type*: N.W. Coast of Australia, *Bynoe* (syn: K, photo seen); Victoria River (syn: K, photo seen; MEL); Cygnet Bay, N. W. Coast *A. Cunningham* (syn: BM, photo seen).

*Hybanthus enneaspermus* var. *aurantiacus* (F. Muell. ex Benth.) F. Muell., Pl. Indig. Shark Bay 6 (1883).

*Hybanthus miniatus* F. Muell. et Tate, Trans. Proc. Roy. Soc. S.A. 13:97 (1890) (nom. nud.). *Type*: Gills Creek, S.A., (n.v.). See Trans. Proc. Roy. Soc. S. Austral. 19:83 (1894).

*Hybanthus elegans* Domin, Biblioth. Bot. 89:984 (1928). *Type*: between Ashburton and Yule Rivers, W.A., *F. Clement* (holo: K, photo seen.).

Compact *shrub* to 60 cm tall. *Stems* scabrous or  $\pm$  glabrous. *Leaves* alternate or clustered at the nodes, subsessile (4x1) 35x4 (65x5) mm, linear to lanceolate, coriaceous, margin serrate-dentate occasionally entire, densely hirsute or occasionally glabrous; stipules linear to subulate, 1-30 mm long, pubescent or occasionally glabrous, green and leaf-like or yellow-white and pithy. *Flowers* solitary. *Sepals* lanceolate, 3-6 mm long, acute  $\pm$  prominently carinate or 3-nerved, ciliate, otherwise glabrous, green. *Anterior petal* 7-15 mm long; lamina yellow to orange. *Lateral petals* of dissimilar pairs: 2 outer, linear-oblong, 3-5 mm long; 2 inner, lanceolate-falcate, 3.5-6.5 mm long. *Stamens*: filaments dimorphous: 3 posterior short, 2 anterior  $\pm$  equal in length to anthers and bearing sessile glabrous to densely pubescent nectaries; anthers oblong-elliptic, loculi appendages absent. *Capsule* 5-9 mm long; seeds 5-10, ovoid-ellipsoidal, 2-3 mm long, smooth, pitted, or longitudinally ribbed, yellowish white.

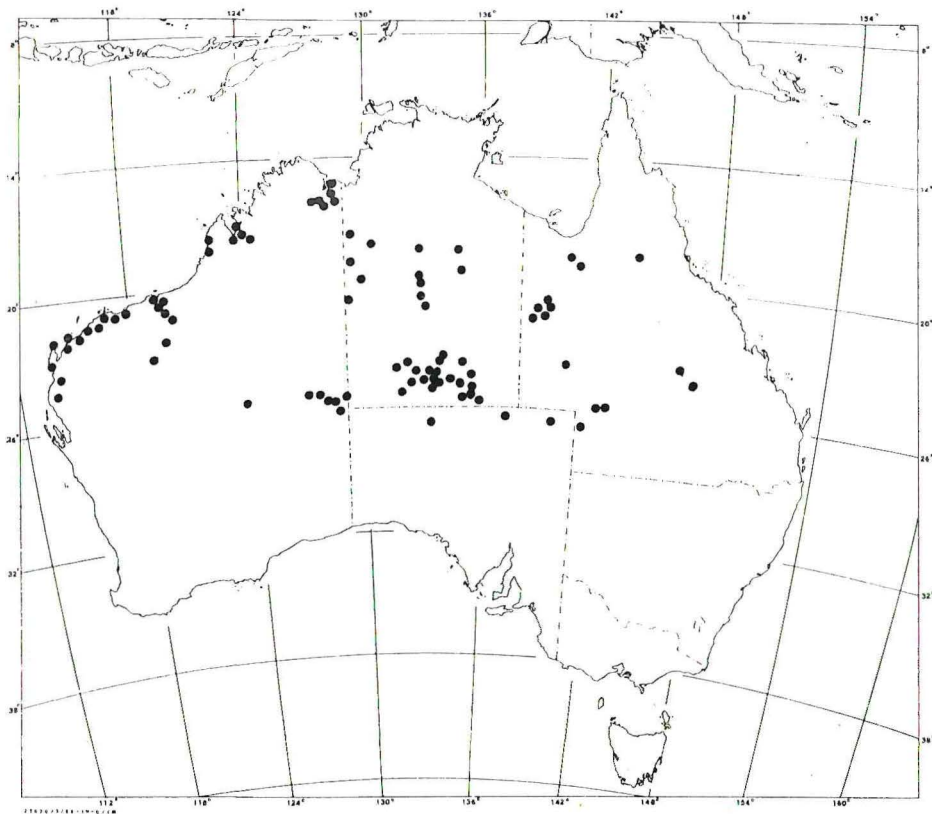


Figure 4—Distribution of *Hybanthus aurantiacus* (F. Muell. ex Benth) F. Muell.

*Distribution:* This species is found in the north of Western Australia, Northern Territory, Queensland, and far north of South Australia (Figure 4). 221 collections were seen.

*Western Australia:* Cape Range, *A. S. George* 2508 (PERTH); Fortescue River, June 1878, *J. Forrest* (MEL.); Lennard River, May 1906, *W. V. Fitzgerald* (NSW); Corong Creek, S. of Port Hedland, *N. T. Burbidge* 5838 (CAMB); Pass of the Abencerrages, *P. G. Wilson* 2437 (AD).

*Northern Territory:* 50 miles N. of Tennant Creek township, *R. A. Perry* 608 (BRI); Alice Springs, *J. R. Maconochie* 471 (PERTH); Ormiston Gorge, *G. M. Chippendale* 2116 (NT); Mt. Liebig, 23 Jul. 1966, *J. H. Willis* (MEL); 1 mile N.W. Lasseters Cave, Peterman Range, 11 Mar. 1959, *D. J. Nelson* (NSW); 9.5 miles NNW Alice Springs township, 5 May 1955, *M. Lazarides* (CANB); New Rabuntja, 1932-33, *Strehlow* (AD); Alice Springs, *Gauba* (CBG); Emily Gap, 7 Jul. 1966, *R. C. Carolin* (SYD).

*Queensland:* Lake Corella, Mary Kathleen, *H. J. Lavery* 110 (BRI); Georgina River, Sept. 1910, *E. W. Bick* (BRI); Cloncurry, Flinders River, 1876, *A. Henry* (MEL); Currawilla, *S. L. Everist* 3941 (CANB); Moongerie, 16 Jan. 1928, *R. D. Riddell* (AD).

*South Australia:* Cooper Creek, *E.N.S. Jackson* 428 (AD).

#### Section **Variabiles** E. M. Bennett sect. nov.

Flores lilacini vel albi. Glandulae in antheris anticis sessiles, glabrae. Ovarium ovulis usque ad 6; embryo linearis.

*Type:* *Hybanthus calycinus* (DC. ex Ging.) F. Muell.

Flowers mauve to white. Nectaries on anterior anthers sessile, glabrous. Ovules 6 or less per ovary; embryo linear. Seeds dark-brown, surface smooth, foveate, or reticulate. Calcium oxalate druses scattered in leaf mesophyll, and in root and stem parenchyma.

#### Group 1: Inflorescence dichasial.

### 3. *Hybanthus cymulosus* C. A. Gardn., Journ. Roy. Soc. W. Austral. 22: 125 (1936).

*Type:* Austin district, at the Northern base of Mt. Singleton, W.A., *W. E. Blackall* and *C. A. Gardner*, 9 July 1931 (holo: PERTH).

Perennial herb to 70 cm tall. Leaves alternate, sessile, narrow-lanceolate to linear, 20-50 x 1-3 mm; stipules 0.1-0.5 mm long, tripartite to lacinate, occasionally entire. Inflorescence 3-to many-flowered in axillary dichasia, 2-5 cm long. Sepals lanceolate 4-6 mm long, tip slightly recurved, ciliate on margin, mid nerve prominent, blue to green. Anterior petal 8-15 mm long, sparsely ciliate on edge, pale violet. Lateral petals of dissimilar pairs, 2-4 mm long, pale violet; 2 outer oblong, 1-nerved, 2 inner orbicular, 3-nerved. Stamens shorter than lateral petals, no loculi appendages present. Capsule 5 mm long, seeds 1-3, ovoid-ellipsoidal, ca 3 mm long, dark-brown, prominently pusticulate.

*Distribution:* Austin District of Western Australia near the townsite of Paynes Find (Figure 8). 8 collections were seen.

*Western Australia:* Ninghan, between homestead and Great Northern Highway, *A. S. George* 3713 (PERTH); 220 miles Paynes Find Road, *C. A. Gardner* 10209 (PERTH); Northern slopes of Mt. Singleton, *E. M. Scrymgeour* 2112 (PERTH); 7 miles from Great Northern Highway to Mt. Singleton, *E. M. Bennett* 2246, 2247 (PERTH).

### 4. *Hybanthus floribundus* (Lindl.) F. Muell., Fragm. 10: 81 (1876).

*Pigea floribunda* Lindl. in Mitch., Three Exped. 2:164 (1838) n.v., ed. 2, 2:165 (1839). *Type:* Mitchell's Journey, 1836, July 6 No. 223 (iso: MEL).

*Ionidium floribundum* (Lindl.) Walp., Repert. Bot. Syst. 2:767 (1843).

*Calceolaria floribunda* (Lindl.) O. Kuntze, Rev. Gen. Pl. 1:41 (1891).

*Ionidium australasiae* Behr, Linnaea 20:629 (1847). *Type:* Süd Australien Lyndock Valley in der Barossa range und in dem Pine Forest-Walde, *H. Behr*. (holo: HAL).

*Ionidium multiflorum* Turcz., Bull. Soc. Nat. Mosc. 27, Sect. 2:340 (1854). Type: Nova Hollandia. Drummond 5th Coll. No. 72 (holo: n.v.)  
*Ionidium brevilabre* Benth., Fl. Austr. 1:102 (1863). Type: West. Austr. Drummond 665 (syn: MEL); Swan River, Drummond, 1st Coll. (syn: n.v.)  
*Clelandia convallis* J. M. Black, Trans. and Proc. Roy. Soc. S. Austral. 56:47 (1932). Type: Wilpena Pound, S.A., J. B. Cleland (holo: AD).

Shrub to 1.5 m tall. Leaves alternate, sessile, linear, lanceolate or oblong, 5.35 x 0.5-7 mm, acute or obtuse  $\pm$  recurved; stipules linear 0.5-1.5 mm long, glabrous or with a few trichomes towards base. Inflorescence axillary, dichasial or racemose to 40 mm, occasionally flowers solitary. Sepals 0.75 to 4 mm long, pale blue to white or dark blue to green; 2 inner petaloid,  $\pm$  1 mm longer than 3 outer. Anterior petal 4-11 mm long, pale blue to white. Lateral petals of dissimilar pairs: 2 outer petals oblong, 1.5-3 mm long, 1-nerved, 2 inner petals broadly oblong, 2.5-4 mm long, 3 or more nerved. Anther surfaces glabrous or with scattered white hairs, loculi appendages sometimes present. Capsule to 8 mm long; seeds 1-4, ovoid-ellipsoidal, 2-3 mm long, reticulate, foveate, or smooth, dark brown.

#### Key to subspecies

1. Sepals petaloid, pale blue, apices recurved. Leaves  $\pm$  appressed upwards against stem. subsp. **adpressus**
2. Leaves narrow, conduplicate (Ravensthorpe area)
2. Leaves broad, flat, distinct pustules on surface subsp. **floribundus**
1. Sepals dark blue to green, apices appressed to petals. Leaves variously spreading.
3. Leaves conduplicate, curved (Norseman area) subsp. **curvifolius**
3. Leaves flat, not curved subsp. **floribundus**

#### subsp. **floribundus**

Leaves  $\pm$  flat, apex  $\pm$  uncinatae.

*Distribution:* This subspecies is found in the south of Western Australia, South Australia, Victoria and southern New South Wales (Figure 5). 319 collections were seen.

*Western Australia:* 12 km SW Queen Victoria Spring, D. W. Goodall 2964 (PERTH); Victoria Desert Camp, R. Helms 58 (MEL); Cundelee Mission, March 1963, M. C. George (NSW); East Yuna, A. C. Burns 97 (PERTH); ca. 20 miles east of Merredin, R. Carolin 3089 (SYD.); Yilgarn, Herb. F. Mueller (AD); Wedgicarrup W. of Wagin, N. T. Burbidge 2359 (CANB); Bannister, 31 Jul. 1950, J. McNeur (CANB); W.A., Sept 1930, E. Ashby (ADW); Waroona, July 1907, G. F. Barthoud (NSW).

*South Australia:* Port Lincoln, 1874, I. L. Browne 5 (MEL); Eyre Peninsula, 28 Aug. 1958, Gauba (GAUBA); Old Coach Road 3-4 miles W. of Stony Pinch, D. E. Symon 3819 (CANB); Wilpena Pound, July 1937, A. E. V. Richardson (ADW); near Chain of Ponds, Torrens Gorge 24 Aug. 1946, J. Vickery (NSW); Mt. Remarkable, 17 Sept. 1958, H. M. Cooper (AD); Mt. Lofty Range, J. G. V. Syme (BRI).

*Victoria:* Between Ouyen and Hopetoun, 6 Jul. 1966, C. W. E. Moore (CANB); Stawell, Apr. 1911, J. Staer (NSW); 12 miles S. of Ouyen, 8 Sept. 1961, M. E. Phillips (CBG); Warracknabeal, 10 May 1903, F. M. Reader (MEL); Bendigo, August (BRI).

*New South Wales:* Near Barellan, August 1927, G. V. Scammel (SYD, CANB); near Ardlethan, 8 Aug. 1966, L. D. Pryor (GAUBA); Nericon near Griffith, G. R. Saintly 257 (NSW).

*Queensland:* Queensland, Mather (BRI). This locality is doubtful.

Included under subsp. *floribundus* are plants which at their extremes appear to be subspecifically distinct but which are in fact connected by intermediate variants.

There is a large form at Queen Victoria Spring in Western Australia which reaches a much greater height (up to 1.5 m) than the common shrubby plants of this species. Two characters were found useful in recognising herbarium specimens of this plant, firstly the flower size and secondly the glaucous and pustular appearance of the leaf surface. However plants occurring in South Australia, particularly those growing around Wilpena Pound, have flowers which are within the lower size limits of the Queen Victoria Spring plants. Also some South Australian plants have a leaf texture and surface similar to that found in the plants collected in Western Australia, South Australia and Victoria.

Plants with oval glaucous leaves occur in various localities throughout Australia but there are several collections showing intermediates between the typical and glaucous ones. One of the glaucous plants collected near Southern Cross has a different chromosome number ( $n=6$ ) from the typical subsp. *floribundus* ( $n=12$ ).

From herbarium specimens alone it is difficult to distinguish these several different forms; further collecting and possibly cytological work will need to be carried out before any definite conclusion on their taxonomic status can be reached.

subsp. **adpressus** E. M. Bennett subsp. nov.

*Folia* ad caulem sursum  $\pm$  adpressa, angusta, conduplicata. *Sepala* petaloidea apicibus recurvis.

*Leaves*  $\pm$  appressed upwards against stem, narrow, conduplicate. *Sepals* petaloid, apices recurved.

*Type*: 5 miles south of Ravensthorpe, in heavy brown clay, W.A., 16 May, 1968. E. M. Bennett 2195 (holo: PERTH).

*Distribution*: This subspecies is found in the Eyre district of Western Australia near Ravensthorpe (Figure 5). 29 collections were seen.

*Western Australia*: South-west coast and interior of Western Australia, G. Maxwell (MEL); 1.5 miles along old road north of Ravensthorpe, F. Lullfitz 5252 (PERTH); 34 miles E. of Ravensthorpe E. M. Bennett 2189 (PERTH).

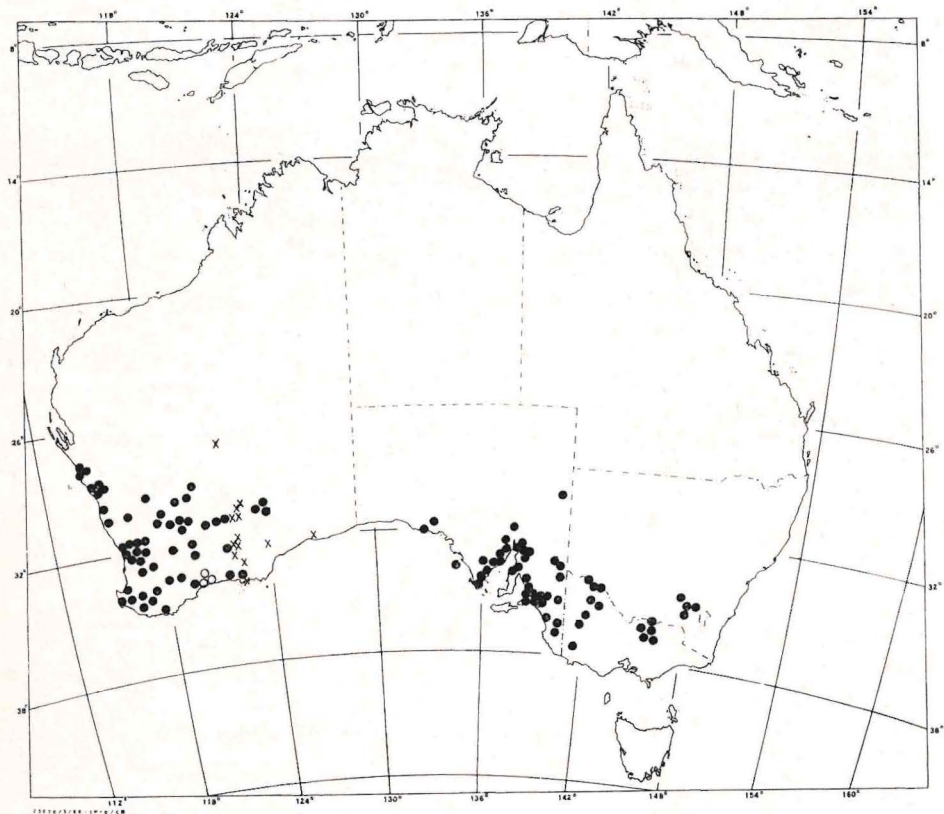


Figure 5—Distribution of *Hybanthus floribundus* (Lindl.) F. Muell. subsp. *floribundus* (●), subsp. *adpressus* E. M. Bennet (o) and subsp. *curvifolius* E. M. Bennett (x).

subsp. **curvifolius** E. M. Bennett subsp. nov.

*Folia* conduplicata, manifeste curvata, apicibus uncinatis.

Type: South edge of Lake Cowan, Norseman district, W.A., 15 May 1968. E. M. Bennett 2152. (holo: PERTH).

*Leaves* conduplicate, distinctly curved, apex uncinatae.

*Distribution*: This subspecies is found in the Coolgardie district of Western Australia between and east of the townsites of Kalgoorlie and Norseman (Figure 5). 43 collections were seen.

*Western Australia*: Comet Vale, Aug. 1917, J. L. Jutson (MEL); Coolgardie, July 1899, R. Helms (NSW); Mt. Thirsty, Norseman, J. Barnes 6079 (PERTH); Between the bank and Eyres Relief, Maxwell (MEL); 13 miles SE of Coolgardie on Coolgardie Esperance Highway, B. G. Briggs 278 (NSW); Londonderry, K. Newbey 2588 (PERTH).

Group II: Inflorescence a raceme

5. **Hybanthus monopetalus** (Roem. et Schult.) Domin, Biblioth. Botanica 89: 984 (1928).

*Ionidium monopetalum* Roem. et Schult., Syst. Veg. 5:400 (1819). Type: "Ex anglia habuit Römer in Herbario suo." (holo: probably once at LZ, if so now destroyed; ?iso: BM).

*Pigea monopetalata* (Roem. et Schult.) DC. ex Ging. in DC., Prodr. 1:307 (1824).

*Solea monopetalata* (Roem. et Schult.) Spreng., Syst. Veg. 1:804 (1825).

*Calceolaria monopetalata* (Roem. et Schult.) Britten in Banks and Solander, Illustrations of the Botany of Captain Cook's Voyage 1:7 (1900).

*Hybanthus monopetalus* var. *normalis* Domin, Biblioth. Bot. 89:985 (1928) nom. illeg.

*Hybanthus monopetalus* var. *abbreviatus* Domin, l.c. Type: Sandsteinhügel der Blue Mts. nicht selten (Domin IV. 1910); Blue Mts., C. T. White; Port Jackson (Georges Head), R. Brown 1805; R. Brown Iter Australiense 1802-05 No. 4951; Blue Mts., A. Cunningham. (syn. n.v.).

*Pigea filiformis* DC. ex Ging. in DC. Prodr. 1:307 (1824). Type: Port Jackson (holo: G-DC, photo seen).

*Ionidium filiforme* (DC. ex Ging.) F. Muell., Pl. Indig. Col. Vict. 1:66 (1862).

*Hybanthus filiformis* (DC. ex Ging.) F. Muell., Fragm. 10:81 (1876).

*Calceolaria filiformis* (DC. ex Ging.) O. Ktze., Rev. Gen. Pl. 1:41 (1891).

*Ionidium linearioides* Presl, Bot. Bemerk. 12 (1845). Type: "Habitat in Nova Hollandia ad Port Jackson, collegit Sieber." (holo: PR, n.v.).

*Hybanthus tatei* F. Muell. ex Tate. Fl. Extratrop. S.A. 19 (1890). Type: Wilpena, S.A., (holo: MEL).

*Calceolaria tatei* (F. Muell. ex Tate) O. Ktze., Rev. Gen. Pl. 1:41 (1890).

Perennial herbs to 60 cm tall. *Leaves* alternate (upper leaves  $\pm$  opposite), linear to oblong, 5-90x0.5-4 mm; stipules linear-lanceolate to triangular-deltoid, 0.25-1.5 mm long. *Inflorescence* axillary racemose, to 20 cm long. *Anterior petal* 5-21 mm long, blue. *Lateral petals* of dissimilar pairs, mauve, 2 outer lanceolate acute, 2 inner broadly lanceolate-falcate, oblique, rounded edge raised with several enlarged cells. *Anthers*: loculi appendages (if present) narrow triangular, <0.5 mm, white or orange. *Capsule* 6 mm long; seeds 3-6, reticulate to reticulate-foveolate, black.

*Distribution*: This species is found in South Australia, S.E. Victoria, New South Wales and eastern Queensland (Figure 6). 265 collections were seen.

*Queensland*: Wallangarra, W. T. Jones 2617 (CANB); Mt. Barney slopes, Macpherson Ranges, 15 Nov. 1952, E. F. Constable (NSW); Bribie Island and Pine River, Eaves (MEL); Callabah, S. L. Everist 3116 (BRI).

*New South Wales*: Clarence River, 1869, Wilroy (MEL); near Tinda Creek, Putty Road, 20 Feb. 1961, M. E. Phillips (CBG); in bushland near Bundanoon, 29 Nov. 1961, Gauba (GAUBA) Khyber Pass, east of Rylstone, H. S. McKee 936 (SYD); Wollomombi, 17 Dec., 1950, G. L. Davis (AD); 2 miles W. of Karuah, 12 Oct., 1953, L. A. S. Johnson (NSW); Blackheath Nov. 1914, A. A. Hamilton (NSW).

*Victoria*: Avon and Mitchell River, Dec. 1884, F. Mueller (MEL); Nitta Nitta, Oct. 1919, S. F. Cliton (MEL).

*South Australia*: Wundinna, 7 Apr. 1936, E. H. Ising (AD); Summit of Mt. Woodroffe, Musgrave Ranges, D. E. Symon 2663 (ADW).

Under *Ionidium monopetalum* Roemer and Schultes gave a short diagnosis and cited *Viola monopetala* as a manuscript name. The authors gave the origin of the type specimen as "Ex Anglia habuit Römer in Herbario suo." The bulk of the specimens on which Roemer and Schultes descriptions were based were housed at LZ and are now destroyed.

The name "*Viola monopetala*" which was cited in synonymy by Roemer and Schultes was used by Robert Brown both in his unpublished manuscript and in his herbarium for the same species as that described by Roemer and Schultes. It is possible that it was through Brown that Roemer and Schultes obtained the type. This means that the collection of Robert Brown's housed at the British Museum (Natural History) is a possible isotype. A photograph of a plant collected at Port Jackson, on May 11, 1802 by Robert Brown has been seen.

**6. *Hybanthus debilissimus* F. Muell., Fragm. 11:4 (1878).**

In silvis Karri-forests secus flumen Shannon, (W.A.), F. Mueller. (holo: MEL; iso: AD). *Calceolaria debilissima* (F. Muell.) O. Kuntze Rev. Gen. Pl. 1:41 (1891).

Perennial herb, procumbent or low-growing. Leaves alternate, sessile or shortly petiolate, lanceolate, 5-25x2-5 mm, stipules not present (minute?). Inflorescence of 1-3 flowers in axillary racemes, 2-3 cm long. Sepals narrow-lanceolate, 2-4 mm long, acuminate, glabrous, deep-blue edged with white. Anterior petal 5-12 mm long, blue. Lateral petals of dissimilar pairs, 2-3 mm long, mauve, 2 outer petals narrow oblong, 1-2 nerved; 2 inner petals broadly

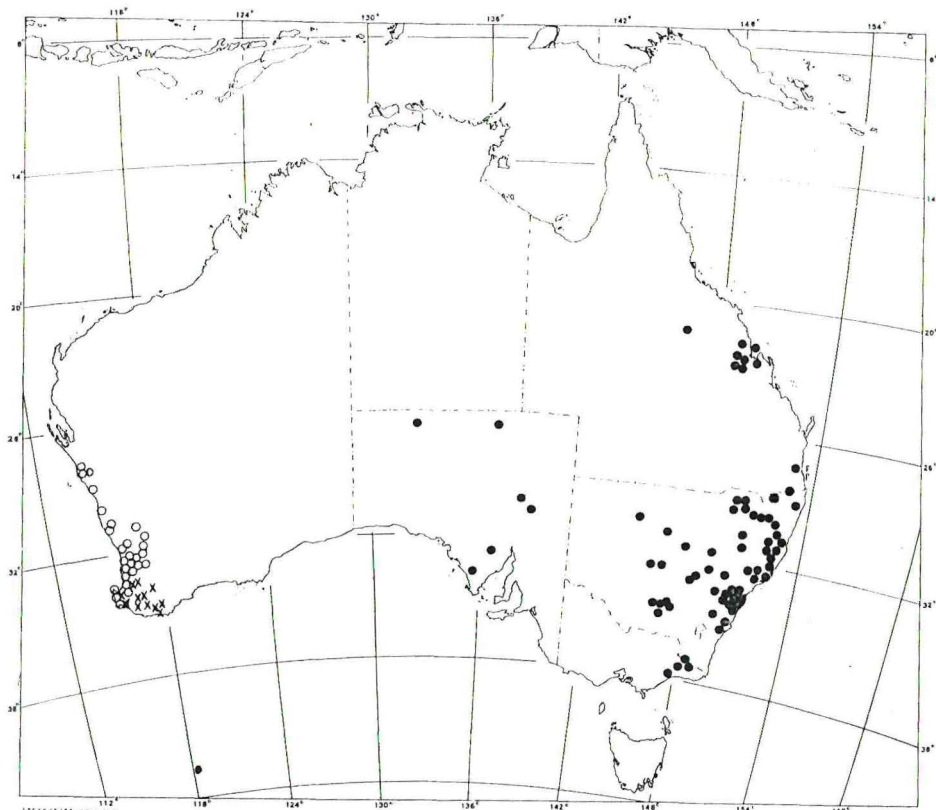


Figure 6—Distribution of *Hybanthus monopetalus* (Roem. et Schult.) Domin (●), *H. debilissimus* F. Muell. (x) and *H. calycinus* (DC. ex Ging.) F. Muell. (o).

oblong, 3-4 nerved. *Stamens*: paired loculi appendages (when present) narrow-triangular, <0.5 mm long, white or orange. *Capsule* 5 mm long; seeds ca. 6, dark brown, pusticulate.

*Distribution*: This species is found in the Warren and Darling districts of Western Australia (Figure 6). 26 collections were seen.

*Western Australia*: Stream banks on outskirts of Collie, A. R. Fairall 760 (PERTH); near Pemberton, 18 Oct. 1919, C. G. Sargent (NSW); near Mt. Lindsay, 1879, Muir (MEL); Hamden, Clarke (MEL); Margaret River, R. D. Royce 4683 (PERTH).

Mueller, in his original description, stated that there are small stipules present at the base of the leaves, but none of the herbarium specimens (including the type) shows these.

#### 7. *Hybanthus calycinus* (DC. ex Ging.) F. Muell., *Fragm.* 10:81 (1876).

*Pigea calycina* DC. ex Ging. in DC., *Prodr.* 1:307 (1824). *Type*: Nouv. Holland: Côte occidentale (holo: P, photo seen).

*Pigea glauca* Endl. in Endl. et al., *Enum. Pl. Huegel* 5 (1837). *Type*: Freemantle ad Swan-River, Hügel (holo: W).

*Solea calycina* (DC. ex Ging.) Spreng., *Syst. Veg.* 1:804 (1825).

*Vlamingia australasiaca* De Vr. in Lehm., *Pl. Preiss.* 1:399 (1845). *Type*: Herb. Preiss, No. 1449 (holo: W).

*Ionidium glaucum* (Endl.) F. Muell., *Pl. Col. Vict.* 1:67 (1862).

*Ionidium calycinum* (DC. ex Ging.) F. Muell., *Pl. Col. Vict.* 1:224 (1862).

*Calceolaria calycina* (DC. ex Ging.) O. Ktze., *Rev. Gen. Pl.* 1:41 (1891).

Perennial herb to 60 cm tall. *Leaves* alternate, sessile, linear, 2.4-5x 0.1-0.3 cm, glabrous or scabrous; stipules linear-lanceolate, 0.2-1.0 mm long, glabrous ± pubescent. *Inflorescence* a 5-to many-flowered axillary raceme, ca. 20 cm long. *Sepals* lanceolate, 3-7 mm long, prominently 3-5 nerved, glabrous or with ciliate margins, blue with white margins. *Anterior petal* 10-16 mm long, blue to purple. *Lateral petals* of dissimilar pairs, 3.5-4.5 mm long, margins recurved, ciliate, blue to purple, prominent purple veining. *Stamens* densely pilose, purple; paired loculi appendages narrow-triangular, <0.5 mm long, orange. *Capsule* 6 mm long; seeds 3-6, ovoid to ellipsoidal, 2-5 mm long, black, prominently reticulate.

*Distribution*: This species is found in the coastal regions of the Irwin, Darling, and Warren districts of Western Australia (Figure 6). 123 collections were seen.

*Western Australia*: 45 miles NE. Perth, F. W. Went 65 (PERTH); Moresby Range, Howatharra, A. C. Burns 3 (PERTH); 43 miles N. of Geraldton A. S. George 9182 (PERTH); Cape Naturaliste, E. M. Bennett 2269 (PERTH); Ogilvie, N. T. Burbidge 2142 (CANB); Leederville, 1 Aug. 1897, R. Helms (BRI); King's Park Perth, Dec. 1910, J. Sheath (NSW); Between Champion Bay and Port Gregory, Oct. 1877, F. Mueller (MEL); 18 miles N. of Bunbury, 21 Oct. 1962, M. E. Phillips (CBG).

#### Group III: Flowers solitary

#### 8. *Hybanthus volubilis* E. M. Bennett sp. nov. (Figure 7).

*Herba* perennis volubilis. *Folia* alterna, sessilia, vel linearia vel lanceolata, herbacea; stipulae lineares. *Flores* axillares, solitarii, violacei. *Sepala* lineari-lanceolata, acuta, recurvata. *Petalum* anticum manifeste calcaratum, album venis atrovioleaceis, petala lateralia oblonga. *Loculi antherarum* appendicibus anguste-triangularibus. *Ovarium* ovoideum vel globosum, glabrum, ovulis 6.

Twining perennial herb. *Leaves* alternate, sessile, linear-lanceolate, 10-18x2-4 mm, occasionally basal leaves 16-20x5-6 mm chartaceous, glabrous; stipules linear, glabrous, 0.25 mm long. *Flowers* axillary, solitary. *Sepals* lanceolate to linear, acute, 2-2.5 mm long, recurved, green to purple. *Anterior petal* 6-8 mm long, lamina white with mauve veining. *Lateral petals* oblong, apices truncate, recurved, 1.5-2.5 mm long, blue-mauve with darker veining.

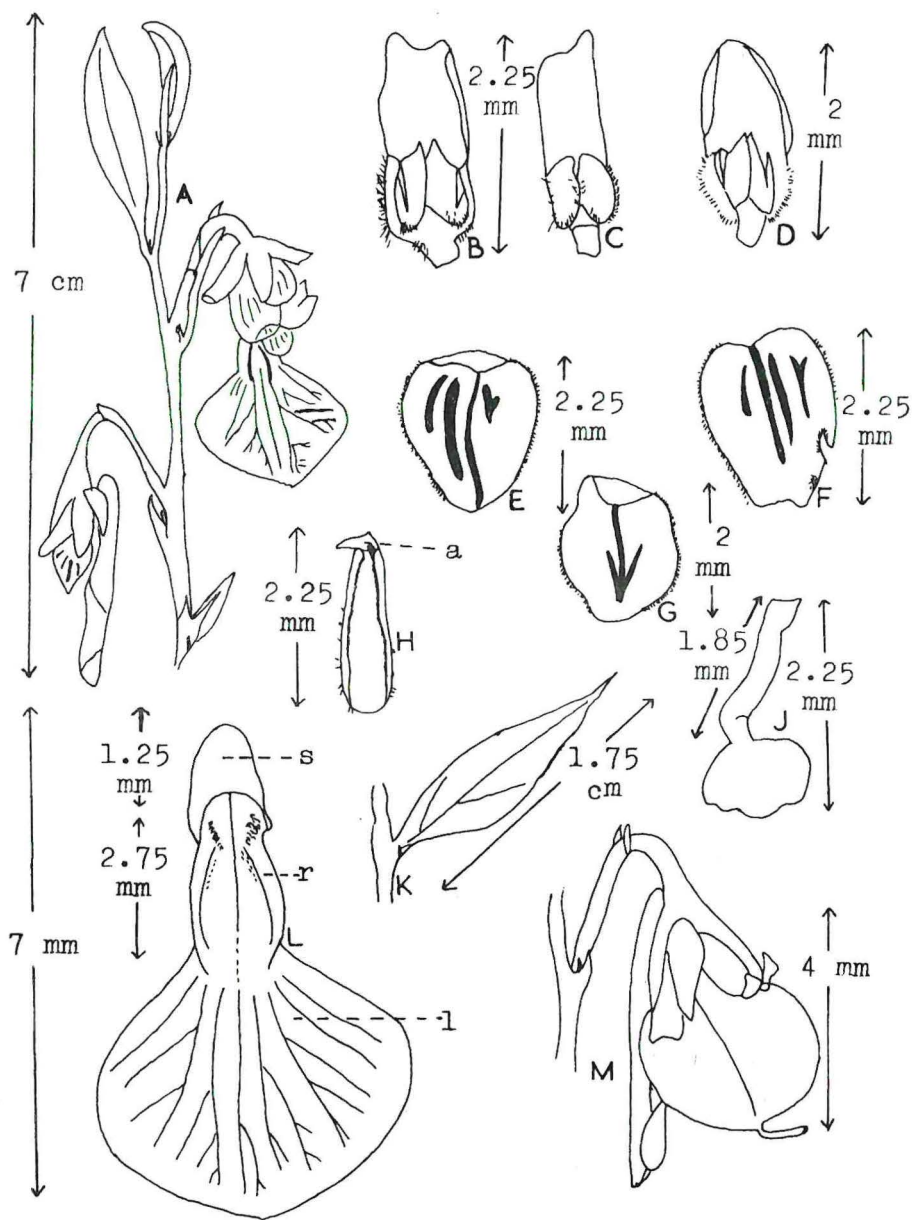


Figure 7—*Hybanthus volubilis* sp. nov. A—Inflorescence. B—Posterior surface of anterior anther. C—Anterior surface of anterior anther. D—Posterior anther. E—Posterior surface of inner petal. F—Anterior surface of inner petal. G—Outer petal. H—Sepal, J—Ovary. K—Leaf. L—Anterior petal. M—Capsule. a = apex recurved; s = spur; r = raised ridges; l = anterior petal, white with mauve markings.

*Anthers* green-yellow; loculi appendages narrow-triangular, 0.25-0.5 mm long, orange-yellow. *Ovary* ovoid to globose, glabrous, ovules 6. *Capsule* 5 mm long; seeds 1-6 per capsule, ovoid-ellipsoidal, ca. 2.5 mm long, smooth, mottled pale and dark brown.

*Type*: 8 miles E. of Margaret River townsite on banks of Margaret River, W.A., 17 Nov. 1968, E. M. Bennett 2815 (holo: PERTH).

*Distribution*: This species is found in the Warren district of Western Australia near the townsite of Margaret River (Figure 8).

*Western Australia*: Rosa Brook, R. D. Royce 2803 (PERTH); on banks of Margaret River, Osmington, R. D. Royce 2464 (PERTH); Osmington, Margaret River district, R. D. Royce 4621 (PERTH).

### 9. *Hybanthus vernonii* (F. Muell.) F. Muell., Fragm. 10:81 (1876).

*Ionidium vernonii* F. Muell., Pl. Indig. Col. Vict. 1:223 (1862). *Type*: Twofold Bay, N.S.W., F. Mueller (syn: MEL, K, photo); Genoa River, Vic., Sept. 1860, F. Mueller (syn.: BM, photo seen).

*Calceolaria vernonii* (F. Muell.) O. Kuntze, Rev. Gen. Pl. 1:41 (1891).

*Hybanthus enneaspermus* (L.) F. Muell. var *vernonii* (F. Muell.) Domin, Biblioth. Bot. 89:982 (1928).

Perennial herb or shrub to 90 cm tall. *Leaves* alternate, sessile, basal leaves usually lanceolate, upper leaves linear 5.45x1.4 mm, stipules ca. 0.5 mm long, linear. *Flowers* solitary in axils of upper leaves. *Sepals* lanceolate, 1.5 to 5 mm long, glabrous or outer surface scabrous, green to dark blue, margins

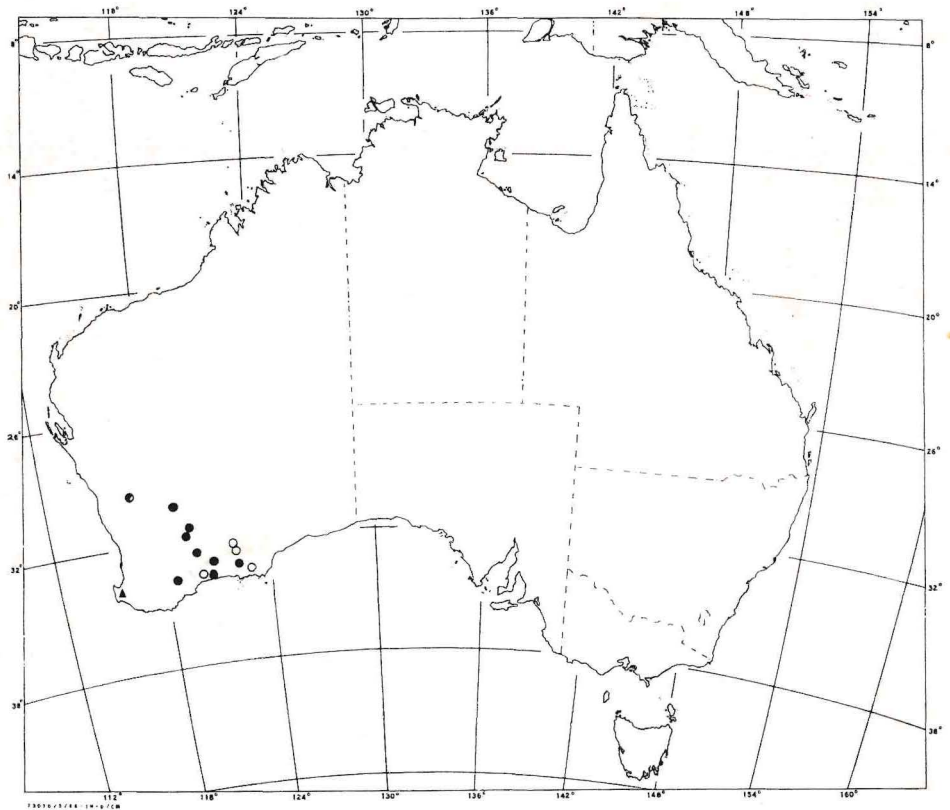


Figure 8—Distribution of *Hybanthus cymulosus* C. A. Gardn. (◐), *H. volubilis* sp. nov. (▲), *H. epacroides* (C. A. Gardn.) Melch. (●) and *H. bilobus* C. A. Gardn. (○).

± white. *Anterior petal* 6-13 mm long, blue to mauve. *Lateral petals* of dissimilar pairs, 1.5-3 mm long, blue to mauve, 2 outer petals narrow-oblong, 1-nerved, 2 inner petals broadly oblong, several nerved. *Stamens*: anterior anthers densely pubescent on surface, posterior 3 ± shortly pubescent; loculi appendages white, narrow-triangular, <0.5 mm long. *Capsule* 6-8 mm long; seeds 3-6, ovoid-ellipsoidal, ca. 2.5 mm long, brown, smooth to lineolate.

#### Key to subspecies

Leaves and stems glabrous. Upper leaves linear, lower usually lanceolate subsp. **vernonii**  
 Leaves and stems scabrous. Leaves lanceolate, oblanceolate or tricuspidate subsp. **scaber**

#### subsp. **vernonii**

Leaves and stems glabrous. Lower leaves much broader than upper leaves, linear to lanceolate, 5-45x1-4 mm.

*Distribution*: This subspecies is found along the Central and South coast of southern New South Wales and Eastern Victoria (Figure 9). 57 collections were seen.

*New South Wales*: Kiola State Forest, South Coast, 26 Oct. 1966, *M. Evans* (CANB); Jervis Bay, 28 Sept. 1961, *Gauba* (GAUBA); National Park N.E. Sector, 16 Aug. 1927, *O. D. Evans* (SYD); Middle Harbour Sydney, Sept. 1909, *J. B. Cleland* (AD); Green Cape Track, 8 Oct. 1961, *M. E. Phillips* (CBG); Port Jackson, *W. Vernon* (MEL); Gynea, *R. H. Goode* 456 (NSW). *Victoria* Gippsland, Point Ricardo, *L. B. Muir* 3783 (MEL); near mouth of Snowy River, *E. Pescott* 14 (MEL).

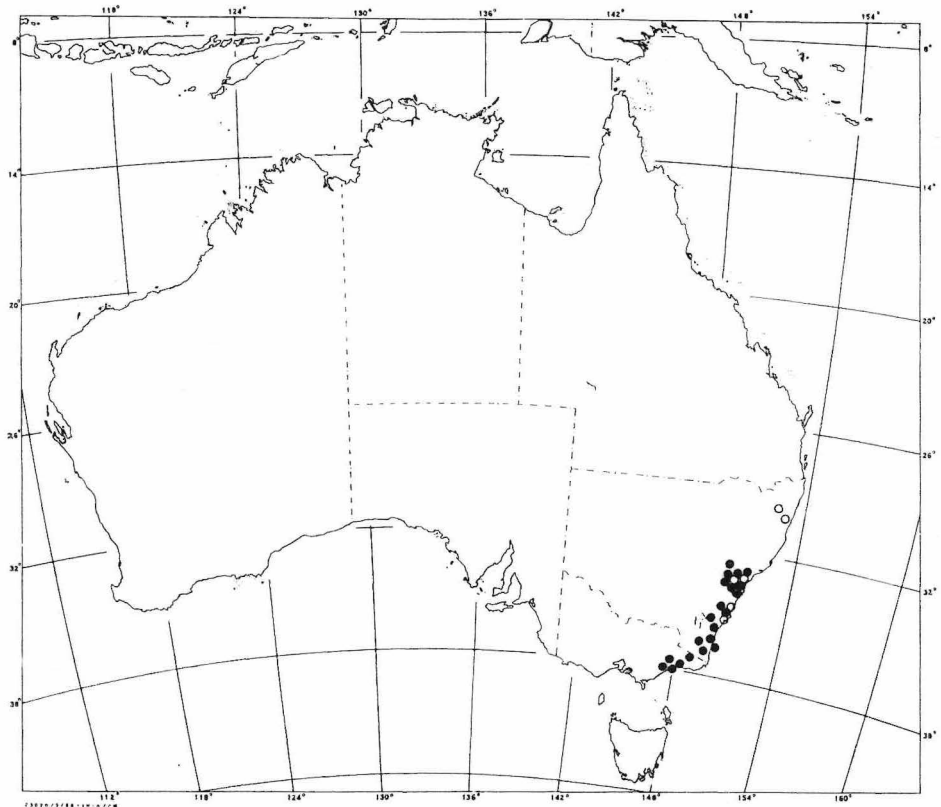


Figure 9—Distribution of *Hybanthus vernonii* (F. Muell.) F. Muell. subsp. *vernonii* (●) and subsp. *scaber* (○).

subsp. **scaber** E. M. Bennett subsp. nov.

*Caules* costis scabris. *Folia* 5-15x1.5-2.5 mm, vel lanceolata vel oblanceolata vel tricuspidata, pilis in paginis ambabus sparsis, praesertim abundioribus in venis et in marginibus recurvis.

*Stems* scabrous along ribs. *Leaves* 5-15x1.5-2.5 mm varying from lanceolate to oblanceolate to tricuspidate, with scattered hairs on both surfaces, especially abundant along veins and recurved margins.

*Type*: Stockout Creek, Coledale Road, N.S.W., Oct. 1909, J. L. Boorman (holo: NSW 97630).

*Distribution*: This species is found along the east coast of New South Wales (Figure 9). 14 collections were seen.

*New South Wales*: Track to Green Cape, 8 Oct. 1961, M. E. Phillips (CBG); Bundanoon, 21 Apr. 1934, L. R. F. and J. W. V. (SYD); Clyde district, Dec. 1884, W. Baeuerlen (MEL); Stockyard Gully near Copmanhurst, 23 Jul. 1967, K. Grieve (NSW); near Turpentine Nowra-Braidwood, 15 Jul. 1934, F. A. Rodway (NSW).

**10. Hybanthus epacroides** (C. A. Gardn.) Melch., Nat. Pflanzenfam. Ed. 2:21:360 (1925).

*Ionidium epacroides* C. A. Gardn., J. and Proc. Roy. Soc. W. Austral. 9:35 (1923). *Type*: near Mt. Marshall, half a mile south of Bencubbin Station, 2 June 1922, C. A. Gardner 1696 (holo: PERTH; iso: MEL).

*Shrub* to 40 cm high, spinescent, lateral branches divaricate. *Leaves* clustered at nodes, sometimes alternate, linear to spatulate, 2-7 x 0.5-1.0 mm, apex recurved; stipules linear to lanceolate,  $\pm$  0.5 mm long, glabrous except for few hairs towards base. *Flowers* axillary or arising from middle of leaf cluster, solitary. *Sepals* ovate-lanceolate, ca. 1.5 mm long, glabrous or ciliate, pale blue to white. *Anterior petal* 3-5 mm long, pale blue. *Lateral petals* of dissimilar pairs, oblong 1.5-3 mm long, apices truncate, recurved, pale blue to white, veining purple. *Anthers* purple,  $\pm$  pubescent; loculi appendages absent. *Capsule* 5 mm long; seeds 1-2, ovoid-ellipsoidal, ca. 3 mm long, smooth, mottled pale and dark brown.

*Distribution*: This species is found in the Coolgardie and Eyre districts of Western Australia (Figure 8). 22 collections were seen.

*Western Australia*: Lake Cronin, Forrestania, 13 June 1929, C. A. Gardner (PERTH); 146 miles Great Eastern Highway, E. M. Scrymgeour 689 (PERTH); Nangeenan, F. Stoward 3 (NSW); 2 miles West of Norseman, 17 September 1962, M. E. Phillips (GBG).

**11. Hybanthus bilobus** C. A. Gardn., J. Roy. Soc. W. Austral. 19:86 (1933).

*Type*: Hamersley River, near Eyre Range, 23 Sept. 1925, C. A. Gardner 1886 (holo: PERTH). *H. floribundus* (Lindl.) F. Muell, var. *minutifolia* F. Muell, Fragm. 10:82 (1876). *Type*: Crescit a Phillips River usque Cape Arid, Maxwell (holo; MEL).

*Shrub* to 20 cm tall, lateral branches divergent forming a dense intricate network. *Leaves* scattered, usually crowded in small clusters at the nodes, sessile, obdeltoide, 1-2x0.5-1.5 mm, truncate, appearing bilobed as a result of the recurved central portion of the apex; stipules linear,  $\pm$  0.5 mm long, densely hairy in lower half. *Flowers* axillary or arising from middle of leaf cluster, solitary. *Sepals* lanceolate to oblanceolate, 1.5-2.5 mm long, densely hirsute along margins and veins. *Anterior petal* 3-4 mm long, pale blue. *Lateral petals* of dissimilar pairs, oblong, 2-3 mm long, pale blue, veining purple. *Anthers* blue or green, pubescent, loculi appendages not present.

*Distribution*: This species is found in the Eyre and Coolgardie Districts of Western Australia (Figure 8). 10 collections were seen.

*Western Australia*: Mungilginup River,  $\pm$  50 miles east of Esperance, 8 Sept. 1963, J. H. Willis (MEL); 544 mile peg Norseman-Esperance road, E. M. Bennett 2168 (PERTH); 5 miles S of Salmon Gums, 10 Aug. 1951, N. H. Brittan (UWA).

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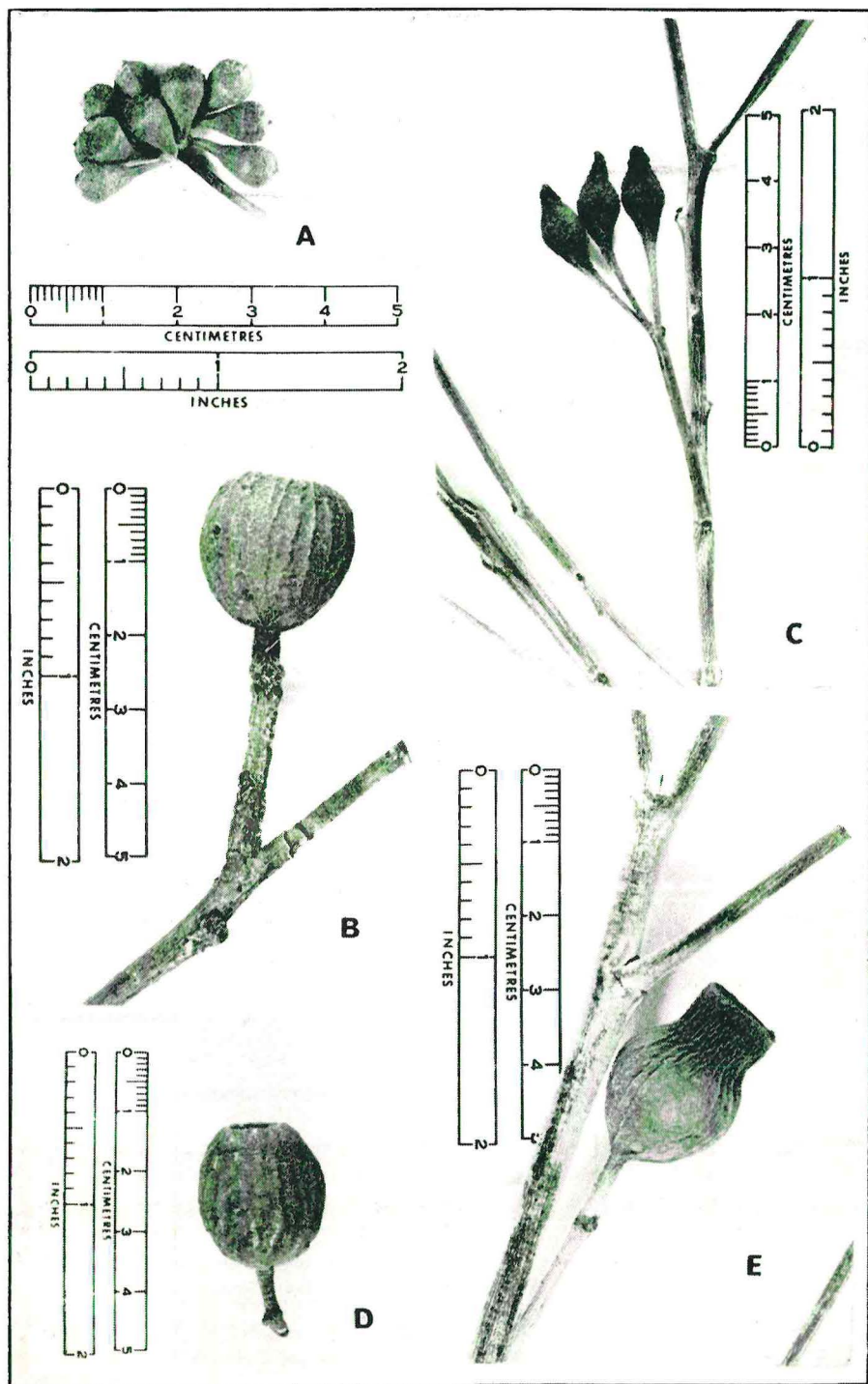


Figure 1—A, B—*Eucalyptus pendens* sp. nov. A—Buds (Brooker 1853). B—Fruit (Brooker 1949). C—E—*Eucalyptus sepulchralis* F. Muell. C—Buds (Middle Mt. Barren, Gardner 2976). D—Fruit (Gardner 2976). E—Fruit (cultivated Hamel nursery, FRI 15797).

## Four new taxa of *Eucalyptus* from Western Australia

By M. I. H. Brooker\*

### Abstract

Four taxa of *Eucalyptus* are described—*E. pendens* from the Badgingarra district, *E. acies* from the Fitzgerald River Reserve, *E. loxophleba* subsp. *gratie* from the Lake Grace district, and *E. conglobata* subsp. *fraseri* from the country north of Esperance and east of Norseman.

### *Eucalyptus pendens* M. I. H. Brooker sp. nov. (Figures 1 A, B, 2)

*Eucalypto sepulcrali* F. Muell. affinis a qua alabastris minus elongatis et fructibus minoribus non-urceolatis differt.

*Frutex* "mallee" 2–5 m altus ramificatione laxa demum pendente. *Ramuli* juvenes quadrangulares cortice laevi atro-rubra nitenti glauca. *Ramuli* maturi et caules cortice laevi cinereo-erubescenti. *Glandulae* oleorae in cortice et in medulla nullae. *Lignotuberum* formans.

*Cotyledones* reniformes 1.4–3.0 x 1.1–1.5 cm, triplinerves, supra virides, infra purpureae.

*Folia* plantulae sessilia, decussata, elliptica vel ovato-oblonga undulato-sessilis, 2–5 x 1–4 cm. *Axis* plantulae laevis. *Folia intermedia* breviter petiolata, decussata, late-elliptica, valde undulata, usque ad 16 x 8 cm. *Folia matura* petiolata, in gemma decussata, demum ab intranodiis separata, lanceolata, 6–12 x 1–2 cm costa in pagina una vel utrinque impressa, dense reticulata, sine glandulis oleosis manifestis, viridia, concoloria. *Petioli* complanati, 2–3 cm longi.

*Inflorescentiae* axillares, 7–11(13)-florae. *Pedunculi* erecti, validi, in sectione transversali ovales vel complanati ad apices latiores, 1.5–4.0 cm longi. *Involucrum* 6-bracteatum, bracteis 5–6 mm longis pro longitudine maxima connatis, demum deciduis. *Inflorescentiae* bracteatae in axillis foliorum dum inflorescentiae maturae expansis in ramulis vetioribus defoliatis praesentes. *Alabastra* clavata sine cicatricibus abscissis, 9–11 x 6–8 mm, in pedicello complanatos vel quadrangulares 3–8 mm longos angustata. *Operculum* hemisphaericum interdum umbonatum, vel conicum, verrucosum interdum radiatim 2–3-costatum, hypanthium aequans vel brevius. *Stamina* omnia fertilia. *Filamenta* alba, in alabastro radiale inflexa, eglandulosa, acuminata. *Antherae* dorsifixae versatiles, reniformi-orbiculares, ab rimis obliquis, ovalibus, non-confluentibus dehiscences. *Glans* terminalis. *Stylus* glandulosus, interdum ad apicem flexus. *Ovarium* 4–5-loculare, in hypanthio profunde impressum. *Ovula* verticaliter 2-seriata.

*Fructus* ovoideus vel cylindricus, truncatus, 1.3–2.0 x 1.2–2.0 cm, rugosus vel parum costatus. *Discus* obliquus ad verticalis. *Valvae* 4–5, profunde inclusae.

*Semina* 4–5 x 3–4 mm, latere dorsali rotundata, ventrali cum porcis aliquot ad hilum ascendentibus, nigra. *Ovulodia* angularia, quam semina minora, rufa.

*Type*: At 125 mile peg north of Perth on highway between Gingin and Badgingarra, Western Australia (30°14'S, 115°28'E), 23 July 1969, M. I. H. Brooker 1949. (holo: PERTH; iso: PERTH, FRI, K).

Allied to *E. sepulcralis* F. Muell. but differing in the less elongate buds and in the fruit which are smaller and not urceolate.

*A mallee* 2–5 m tall with a light, finally drooping canopy. *New branchlets* quadrangular, bark smooth, dark red, shining, glaucous. *Older branchlets* and main stems with pinkish-grey smooth bark. *Oil glands* absent in both bark and pith. *Capable* of forming lignotubers.

*Cotyledons* reniform, 1.4–3.0 x 1.1–1.5 cm, triplinerved, green above, purple beneath.

*Seedling leaves* sessile, decussate, elliptical or ovate-oblong, becoming undulate, 2–5 x 1–4 cm. *Seedling axis* smooth. *Intermediate leaves* shortly

\* Forestry and Timber Bureau, Canberra, A.C.T. 2600

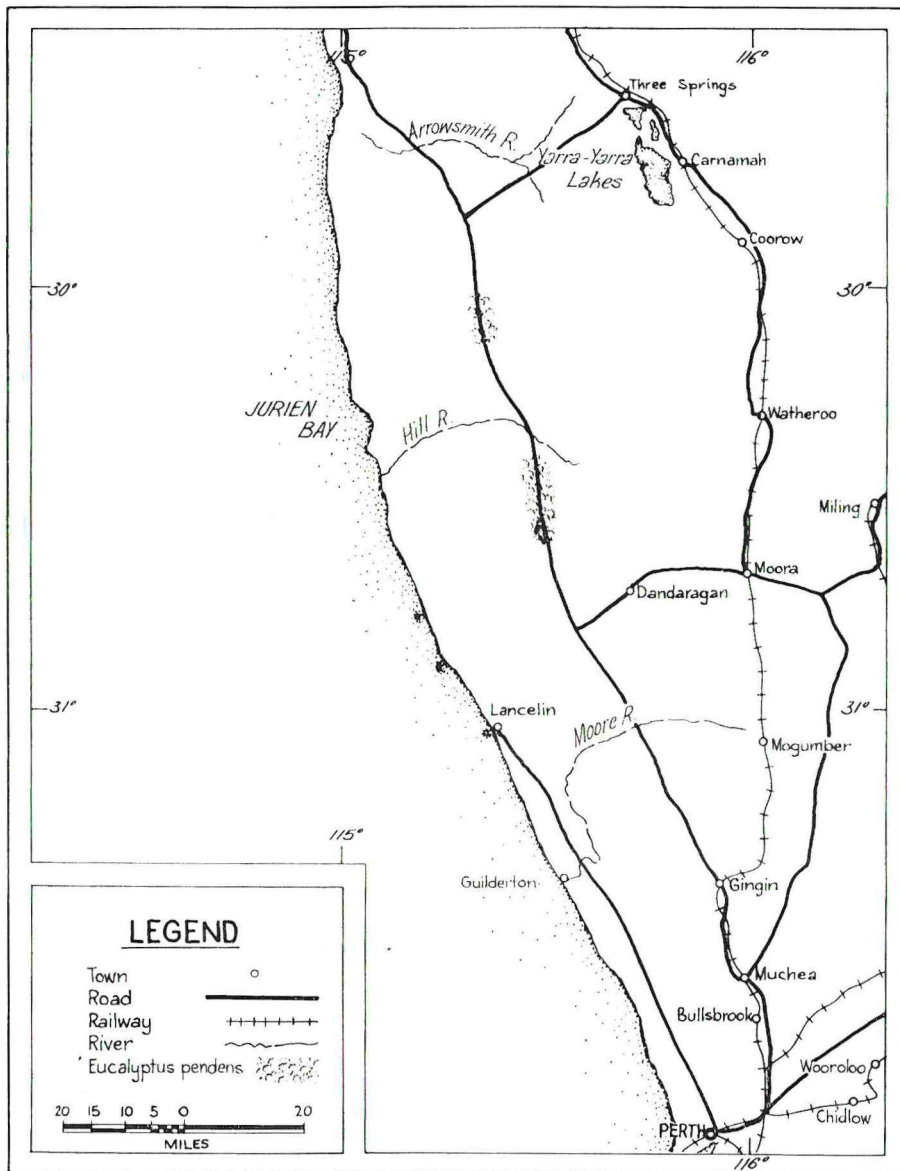


Figure 2—Distribution of *Eucalyptus pendens* sp. nov.

petiolate, decussate, broadly elliptical, markedly undulate, up to 16 x 8 cm. *Adult leaves* petiolate, decussate in bud, finally separated on the axis by intranodes, lanceolate, 6-12 x 1-2 cm the midrib impressed on one or both sides densely reticulate, without apparent oil glands, green, concolorous. Petioles flat, 2-3 cm long.

*Inflorescences* axillary, of 7-11 (13) buds. Peduncles erect, stout, oval or flattened in transverse section, widening at the tip 1.5-4.0 cm long. *Involucre* of six bracts, 5-6 mm long, fused for most of their length, finally deciduous. Bracteate inflorescences occurring in leaf axils while mature expanded inflorescences occur on older branchlets from which the leaves have fallen. *Unopened buds* clavate, without an abscission scar, 9-11 x 6-8 mm tapering into the pedi-

cels which may be flattened or quadrangular, 3-8 mm long. *Operculum* hemispherical and sometimes umbonate, or conical, verrucose and sometimes with 2-3 radial ribs, equal to or shorter than the hypanthium. *Stamens* all fertile. Filaments white and inflexed radially in the bud, non-glandular, acuminate. *Anthers* dorsifixed versatile, reniform-orbicular, opening by oblique, oval, nonconfluent slits. Gland terminal. *Style* glandular, sometimes bent at the top. *Ovary* 4-5 locular, deeply sunk in the hypanthium. *Ovules* in two vertical rows.

*Fruit* ovoid or cylindrical, truncate, 1.3-2.0 x 1.2-2.0 cm, wrinkled or shallowly ribbed. Disc oblique to vertical. Valves 4-5, deeply enclosed.

*Seed* 4-5 x 3-4 mm, dorsal side rounded, ventral side with several ridges ascending to the hilum, black. *Chaff* angular, smaller than seed, red-brown.

*Distribution*: Western Australia, near west coast in the region of the Hill River 120 to 150 miles north of Perth (Figure 2).

*Other collections*: 119.6 miles N of Perth on Gingin-Badgingarra highway (30°18'S, 115°30'E), 14 May 1969, *A. S. George* 9312, 9314, 9315 (PERTH); 120 miles on same highway (30°18'S, 115°30'E), 6 June 1969, *Brooker* 1850, 1852 (PERTH); 127.5 miles on same highway (30°12'S, 115°27'E), 6 June 1969, *Brooker* 1853 (PERTH, AD, GAUBA, CANB, FRI, K, MEL, NSW); 151 mile peg, Badgingarra-Eneabba road (30°02'S, 115°20'E), 30 Aug. 1969, *A. S. George* 9624 (PERTH).

*Flowering period*: July-August,

*E. pendens* is a remarkable species closely related to and resembling *E. sepulcralis* but differing in bud and fruit morphology (Figure 1). The two species occur approximately 350 miles apart and like some other Western Australian eucalypts they are notable for their restricted occurrence. *E. sepulcralis* occupies a few sites on sandy foothills of the ranges between the Fitzgerald River and Hopetoun on the south coast, *E. pendens* occurs on lateritic sandhills and has been collected only at the localities cited above. The species occurs as isolated groups of slender mallees whose stems are only a few cm in diameter and which emerge above low, dense, sclerophyllous shrubs. The canopy is thin and always pendulous. There are no other *Eucalyptus* species associated with it in the field.

#### ***Eucalyptus acies* M. I. H. Brooker, sp. nov. (Figures 3 A-C, 4)**

*Frutex* "mallee" 1.0-2.5 m altus, vulgo pluricaulis, cortice laeve. *Ramuli* juvenes complanati, quadrangulares. *Glandulae* oleosae in cortice et in medulla nullae.

*Cotyledones* emarginatae, reniformes, 1.7-2.2 x 1.5-2.0 cm, supra atrovirides, infra atromalvinae. *Folia plantulae* sessilia, decussata, elliptica, 5-7 x 3-5 cm, parum discoloria. *Axis plantulae* verrucosus, glandulosus. *Folia matura* opposita vel sub-opposita, lanceolata ad latelanceolata, symmetrica ad parum falcata, acuminata, coriacea, (8.5) 9.0-13.5 (14.5) x 2.0-3.5 cm, viridia, concoloria. *Petoli* complanati (1.5) 2.0-3.0 cm longi. *Costa* mediana distincta, infra prominentior, paribus multis venarum lateralium ab costa mediana sub angulo (40°) 45°-55° (60°) prodeuntibus. *Vena* intramarginalis ab margine 1-2 mm distans.

*Inflorescentiae* axillares 7-florae. *Pedunculi* complanati, biconvexi, ad apices latiores, saepe reflexi, (1.3) 1.7-2.3 (2.6) cm longi. *Gemma* inflorescentiae inapertae rotundata, ab bracteis 4 inclusa.

*Alabastra* clavata sine cicatricibus abscissis, cum pedicellis 1.5-2.1 x 0.7-1.1 cm longa. *Hypanthium* parum angulare, manifeste costatum, quam operculum vulgo multo longius, 0.9-1.4 cm longum, in pedicellum angustatum. *Operculum* depresso-hemisphaericum, laeve vel parum costatum, saepe breviter rostratum. *Stamina* omnia fertilia. *Filamenta* in alabastro radiale inflexa, eglandulosa, acuminata. *Antherae* dorsifixae, versatiles, reniformi-orbiculares, ab rimis longitudinalibus obliquis dehiscentes. *Glans* terminalis. *Stylus* conicus, rectus, alabastro supra filamenta elevatus. *Stigma* inconspicuum. *Ovarium* quam hypanthium multo brevius, 3(4)-loculare. *Ovula* verticaliter 2-seriata.

*Fructus* hemisphaerico-campanulata costibus prominentibus aliquot, 1.1-1.6 x 1.2-1.6 cm, in pedicello brevi in sectione transversali triangulari 3-8 mm longo attenuata. *Annulus* calycinus angustus, planus, manifestus; *discus* latus, conspicuus, planus vel convexus; *valvae* 3(4), rudimentales, cum disco aequatae.

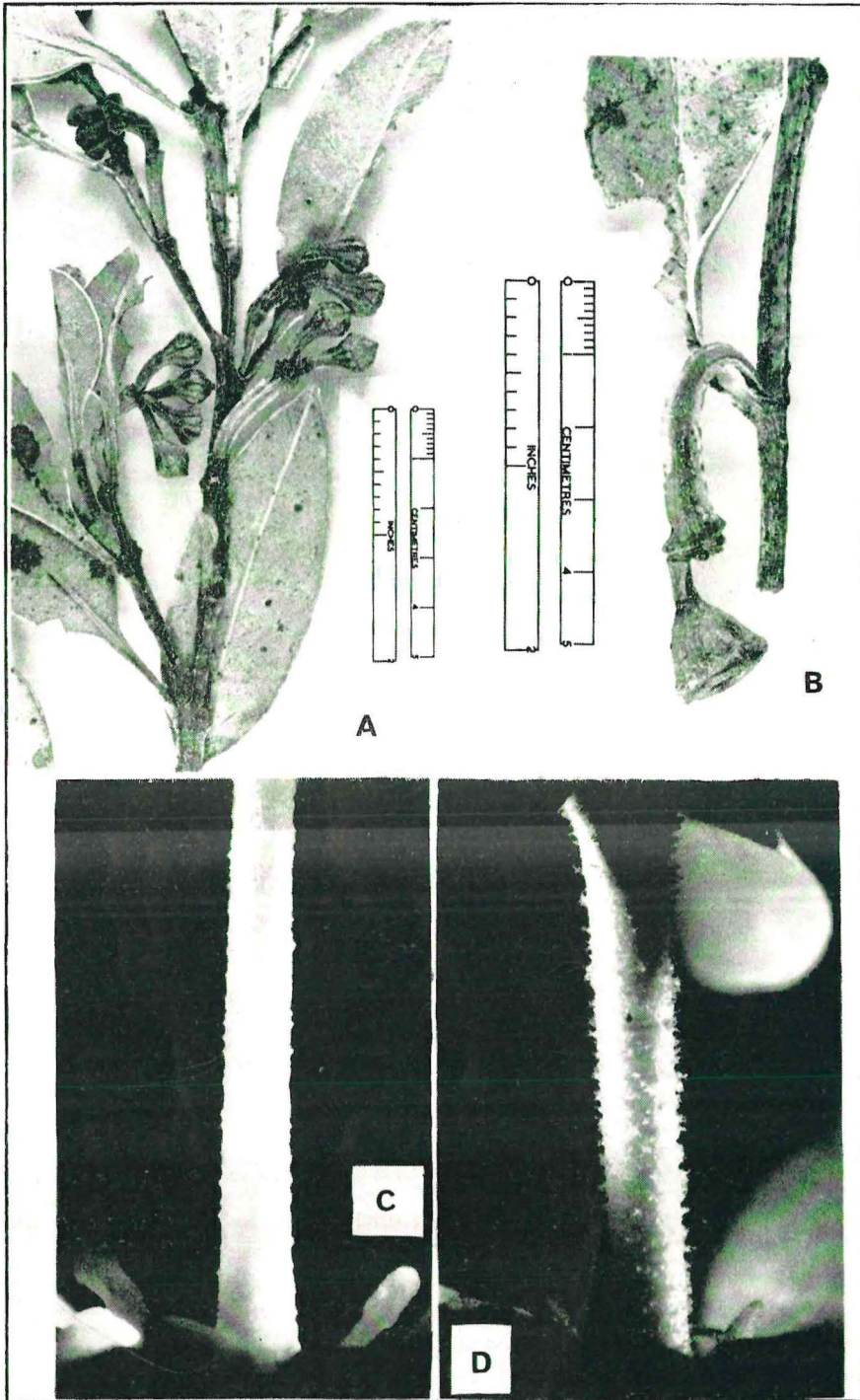


Figure 3—A—C—*Eucalyptus acies* sp. nov. A—Buds (Brooker 2723). B—Fruit (Brooker 2723). C—Seedling stem (cultivated FRI nursery). D—*Eucalyptus preissiana* Schau. Seedling stem (cultivated FRI nursery).

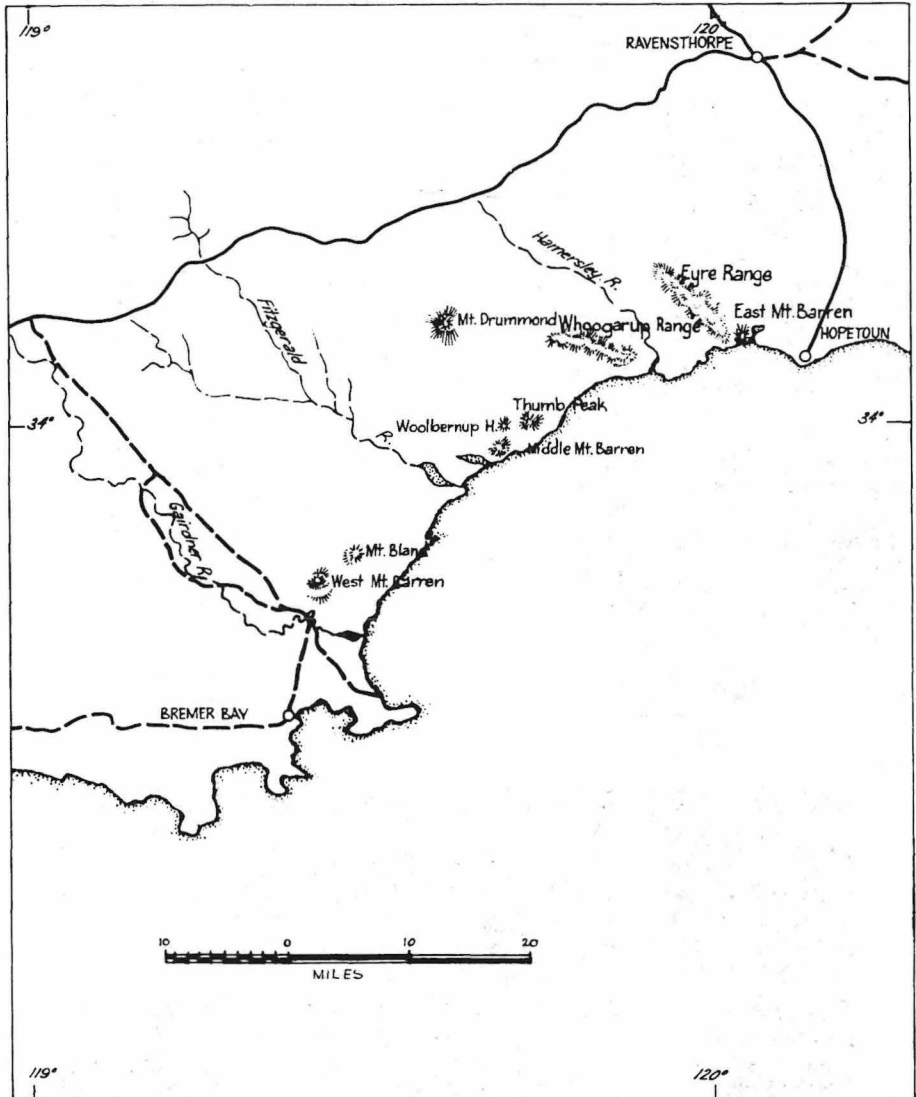


Figure 4—Distribution of *Eucalyptus acies* sp. nov.

*Semina* angulata porcis parum alatis, 2-3 x 2 mm, atro-cinerea vel nigra, aliquantum nitentia.

*Type*: On Woolbernup, a rocky hill in the Fitzgerald River Reserve between Bremer Bay and Hopetoun, Western Australia (34°02'S, 119°41'E), 4 Aug. 1970, *M. I. H. Brooker* 2725 (holo: PERTH iso: PERTH, GAUBA, FRI, K, MEL, NSW).

*A mallee* shrub 1.0-2.5 m tall, usually several-stemmed, with smooth bark. *Young branchlets* flattened and quadrangular. Oil glands absent in both bark and pith.

*Cotyledons* emarginate, reniform, 1.7-2.2 x 1.5-2.0 cm dark green above, deep mauve below. *Seedling leaves* sessile, decussate, elliptical, 5-7 x 3-5 cm slightly discoloured. *Seedling axis* verrucose, glandular. *Adult leaves* opposite to sub-opposite, lanceolate to broad-lanceolate, symmetrical to slightly falcate, acuminate, coriaceous, (8.5) 9.0-13.5 (14.5) x 2.0-3.5 cm green, concolorous.

Petioles flat (1.5) 2.0-3.0 cm long. Midrib distinct, more prominent below, with numerous pairs of primary lateral veins at an angle of (40°) 45°-55° (60°). Intramarginal vein 1-2 mm from the margin.

*Inflorescences* axillary, of 7 flowers. Peduncles flattened, biconvex, and broader at the top, often reflexed (1.3) 1.7-2.3 (2.6) cm long. Unopened inflorescence bud rounded, enclosed by 4 bracts.

*Unopened buds* clavate without abscission scars 1.5-2.1 x 0.7-1.1 cm including the pedicel. Hypanthium slightly angular, with prominent ridges, usually much longer than the operculum, 0.9-1.4 cm, tapering into the pedicel. *Operculum* depressed-hemispherical, smooth or shallowly ribbed and often shortly beaked. *Stamens* all fertile. Filaments inflexed radially in the bud, non-glandular, acuminate. *Anthems* dorsifixed, versatile, reniform-orbicular, opening by longitudinal-oblique slits. Gland terminal. *Style* conical, erect, raised above filaments in the unopened bud. Stigma inconspicuous. *Ovary* much shorter than the hypanthium, loculi 3 (4). *Ovules* in 2 vertical rows.

*Fruit* hemispherical-campanulate, with several prominent ridges, 1.1-1.6 x 1.2-1.6 cm, tapering into a short pedicel, triangular in cross-section, 3-8 mm long. Calycine ring narrow, flat and well defined; disc wide, conspicuous, level to convex; valves 3(4), rudimentary, more or less level.

*Seeds* angular, with slightly winged ridges 2-3 x 2 mm, dark grey or black, rather shiny. Hilum area conspicuous. *Chaff* light red-brown, angular, smaller than the seed.

*Distribution*: Western Australia, south coast between Bremer Bay and Hope-toun (Figure 4).

*Other collections*: Thumb Peak Range (34°02'S, 119°43'E), 31 Oct. 1965, *A. S. George* 7150 (PERTH); Thumb Peak (summit) (34°02'S, 119°43'E), 23 Oct. 1970, *R. D. Royce* (PERTH); Middle Mt. Barren (34°03'S, 119°41'E), 16 July 1970, *A. S. George* 10088 (PERTH); Wool-bernap (34°02'S, 119°41'E), 4 Aug. 1970, *M. I. H. Brooker* 2723 (PERTH).

*Flowering period*: September-November.

*E. acies* is a species of notably restricted occurrence. Its distribution is known only from the above localities which are themselves only a few miles apart. It has not been collected on the intervening plains. The species is therefore likely to be an endemic in the Fitzgerald River Reserve.

The natural affinity of *E. acies* is not clear. It belongs in the *Renantherae* and is probably closest to *E. preissiana* which it somewhat resembles in habit and gross morphology. It differs from *E. preissiana* in having 7 buds to the inflorescence, ribbed hypanthia, filaments which are apparently non-glandular, and glandular-verrucose seedling stems compared with the stellate hairy stems of *E. preissiana* (Figure 3 C, D).

The Series *Preissianae* of Pryor and Johnson (1971) consists of three renantherous species, *E. megacarpa*, *E. preissiana* and *E. coronata* which were incorrectly included by Blakely in the Section *Macrantherae*. Each has 3 buds to the inflorescence and glandular filaments and it may be incorrect to classify *E. acies* with equal status within this Series. As *E. acies* does not resemble other known species I suggest it tentatively be placed in the Series *Preissianae* or be considered as a related, as yet monotypic, Series.

***Eucalyptus loxophleba* Benth. subsp. *gratiae* M. I. H. Brooker subsp. nov.**  
(Figures 5, 6).

A subspecies typica foliis, alabastris, fructibusque majoribus differt. *Cortex* laevis, nitidus. *Ramuli* plerumque glauci. *Folia* 7-11 x 1-2.5 cm, nitida. *Pedunculi* complanati, lati, glauci. *Alabastra* 12-15 x 4-5 mm. *Fructus* obconica usque ad 12 x 9 mm pedicellis inclusis.

Type: 0.5 mile west of Burngup, Western Australia (33°01'S, 118°41'E), 3 Nov. 1969, *M. I. H. Brooker* 2273 (holo: PERTH).

Differs from the typical subspecies in the larger leaves, buds and fruit. Bark smooth, shining. *Branchlets* usually glaucous. *Leaves* 7-11 x 1-2.5 cm, glossy. *Peduncles* flattened, broad, glaucous. *Buds* 12-15 x 4-5 mm. *Fruit* obconical, up to 12 x 9 mm, including the pedicel.

*Distribution*: Western Australia, south-west, between Dumbleyung and Lake King (Figure 6).

*Other collections*: 4 miles east of Dumbleyung (33°16'S, 117° 46'E), 29 Oct. 1962, *M. E. Phillips* (CBG 023097); 12 miles east of Newdegate (33°06'S, 119°14'E), 30 Oct. 1962, *M. E. Phillips* (CBG 023090); 15.5 miles west of Lake King (33°06'S, 119°23'E) 17 Mar. 1967, *G. M. Chippendale* 225 (FRI); 25.7 miles north east of Lake Grace township (32°52'S, 118°39'E), 17 Mar. 1967, *G. M. Chippendale* 230, (FRI); 25 miles west of Lake King (33°06'S, 119°14'E), May 1969, *B. A. Rockel* (FRI 18598); 10 miles west of Lake Grace (33°06'S, 118°16'E), 3 Nov. 1969, *M. I. H. Brooker* 2268, 2269 (PERTH, FRI, NSW); 0.5 mile east of Cargonocking Hill (32°49'S, 118°04'E), 13 July 1970, *M. I. H. Brooker* 2652 (PERTH).

*Flowering period*: June-October.

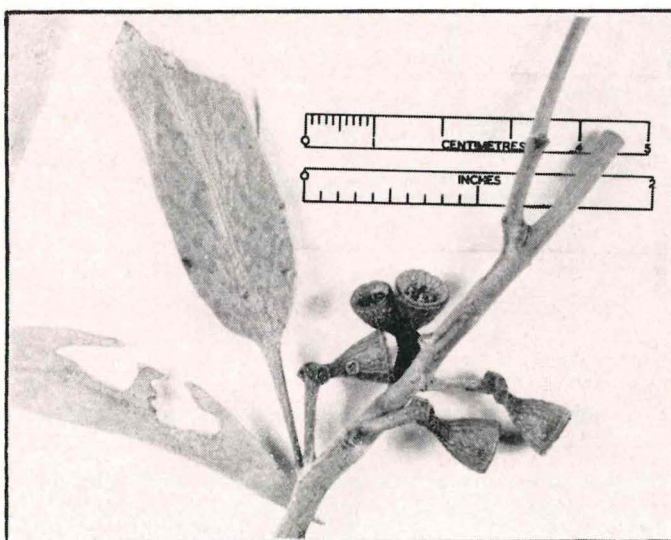


Figure 5—*Eucalyptus loxophleba* subsp. *gratiae* subsp. nov. Fruit (25.7 miles north east of Lake Grace, Chippendale 230).

*E. loxophleba* is a widespread species in south west Western Australia in the 10-20 in. rainfall region. Published by Bentham in 1867, its status was doubted by Mueller (1884) who considered it may only have been a tree form of "*E. foecunda*" (*E. oraria* L. A. S. Johnson). This suggestion was adopted by Luehmann (1898) who indicated it was a variety of "*E. foecunda*" and by Maiden (1909) whose comments on the taxonomy of *E. loxophleba* were confined to quotations from Mueller and Luehmann. Blakely restored *E. loxophleba* to specific status (1934) and it has since been regarded as a distinct species. Blakely, however, seems to have assumed its affinity with "*E. foecunda*" (*E. oraria*) by placing these two species next to each other in his classification. This anomaly was recognised by Pryor and Johnson (1971) who place *E. loxophleba* in the Section *Bisectaria* and *E. oraria* in the Section *Dumaria*. The species of these two Sections are separable on cotyledon shape.

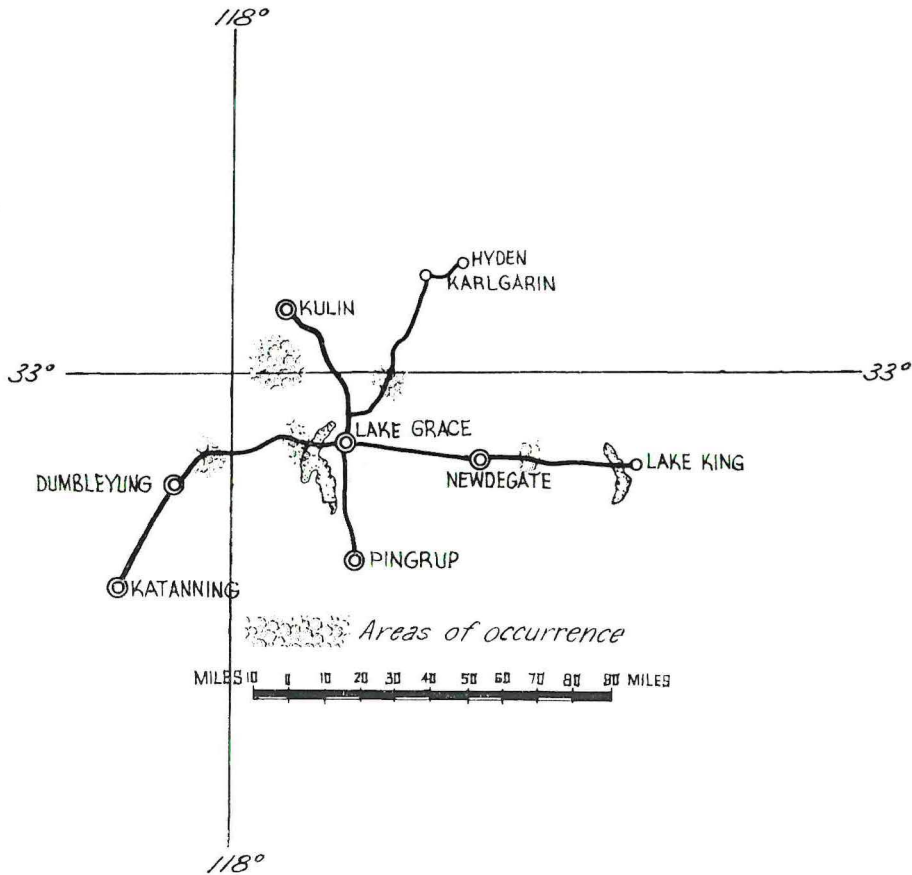


Figure 6—Distribution of *Eucalyptus loxophleba* Benth. subsp. *gratiae* subsp. nov.

*E. loxophleba* is a unique species and when a complete specimen is available it is easily recognizable. It is characterised by bisected cotyledons; glandular pith; prominent leaf venation with the intramarginal nerve well in; thick, inflected filaments in several series, the outer ones long, elbowed in the bud and strongly spreading in the flower, the inner ones short and erect in the flower, some filaments strongly sculptured at the base, all narrowing suddenly to the attachment with the connective: style constricted at the base.

While the above characters are invariable the species is notoriously variable in habit and bark. Typical specimens as described in Bentham are trees with "rough ash grey fibrous bark". This description would suit the species as known in the higher rainfall areas. *e.g.*, at York whence comes its common name. However, the species appears to vary clinally from the higher rainfall to the lower rainfall areas of distribution in that the tree habit is lost to the north and east and also the amount of rough bark becomes less and less until in the dry lands (*e.g.* Carrabin) *E. loxophleba* is a smooth-barked mallee. Such a cline form is probably what is represented by *E. loxophleba* var. *fruticosa* which Bentham described as a shrub from the Murchison River.

By contrast, subsp. *gratiae* is a distinctive form which occupies a small area of distribution between Dumbleyung and Lake King and the sub-specific name is derived from Lake Grace where it is prominent. It is notable in the

field for its fairly dense rounded canopy of bright green leaves, the smooth trunks and the bright green-leaved seedlings.

***Eucalyptus conglobata*** (R. Br. ex Benth.) Maiden subsp. ***fraseri*** M. I. H. Brooker subsp. nov. (Figures 7, 8).

A subspecies typica habitu et alabastrorum forma differt. *Arbor* erecta ad 20 m alta cortice laevi alba vel cinerea (interdum per 0.5 m e basi fibrosa). *Alabastro* variabilia, sessilia ad breviter pedicellata, operculis pyramidalibus, rostratis vel obtuse conicis, costatis. *Type*: 14 miles west of Balladonia, Western Australia, 14 Feb. 1970, M. I. H. Brooker 2472. (holo: PERTH; iso: PERTH, AD, GAUBA, BRI, CANB, FRI, K, MEL, NSW).

Differs from the typical subspecies in habit and the form of the buds. An erect tree to 20 m tall with smooth white to whitish-grey bark (or sometimes with 0.5 m of basal rough bark). *Buds* variable, sessile to shortly pedicellate, with pyramidal, rostrate or obtusely conical, ribbed opercula.

*Distribution*: Western Australia, north of Esperance and east of Norseman. (Figure 8).

*Other collections*: 2 miles south from Beete Siding (32°44'S, 121°32'E), 7 Nov. 1953, C. A. Gardner 11161 (PERTH); near Balladonia (32°27'S, 123°51'E), 9 Sept. 1962, M. E. Phillips (CBG 021970); east side of pass in Fraser Range (32°02'S, 122°52'E), 18 Oct. 1966, A. S. George 8597 (PERTH); 67.4 miles east of Norseman (32°02'S, 122°52'E), 12 Mar. 1967, G. M. Chippendale 158 (FRI); between 497 and 498 mile peg on Norseman-Esperance Road (32°04'S, 122°29'E), April 1969, B. A. Rockel (FRI 18590); 8 miles north of Salmon Gums (32°52'S, 121°36'E), 15 Feb. 1970, M. I. H. Brooker 2495 (PERTH); 6 miles east of Scaddan (33°56'S, 121°50'E), 8 Aug. 1970, M. I. H. Brooker 2772 (PERTH); between 497 and 498 mile peg on Norseman-Esperance Road (32°04'S, 122°29'E), 13 Sept. 1970, J. Baker 67 (FRI).

*Flowering period*: February.

*Eucalyptus dumosa* var. *conglobata* R. Br. ex Benth, was published by Bentham (1867) who cited two South Australian localities, viz., "Port Lincoln" (Wilhelmi) and "South Coast" (R. Brown). Maiden (1909) published it as a variety of *E. incrassata* Labill. and subsequently raised it to *E. conglobata* (1924). In doing so he inadvisedly chose a later collection from Port Lincoln as the type. It is now known that the Robert Brown specimen at least is extant and is lodged in the Herbarium of the Royal Botanic Gardens, Kew (G. Chippendale pers. comm.).

In the original description of var. *conglobata* Bentham (loc. cit.) did not mention habit though for *E. dumosa* the habit is given as "a shrub or small tree". Bentham's description of the flowers of var. *conglobata* as being "closely sessile, the calyx-tube shorter than broad, angular, and operculum conical" fits the Port Lincoln specimens but is inadequate to embrace all the forms which are now known to occur in the wide distribution from Western Australia to Encounter Bay in South Australia.

One such form is the striking smooth-barked inland tree with the variable bud form (subsp. *fraseri*) compared with the coastal mallee with the strictly sessile buds which is typical of the form in the Port Lincoln district and the south coast of Western Australia (subsp. *conglobata*). Maiden (1924) reported trees of *E. conglobata* on Boston Island near Port Lincoln which were "50 feet high". Further collecting is required to sort out the relationship of these trees to subsp. *conglobata* and subsp. *fraseri*.

Pryor and Johnson (1971) accepted *E. conglobata* as a distinct species to include *E. anceps* R. Br. ex Maiden (Blakely) which is given anticipated subspecific status. In this scheme subsp. *fraseri* should be given taxonomic status equal to both "*conglobata*" and "*anceps*".

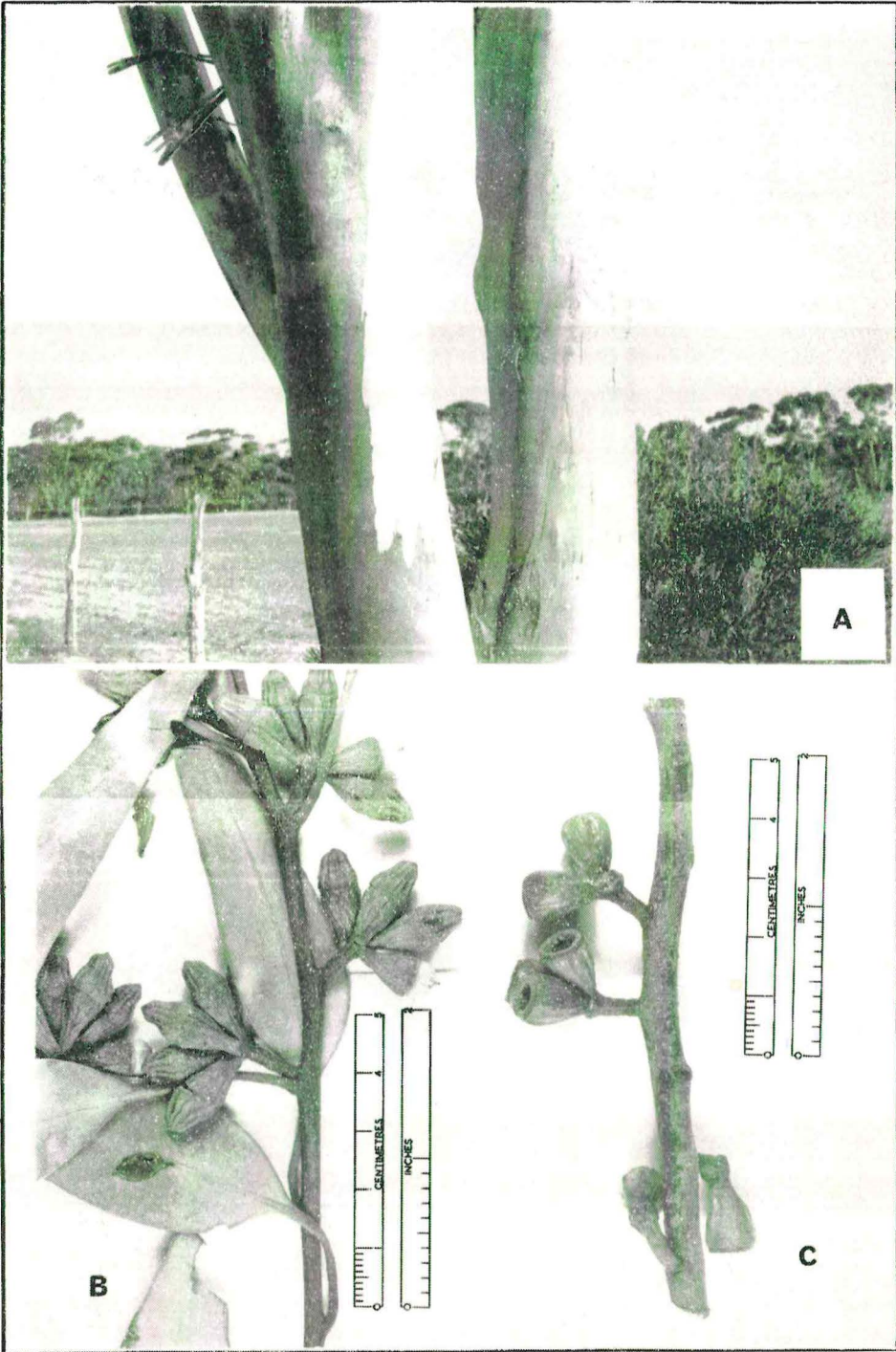


Figure 7—*Eucalyptus conglobata* (R. Br. ex Benth.) Maiden subsp. *fraseri* subsp. nov. A—Bark (Brooker 2495). B—Buds (Brooker 2472). C—Fruit (Brooker 2472).

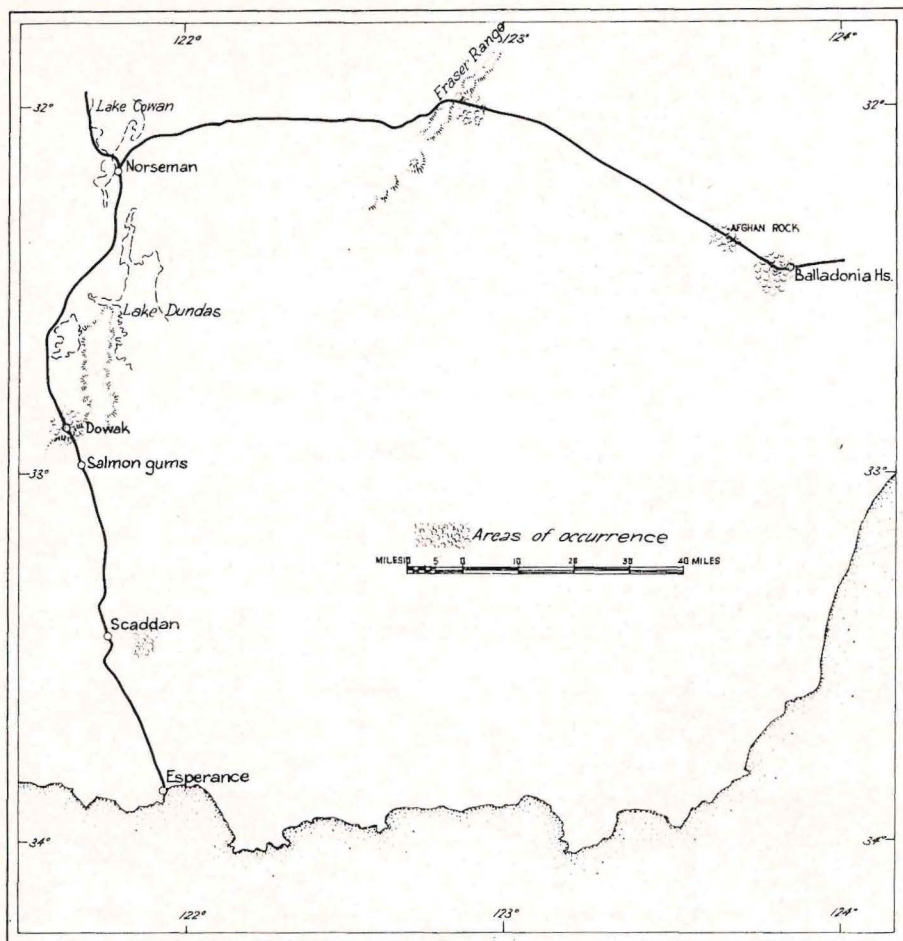


Figure 8—Distribution of *Eucalyptus conglobata* (R. Br. ex Benth.) Maiden subsp. *fraseri* subsp. nov.

#### Acknowledgements

I would like to thank Mr. A. Popplewell for drawing my attention to *E. conglobata* subsp. *fraseri*, and Mr. A. S. George for drawing my attention to *E. pendens* and *E. acies* and for all the latin descriptions. Thanks are also due to Mr. J. Baker for assistance with the description of *E. acies*, and to Mr. N. Hall and Mr. A. Edward for the photographs.

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## Studies in the genus *Acacia*—I

By B. R. Maslin

### Abstract

Two species and one subspecies of *Acacia* are described—*A. megacephala* sp. nov., *A. echinata* sp. nov. and *A. moirii* E. Pritzel subsp. *recurvistipula* subsp. nov. All three taxa belong to Bentham's series *Pulchellae*.

### Introduction

This is the first in a series of papers which will deal with the taxonomy of *Acacia* species primarily from Western Australia. Some of the morphological terms used in this and subsequent articles require brief explanation.

1. *Receptacle*: that portion of the inflorescence axis on which the flowers are borne.

2. *Bracteoles*: small bracts positioned on the receptacle, each of which subtends one flower.

3. *Terminal seta*: Bentham, Journ. Bot. (Hooker) 4:325 (1842), defined this structure as "A small point (which) terminates the petioles whether common or partial, in all or nearly all Mimoseae . . ." The present author has modified Bentham's usage of this term: as applied here the terminal seta refers to the appendage which terminates the primary axis of a bipinnate leaf (Bentham's "common petiole"). It does not refer to the apical portion of the secondary axis of the leaf (Bentham's "partial petiole").

4. *Areole*: an area which occurs on each face of most Mimosoideae seeds, generally more or less elliptic or oblong and bounded by a fine line (the *pleurogram*). (See J. P. M. Brenan, Leguminosae-Mimosoideae in Flor. Trop. E. Africa, p. 1 (1959) for a definition of areole, and E. J. H. Corner, The Leguminous Seed, in Phytomorphology 1:117-150 (1951) for a definition of pleurogram).

### *Acacia megacephala* B. R. Maslin sp. nov. (Figure 1)

*Frutex* erectus diffusus 1-2 m altus, uni- vel multi-caulis, ramulis saepe pendulis, modice ad dense pilosis; cortex laevis, ad basin cinereo-brunneus, in ramulis rufo-brunneus. *Spinae* axillares, 5-15 mm longae, solitariae (saepe carentes), glabrae vel ad basin pilosae. *Stipulae* angustissime triangulares, 2-4 mm longae, plerumque sparsim pilosae. *Folia* bipinnata; *pinnae* unijugatae; *petiolus* brevissimus, ca. 1 mm longus; *seta terminalis* angustissime triangularis, 3-4(5) mm longa, breviter pilosa; *glans* ab axilla pinnarum oriens, stipitata, setam terminalem aequans, ad apicem dilatata, glabra vel pilosa; *rhachis* 4-6 mm longa, acuta, infra sparsim pilosa, supra glabra costa media prominente; *pinnulae* 4-6-jugae, anguste obovatae, 4-6 x 2-3 mm, obtusae, planae, inconspicue 1-nervatae, laeves glabrae, obscure virides. *Capitula* florentia globulosa, sub anthesi 8-10 mm dia., floribus 80-90. *Pedunculi* axillares, solitarii vel binati 15-25 mm longi, folia multum excedentes, glabri. *Receptaculum* capitatum, glabrum vel breviter pilosum. *Bracteolae* dimorphae: (1) bracteolae inferiae in serie singulari ad basin receptaculi dispositae, reflexae, oblongae, ca. 1 mm longae, acutae, glabrae praeter apices; (2) bracteolae superiores spiraliter dispositae, erectae, ca. 1.5 mm longae, unguibus linearibus plerumque glabris, in laminas pyriformes aliquantum concavas sparsim ciliolatas abrupte expansae. *Florae* 5-merae; *calyx* longitudine 2/3 corollae partes aequans, anguste turbinatus, longitudine 4/5 ejus connatus tubo glabro vel sparsim piloso, lobis oblongis obtusis sparsim ciliolatis; *corolla* 2-3 mm longa, longitudine 3/4 ejus connata, glabra; *pollinia* 12-granularia; *ovarium* sessile, glabrum. *Legumen* lineare ad anguste oblongum, 25-50 x 4 mm, glabrum pagina parum undulata, badium; marginibus crassis, fere rectis, pallidis. *Semina* longitudinalinalia, oblonga 3-4 x 1.5-2.0 mm, fusca; funiculus plerumque 2-plicatus, arillatus.

*Type*: At Kojarena Siding, 19 miles east of Geraldton towards Mullewa, Western Australia, 8 Aug. 1970, B. R. Maslin 676 (holo: PERTH, iso: K, MEL, NSW).

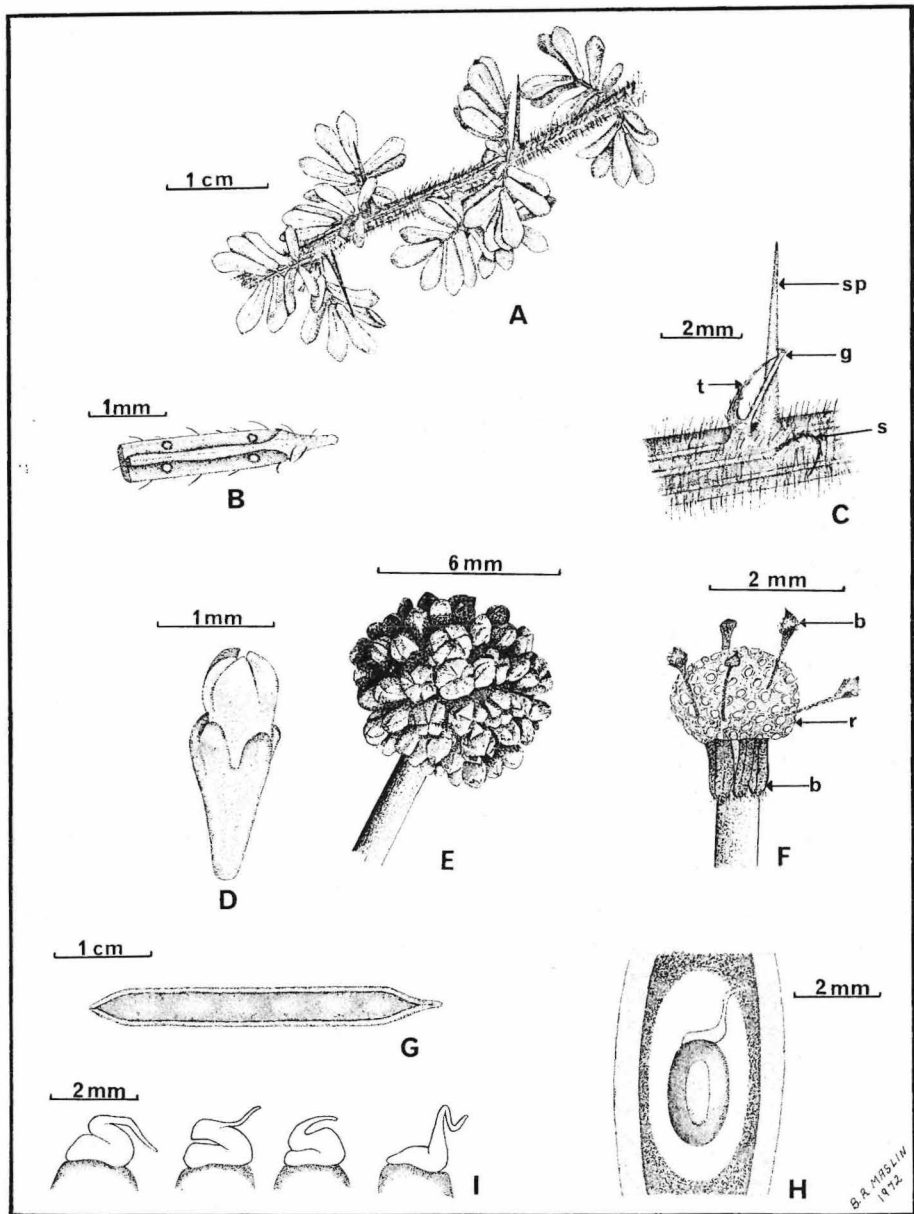


Figure 1—*Acacia megacephala* sp. nov. A—Portion of stem. B—Portion of rachis showing prominent midrib. C—Node with pinnae removed showing spine (sp), gland (g), terminal seta (t), and stipule (s). D—Flower. E—Flower head. F—Recptacle (r) with dimorphic bracteoles (b). G—Pod. H—Young seed in pod. I—Seed showing funicle variability. A-F from B.R. Maslin 676; G-H from B. R. Maslin 684; I from Phillips s.n.

Erect, diffuse, single- or multi-stemmed *shrub*, 1–2 m tall; branchlets often pendulous, moderately to densely pilose; bark smooth, grey/brown at base, red/brown on branches. *Spines* axillary, 5–15 mm long, solitary (often absent from some nodes), glabrous, or pilose towards the base. *Stipules* very narrowly triangular, 2–4 mm long, normally shortly pilose. *Leaves* bipinnate; *pinnae* 1 pair; *petiole* very short, ca. 1 mm long; *terminal seta* very

narrowly triangular, 3–4(5) mm long, shortly pilose; *gland* arising at junction of pinnae, stipitate,  $\pm$  equalling terminal seta, dilated at apex, glabrous or shortly pilose; *rachis* 4–6 mm long, acute, sparsely pilose below, glabrous and with a prominent midrib above; *pinnules* 4–6 pairs, narrowly obovate, 4–6 x 2–3 mm, obtuse, flat, inconspicuously 1-nerved, smooth, glabrous, dull green (at maturity). *Flower heads* large, globular, 8–10 mm diameter at anthesis, with 80–90 flowers. *Peduncles* axillary, solitary or in pairs, greatly exceeding the leaves, 15–25 mm long, glabrous. *Receptacle* capitate, glabrous or shortly pilose. *Bracteoles* dimorphous: (1) lower series (arranged in a single ring at base of receptacle) reflexed, oblong, ca. 1 mm long, acute, glabrous except at apex; (2) upper series (spirally arranged) erect, ca. 1.5 mm long, claws linear, normally glabrous, expanded into sparsely ciliolate, somewhat concave, pear-shaped laminae. *Flowers* 5-merous; *calyx* about 2/3 length of corolla, narrowly turbinate, connate for 4/5 its length, tube glabrous or very sparsely pilose, lobes oblong obtuse sparsely ciliolate and somewhat incurved at apex; *corolla* 2–3 mm long, connate for 3/4 its length, glabrous; *pollinia* 12-grained; *ovary* sessile, glabrous. *Legume* linear to narrowly oblong, 25–50 x 4 mm, glabrous, surface slightly undulate, dark brown; margin thickened, pale coloured, almost straight. *Seeds* longitudinal, oblong, 3–4 x 1.5–2.0 mm, brown; funicle yellow, usually with 2 short folds, gradually expanded into a thickened aril; areole  $\pm$  oblong, 2.5–3.0 x 1.0 mm; pleurogram continuous.

*Distribution*: Western Australia; apparently confined to sandy or loamy soils in an area extending from about 10 miles east of Geraldton eastwards to the Greenough River. (Figure 4)

10 mi E of Geraldton, *W. E. Blackall* 2755; 19 mi E of Geraldton, *A. S. George* 9220; 17 mi E of Geraldton, *J. W. Green* 474; 19 mi E of Geraldton on the road to Mullewa, *B. R. Maslin* 684; Northern Gully (E of Geraldton), *G. Phillips* s.n.; ca. 50.5 mi W of Mullewa on the road to Geraldton, *M. D. Tindale* 1328.

*Flowering period*: August–September.

The presence of stipitate glands, axillary spines, and unjugate leaves relates this species to *A. lasiocarpa* Benth. and more closely to *A. pulchella* R.Br. However *A. megacephala* is readily distinguished from both of these species by its very long peduncles, prominently capitate receptacles, and its large flower heads each bearing 80–90 narrowly turbinate flowers. Vegetatively *A. megacephala* is distinguished from *A. pulchella* by its one-spined nodes (*A. pulchella* normally has 2 spines per node), longer narrower stipules and terminal setae, and somewhat larger pinnules. The flat pinnules and longer glands readily separate it from *A. lasiocarpa*.

#### ***Acacia echinata* B. R. Maslin sp. nov. (Figure 2)**

*Frutex* nanus, ramosissimus, compactus, pulvinatus, 2–5 cm altus, 50 cm vel major diam. partibus vegetativis sparsim strigillosis vel glabris; ramuli  $\pm$  erecti, spinescentes, teretes; spinae axillares nullae. *Stipulae* anguste triangulares, 0.5–1 mm longae, praecipue ad basin aliquantum incrassatae. *Folia* bipinnata; *pinnae* unjugatae; *petiolus* prominens, ca. 2 mm longus, teres, ad basin parum contractus; *seta terminalis* 0.5–1 mm longa, aliquantum incrassata; *glans* in pagina supra petioli plerumque ad apicem, parva, sessilis, rotunda; *rhachis* 2–3 mm longa, teres, apice aliquantum complanato parum expanso, obtuso; *pinnulae* 3–4 jugae, anguste oblongae ad assymetrice anguste obovatae, 2–3 x 1 mm, obtusae, planae, inconspicue 1-nervatae, laeves. *Capitula* florentia parva, globulosa, sub anthesi 3–4 mm diam., floribus 12–15. *Pedunculi* axillares, solitarii 10–15 mm longi, sparsim strigillosi ad glabri. *Receptaculum* globulosum, glabrum. *Bracteolae* minus quam 1 mm longae, unguibus brevibus glabris, in laminas concavas obtusas ciliolatas expansae. *Florae* 5-merae; *calyx* longitudine 1/2 corollae partes aequans, turbintus, longitudine 3/4 ejus connatus tubo glabro, lobis obtusis ciliolatis ad apices parum incurvatis; *corolla* longitudine 1/2 ejus connata, 1.5 mm longa, glabra; *pollinia* 12-granularia; *ovarium* sessile parce papillatum. *Legumen* anguste oblongum, ca. 10 x 3 mm, pagina undulata parce strigosa badia; marginibus crassis, fere rectis, ferrugineis. *Semina* matura non visa.

*Type*: 6 miles east of Kokerin, Western Australia, 20 Dec. 1964, *K. Newbey* 1620 (holo: PERTH, iso: K, MEL, NSW).

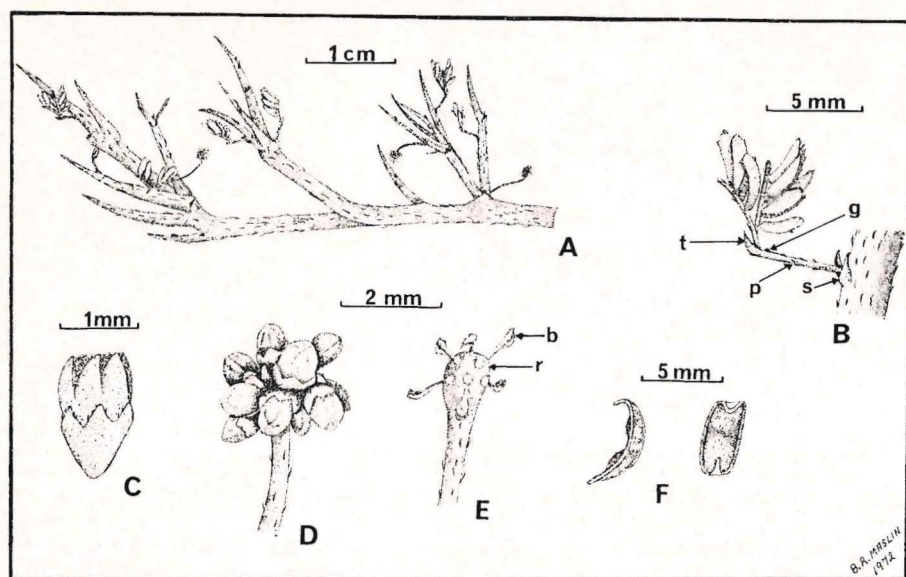


Figure 2—*Acacia echinata* sp. nov. A—Portion of branch system. B—Node showing petiole (p), stipules (s), terminal seta (t), and gland (g). C—Flower. D—Flower head. E—Receptacle (r) with bracteoles (b). F—Pod valves, side and top view. All from K. Newbey 1620.

Dwarf, much branched, compact, cushion-like *shrub*, 2–5 cm high and 50 cm or more in diameter, vegetative parts sparsely strigillose to glabrous; branchlets  $\pm$  erect, spinescent, terete; axillary spines absent. *Stipules* narrowly triangular, 0.5–1 mm long, somewhat thickened especially near the base. *Leaves* bipinnate; *pinnae* 1 pair; *petiole* prominent, 3–4 mm long, terete, slightly contracted at base; *terminal seta* 0.5–1 mm long, somewhat thickened; *gland* on upper surface of petiole (normally near the apex), small, sessile, circular; *rachis* 2–3 mm long, terete, apex somewhat flattened and slightly expanded, obtuse; *pinnules* 3–4 pairs, narrowly oblong to asymmetrically narrowly obovate, 2–3 x ca. 1 mm, obtuse, flat, inconspicuously 1-nerved, smooth. *Flower heads* small, globular, 3–4 mm diameter at anthesis, with 12–15 flowers. *Peduncles* axillary, solitary, 10–15 mm long, sparsely strigillose to glabrous. *Receptacle* globular, glabrous. *Bracteoles* less than 1 mm long, claws short, glabrous, expanded into concave, obtuse, ciliolate laminae. *Flowers* 5-merous; *calyx* about 1/2 length of corolla, turbinate, connate for 3/4 its length, tube glabrous, lobes obtuse ciliolate and slightly incurved at apex; *corolla* 1.5 mm long, connate for 1/2 its length, glabrous; *pollinia* 12-grained; *ovary* sessile, very sparsely papillate. *Legume* narrowly oblong, ca. 10 x 3 mm, with a dark brown undulate moderately strigose surface; margins thickened, light brown, almost straight. *Seed* not seen in mature state.

*Distribution*: South-west Western Australia; known only from the type locality which is a gravelly hill between Kukerin and Tarin Rock. (Figure 4)

6 mi W of Tarin Rock, F. Lullfitz 5901; 198 mile peg Dumbleyung-Lake Grace road, A. S. George 5800.

*Flowering period*: December-January.

The cushion-like habit, the short spinescent branchlets, and the single pair of pinnae borne on a long petiole make *A. echinata* a very distinctive species within the series *Pulchellae*.

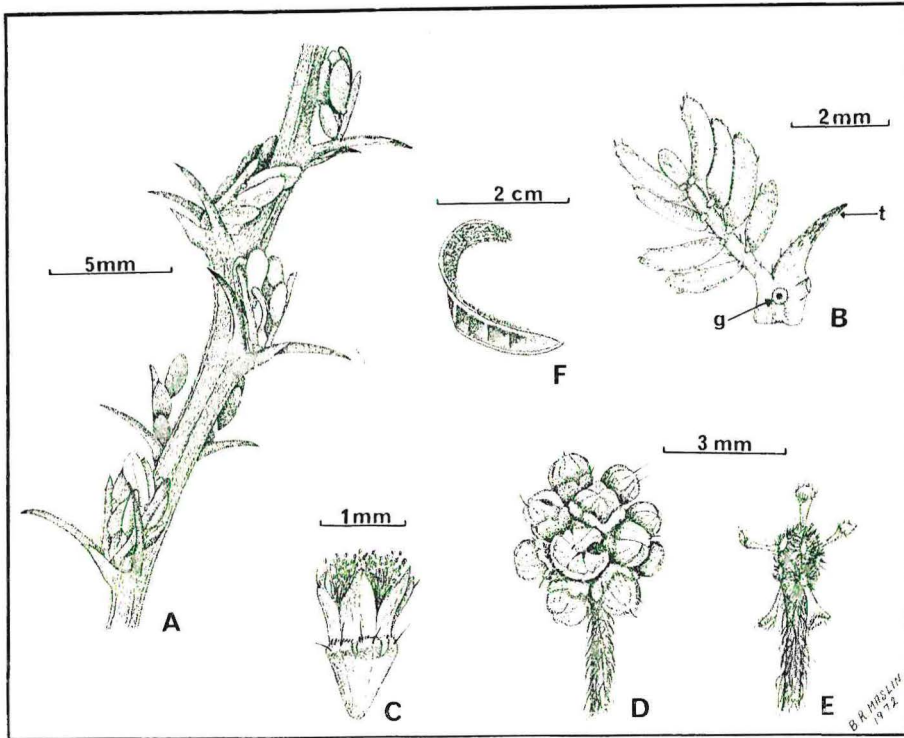


Figure 3—*Acacia moirii* E. Pritzel subsp. *recurvistipula* subsp. nov. A—Portion of branch. B—Leaf with gland (g), and terminal seta (t). C—Flower. D—Flower head. E—Receptacle with bracteoles. F—Pod valve.

A-E from A. S. George 6349; F from B. R. Maslin 525.

***Acacia moirii* E. Pritzel subsp. *recurvistipula* B. R. Maslin subsp. nov. (Figure 3)**

A subspecies *moirii* stipulis spinescentibus recurvis; rhachidi 5 mm longa apice recto; pinnulis 3–5-jugis, parum incrassatis, nerviis vel inconspicue 1-nervatis, laevibus vel sparsim puberulis aliquantum glaucis, differt.

Type: 9 miles north of 'The Humps' (which is ca. 10 miles due north-east of Hyden), Western Australia, 15 July 1970, B. R. Maslin 570 (holo: PERTH).

Differs from *A. moirii* E. Pritzel subsp. *moirii* chiefly in vegetative characters: stipules recurved, spinescent; rachis 5 mm long, apex straight; pinnules 3–5 pairs, scarcely thickened, nerveless or obscurely 1-nerved, glabrous to sparsely puberulous, somewhat glaucous.

Dwarf, erect, compact *shrub*, 20–40 cm tall; branches  $\pm$  flexuose, antorsely puberulous, axillary spines absent. *Stipules* spiny, 3–6 mm long, recurved, sparsely antorsely puberulous, persistent. *Leaves* bipinnate; *pinnae* 1 pair; sparsely antorsely puberulous to glabrous; *petiole* very short, ca. 1 mm long; *terminal seta* spiny, 2–3 mm long, straight or somewhat recurved, persistent; *gland* on upper surface of petiole, circular, sessile; *rachis* ca. 5 mm long, terete, apex straight or slightly recurved  $\pm$  expanded; *pinnules* 3–5 pairs, narrowly oblong to obliquely elliptic, 2–3 x ca. 1 mm, obtuse, flat, nerveless or inconspicuously 1-nerved, smooth, slightly thickened. *Flower heads* globular, ca. 5 mm diameter at anthesis, with ca. 15 flowers. *Peduncles* axillary, solitary, 5–10 mm, mostly retrorsely puberulous. *Receptacle* short, ovoid, ca. 1 mm long, densely puberulous. *Bracteoles* ca. 1 mm long, claws glabrescent, gradually expanded into inflexed, pilose laminae. *Flowers*

5-merous; *calyx* ca.  $1/2$  length of corolla, turbinate, connate for  $3/4$  its length, 5-nerved, tube glabrous, lobes oblong obtuse ciliate (often invested with a few additional long straight hairs) and somewhat incurved at apex; *corolla* 1.5–2 mm long, connate for ca.  $1/2$  its length, 5-nerved, usually glabrous (sometimes invested with a few long straight hairs at apex); *pollinia* 12-grained; *ovary* sessile, sparsely papillate. *Legume*—see below. *Seed* n.v.

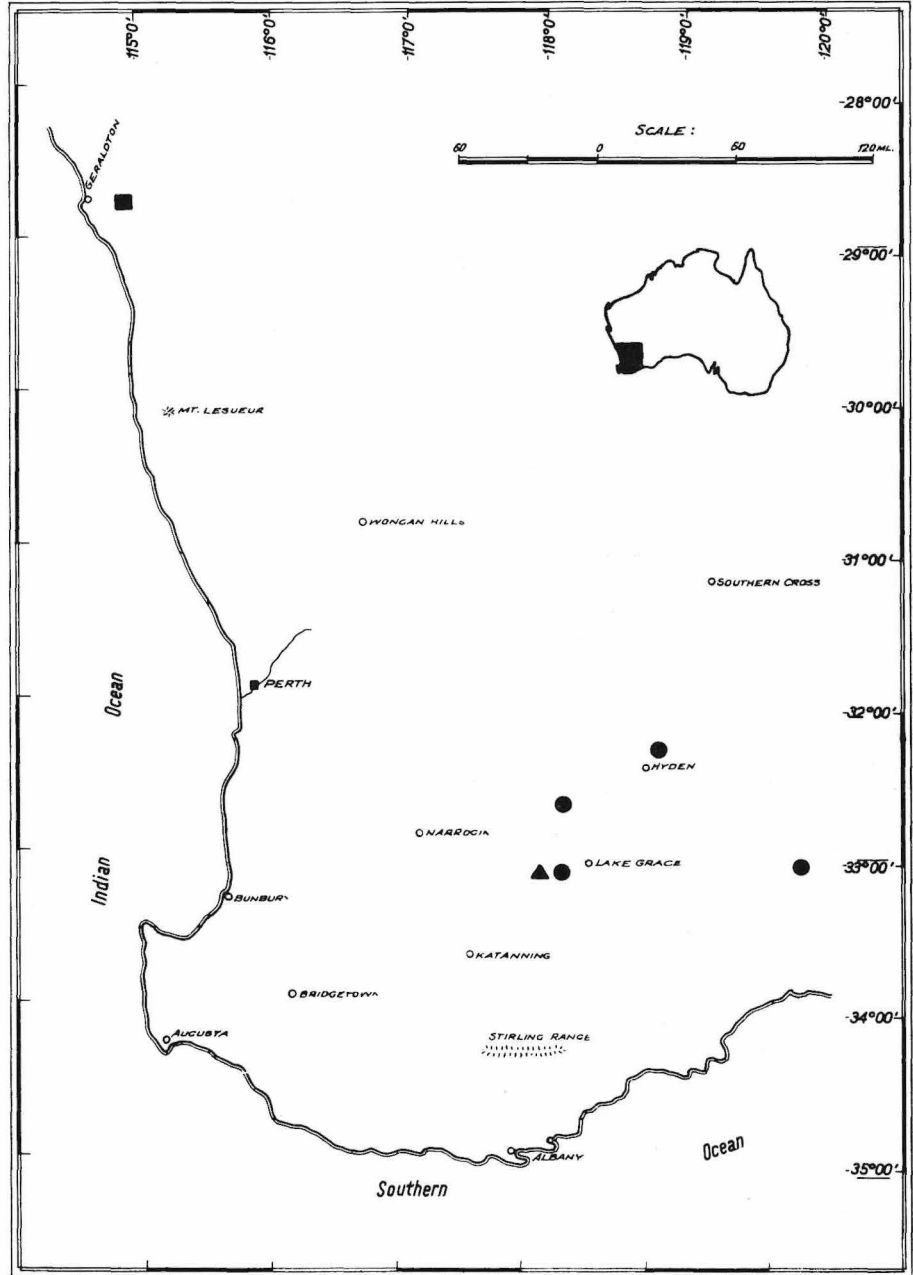


Figure 4—Distribution of *A. megacephala* (■) *A. echinata* (▲), and *A. moirii* subsp. *recurvistipula* (●).

*Distribution:* South-west Western Australia; from Kukerin to Hyden and eastwards to about Lake King. (Figure 4)

8 mi N of 'The Humps', *B. R. Maslin* 569; ca. 4 mi S of Kulin, *B. R. Maslin* 525; 197½ mile-peg, E. of Dumbleyung, *A. S. George* 6349; 16 km W of Lake King township, *P. G. Wilson* 7159; 37 km E of Lake King, *D. Young* 129.

*Flowering period:* May-July.

*A. moirii* subsp. *recurvistipula* differs from the type subspecies chiefly in vegetative characters. Although the stipules of subsp. *moirii* are prominent, and sometimes thickened at the base, they are never spiny or recurved as in the new subspecies. In addition, the rachis of subsp. *moirii* is about twice as long as in subsp. *recurvistipula* and has a more prominently recurved tip. The pinnules of the two subspecies are quite different; in the type subspecies they are thicker, greater in number, and have a prominently raised midrib (a character never found in subsp. *recurvistipula*), they are generally less glaucous, and they have a denser indumentum.

This subspecies usually occurs in open places on sandplains where it grows as a small erect compact shrub. However, on a few occasions it has been found growing among litter beneath tall shrubs such as *Casuarina pinaster* C. A. Gardner. In these latter cases subsp. *recurvistipula* assumes a semi-prostrate and somewhat openly branched habit; in addition its pinnules and peduncles are somewhat enlarged, while the stipules and terminal seta are not so rigid.

No seed of subsp. *recurvistipula* has been collected. The following is a description of a few dehisced fruiting valves caught in the branches of *B. R. Maslin* 525: narrowly oblong, 25 x 5 mm, curved, densely pilose, dark brown, slightly undulate, margins thickened.

The distributions of the two subspecies do not appear to overlap. *A. moirii* subsp. *moirii* has the more southerly range, extending from about Jerramungup to Ravensthorpe while subsp. *recurvistipula* occurs further inland.

## New species and subspecies of *Casuarina* in Western Australia

By L. A. S. Johnson\*

### Abstract

The following taxa are described and discussed: *C. scleroclada* sp. nov., *C. campestris* Diels subsp. *tessellata* (C. A. Gardn.) comb. et stat. nov., *C. campestris* subsp. *eriochlamys* subsp. nov., *C. campestris* subsp. *grossa* subsp. nov. and *C. cristata* Miq. subsp. *pauper* (F. Muell. ex Miq.) comb. et stat. nov.

### Introduction

The following descriptions of new taxa, together with the reduction of a supposed species to subspecific rank, are published so that the names will be available for use in the forthcoming treatment of Casuarinaceae in "The Flora of Western Australia". It is intended to deal with the general taxonomy of the family elsewhere.

For morphological reasons certain terms are employed here and elsewhere in my *Casuarina* studies, for which those more traditionally used in *Casuarina* are indicated in parenthesis: leaf lamina ("tooth", "scale-leaf"), article ("internode"), phyllichnium ("ridge"), infructescence ("cone").

### *Casuarina scleroclada* L. Johnson, sp. nov.

[Greek: skleros = hard, klados = branch]

*Frutex* dioicus 1–3 m altus, saepe trunco singulo, ramis saepe arcuatis, ramulis pendentibus. *Rami persistentes* novelli ramulis deciduis aliquanto similes sed internodiis brevioribus distincti, vetustiores mox lignosi cortice plus minusve sulcato. *Ramuli decidui* multiarticulati, penduli sed duri: verticilli plerumque (9–)10–11-foliati; *laminae foliorum* ("dentes") primo circiter 1.0–1.5 mm longae, demum (fissione vaginarum) usque ad 2.0 mm longae, elongato-triangularis, erectae, brunneae nigrescentesque, marginibus praesertim basin versus plus minusve lanuginoso-ciliatis; *articuli* ("internodia") (1–)2–4(–5) cm longi, plerumque 0.7–0.9 mm crassi, in sicco cinerascens; *phyllichnia* subconvexa (in sicco), haud carinata, pilis sulcorum superficie manifestis sed non protrudentibus. *Inflorescentiae masculae* in ramis persistentibus sessiles (saepe cum ramulis vegetativis in verticillis isdem), 0.3–0.1 (vel plus) cm longae; verticilli bractearum crebri, ad 1.2 mm longi (laminis inclusis); *laminae bractearum* illis foliorum similes sed breviores, circiter 0.5 mm longae; bracteolae persistentes, stipitatae, elongato-cymbiformes, acutae, apicibus ad anthesin plus minusve expositis, marginibus versus apicem minute ciliolatis; tepalum 1 (abaxiale deficiens), adaxiale oblanceolatum, vix cucullatum, antheram partim includens; filamentum 1.5 mm attingens; anthera rubens, apiculata, circiter 0.7 mm longa. *Inflorescentiae foeminae* in ramis persistentibus sessiles, ovoideae, 6–8 mm longae, bracteis tomentosis. *Infructescentiae* ("strobili") sessiles, subgloboisae vel crasse ellipsoideae, apice truncato, 1.5–3.0 cm longae, 1.5–2.5 cm diametro, 18–22-stichae, verticillis fertilibus plerumque 8–12; bracteae tenues apice triangulari tomentoso minute apiculato exposito; *bracteolae* ("valvae") maturitate lignosae, apice crasso convexoque, obtuso, plus minusve glabrato et sine protuberatione separata. *Nux* tota 5–8 mm longa corpore maturo atro vix nitenti, ala expansa quam corpore saepe aliquanto longiore, translucenti basi styli excepta, ad apicem suboblique rotundata apiculataque. Chromosomata somatica 50–52.

*Holotypus* (♀): c. 40 km SSE. of Caiguna (c. 3.2 km in from sea), W.A., 2–3 m, very arching and drooping, no ♂ seen, on limestone plain with mallee and scrub, 1.ix.1967, L. A. S. Johnson 2155, NSW 132432, isotypo in PERTH ponendo.

*Dioecious shrub* 1–3 m, often with a single trunk, the branches often arching and the branchlets drooping. Young *permanent branches* rather similar to the deciduous branchlets but distinguishable by their shorter articles ("internodes"), the older ones soon becoming woody with more or less furrowed,

\* National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, N.S.W. 2000.

hard, grey bark. *Deciduous* ("foliage") branchlets many-jointed, pendulous but hard: whorls usually (9-)10-11-leaved ("-toothed"); *leaf laminae* ("teeth") at first c. 1.0-1.5 mm long but finally apparently up to 2.0 mm long (by splitting of the sheaths), elongate-triangular, erect (appressed to succeeding article), brown and becoming blackish, margins more or less woolly-ciliate especially towards the base; *articles* ("internodes") (1-)2-4(-5) cm long, usually 0.7-0.9 mm thick, becoming ashy-grey when dry; *phyllichnia* ("ridges") slightly convex (when dry) but not keeled, the hairs of the furrows visible on the surface but not protruding. *Male inflorescences* sessile on the permanent branches (often with vegetative branchlets in the same whorl), 0.3-1.0 (or more) cm long; whorls of bracts crowded, to 1.2 mm long (including the laminae); laminae of the bracts ("teeth"), similar to those of the leaves but shorter, about 0.5 mm long; bracteoles persistent, stipitate, elongate-cymbiform, acute, their apices more or less exposed at anthesis, the edges minutely ciliate towards the apex; tepal 1 (the abaxial one lacking), adaxial, oblanceolate, scarcely hooded, partly enwrapping the anther; filament attaining 1.5 mm; anther reddish, apiculate, c. 0.7 mm long. *Female inflorescences* sessile on the permanent branches, ovoid, 6-8 mm long, with tomentose bracts. *Infructescences* ("cones") sessile, subglobose or thickly ellipsoid, truncate at the apex, 1.5-3.0 cm long, 1.5-2.5 cm in diameter, 18-22-stichous (*i.e.* with alternate 9-11-membered whorls), fertile whorls usually 8-12; bracts thin with the tomentose minutely apiculate apex exposed at the cone surface; bracteoles ("valves") woody at maturity, the apex thick and convex, obtuse and without a separate dorsal protuberance. *Nut* 5-8 mm long overall, the body black and scarcely shining when ripe, the wing expanded and usually somewhat longer than the body, translucent (but brownish) apart from the style-base, sub-obliquely rounded and apiculate at the apex. Chromosome No.  $2n = 50-52$ .

*Distribution*: Western Australia, from the Borden district to the western part of the Great Australian Bight.

*Specimens examined*: Western Australia: 312 miles (499 km) on the Lake King-Ravensthorpe road, *E. M. Bennett* 3120, 16.i.1970 (♂ and ♀, apparently separate plants) (PERTH, NSW); 17 miles (27 km) E. of Ravensthorpe on Esperance road, *B. G. Briggs* 442, 443, 444a, 11.ix.1966 (NSW); Mt Ragged, near SW. base, *A. S. George* 2110, 7.xii.1960 (PERTH); Salmon Gums *C. A. Gardner*, v.1924 (PERTH); Great Bight, *Carey* (MEL); 6 miles S. of Toompup, *Newbey* 1249 (PERTH); and the Holotype. Further collections from the Caiguna area by R. F. Parsons seen, but details not recorded (AD).

This sharply defined species is probably nearest to *C. acutivalvis* F. Muell., from which it differs in the arching habit of growth (more pronounced in female plants, *A. S. George* pers. comm.), short sessile male inflorescences, the smaller and always sessile infructescences with obtuse bracteoles, the coarser branchlets and other vegetative parts, as well as in numerous fine details. It differs clearly also from other species of this group, such as *C. campestris* Diels and *C. dielsiana* C. A. Gardn. in habit, male inflorescences, infructescences, and branchlets.

*C. scleroclada* has been little collected but is common enough in places, for instance in the type locality towards the Bight coast from Caiguna. It was first recognized by the author some twenty years ago from the Gardner and the rather fragmentary Carey collections but for many years it was impossible to gain any field knowledge of it or to obtain suitable material for chromosome number determination.

Unlike the diploid *C. acutivalvis*, *C. campestris*, and *C. helmsii* Ewart & Gordon, all of which have  $2n = 24$  (Barlow 1959), and *C. dielsiana* ( $2n = 28$ ), *C. scleroclada* (at least from the type locality) is at the tetraploid level with  $2n = 50-52$ .

This widespread species is fairly uniform over much of its range but in the Mt. Singleton and Kalgoorlie districts, as well as towards the southern coast, populations occur which appear to be best retained within *C. campestris* but differ sufficiently to warrant subspecific rank. *C. dielsiana* C. A. Gardn. also greatly resembles *C. campestris* in vegetative features but differs in the infructescences, the peculiar short, more or less globose male inflorescences, and in chromosome number (Barlow 1959).

Thus *C. campestris* can be regarded as comprising four subspecies which show some morphological intergradation and some geographic overlap. For some purposes, and with intermediate material, it may be convenient to refer simply to *C. campestris*, but the following key indicates the more characteristic features of the four races. Specimens without infructescences may be difficult to determine unless they are associated with fruiting material from the same population.

### Key to Subspecies

1. Surface of fruiting bracteoles divided into 4 "protuberances" (Infructescences pedunculate, glabrescent, bracteoles protruding, phyllichnia markedly convex when dry, leaf-whorls mostly 9-merous) 1. subsp. *tessellata*
- 1\*. Surface of fruiting bracteoles not divided.
2. Infructescences mostly sessile or subsessile (fruiting peduncles mostly 0-4 mm), mostly 1.3-4.0 x 1.2-1.6 cm, glabrescent when ripe. Bracteoles protruding, phyllichnia markedly convex when dry (leaf-whorls 7-9-merous) 2. subsp. *campestris*
- 2\*. Infructescences on peduncles of 4-15 mm, either greyish-pubescent to tomentose when ripe or mostly 1.8-2.8 cm in diameter. Bracteoles flush or protruding. Phyllichnia only slightly convex when dry
3. Infructescences mostly 2.0-3.5 x 1.3-1.6 cm, with fruiting bracteoles  $\pm$  flush with general surface and tawny to greyish pubescent or tomentose. Articles 5-12 mm long, 0.8-0.9 mm diam. (when dry), leaf-whorls 8-9-merous 3. subsp. *eriochlamys*
- 3\*. Infructescences mostly 2.0-5.2 x 1.8-2.8 cm, with fruiting bracteoles markedly protruding, tawny pubescent at first but glabrescent when fully ripe. Articles 8-15 mm long, 0.9-1.1 mm diam. (when dry), leaf-whorls 8-11-merous 4. subsp. *grossa*

#### 1. subsp. *campestris*

*Lectotypus*: Watheroo, *L. Diels* 2038, 31.xii.1900 (B). This is one of four syntypes and is a specimen with mature infructescences which are characteristically sessile, slender, and glabrescent. The Casuarinaceae in the Berlin Herbarium fortunately survived the 1939-1945 war.

This is the very wide-ranging and familiar form of *C. campestris* found throughout the wheat belt of Western Australia on sandplains and laterite. Occasional individuals may be found with over-sized infructescences, and there are forms near the southern coast which may approach subsp. *grossa* in this respect, though the infructescences are usually sessile or subsessile. Intergrading to subsp. *eriochlamys* appears to occur in the Coolgardie district. There is geographic overlap with subsp. *grossa* in the Norseman-Esperance area (see below).

#### 2. subsp. *tessellata* (C. A. Gardn.) L. Johnson, comb. et. stat. nov.

*C. tessellata* C. A. Gardn. in J. Roy. Soc. W. Austral. 22:119 (1936). *Holotypus*: Summit of Mt. Singleton, *C. A. Gardner* 2217, 9.vii.1931. "erect, 10-15 ft. high, red loamy soil", ♀ with cones (PERTH, isotype in K).

I have seen a number of collections, but all are from the type locality and they include no male material. A possibility remains that male inflorescences or chromosome number may support its retention as a species, but on the known characters it appears to differ no more from *C. campestris* subsp. *campestris*

than do the other subspecies here recognized. Subsp. *tessellata* is distinguished by the combination of characters listed in the Key. The peduncles range from 7 to 15 mm in length and the infructescences are similar in shape and size (but not bracteoles) to those of subsp. *campestris*, which subsp. *tessellata* also resembles in branchlet dimension and surface.

3. subsp. *eriochlamys* L. Johnson, subsp. nov.

[Greek: erion = wool, chlamys = mantle]

*Articuli* ramulorum 5–12 mm longi, 0·8–0·9 mm crassi, phyllichniis subconvexis, verticillis plerumque 8–9 foliatis. *Inflorescentiae masculae* eis subsp. *campestris* similes. *Infructescentiae* ("strobili") in pedunculis 7–13 mm longis, maturae circiter 2·0–3·0 cm longae, 1·2–1·6 cm diametro; bractearum facies externa ea subspecierum alterarum crassior; bracteolae ("valvae") haud protrudentes, ad maturitatem pubescentes vel cano-tomentosae. *Holotypus*: NSW 61832, Comet Vale, J. T. *Jutson* 255, viii.1917, ♀ with inflorescences and infructescences.

Branchlet *articles* 5–12 mm long, 0·8–0·9 mm thick, phyllichnia ("ridges") somewhat convex but not prominently so, whorls with 8–9 leaves ("teeth"). *Male inflorescences* like those of subsp. *campestris*. *Infructescences* ("cones") on peduncles of 7–13 mm, when mature 2·0–3·0 cm long, 1·3–1·6 cm in diameter; the outer face of the bracts thicker than in the other subspecies; bracteoles ("valves") not protruding (flush with the general cone surface), tawny to greyish or whitish pubescent or tomentose at maturity.

This subspecies is represented by a number of collections from Comet Vale (of which Royce 4444 and Gardner 7969 in PERTH are good examples). Some specimens of subsp. *campestris* from the Coolgardie district show some approach to subsp. *eriochlamys* in having a denser and more persistent indumentum on the infructescences and less convex phyllichnia than is usual in the type subspecies. Again, subsp. *grossa* shares certain characters (pedunculate infructescences, non-prominent phyllichnia) with subsp. *eriochlamys* and in the northern part of its range may approach the latter subspecies.

4. subsp. *grossa* L. Johnson, subsp. nov.

[Latin: grossus = coarse, thick]

*Articuli* ramulorum 8–15 mm longi, 0·9–1·1 mm crassi, phyllichniis planis vel subconvexis, verticillis 8–11-foliatis. *Inflorescentiae masculae* eis subsp. *campestris* similes sed aliquanto crassiores. *Infructescentiae* ("strobili") in pedunculis 4–15 mm longis, maturae 2·0–5·2 cm longae, 1·8–2·8 cm diametro; bracteolae ("valvae") valde protrudentes, primum fulvo-pubescentes sed ad maturitatem glabrescentes. *Holotypus*: NSW 58480, 5½ miles (9 km) N. of Norseman, L. A. S. *Johnson* W177, 18.xii.1960, "bushy shrubs to 2–2·5 m around granite tors with *Eucalyptus websterana*. Uniform population. Dioecious here. *C. helmsii* nearby". Isotype in PERTH.

Branchlet *articles* 8–15 mm long, 0·9–1·1 mm thick, phyllichnia ("ridges") flat or somewhat convex but not prominently so, whorls with 8–11 leaves ("teeth"). *Male inflorescences* like those of subsp. *campestris* but somewhat thicker. *Infructescences* ("cones") on peduncles of 4–15 mm, when mature 2·0–5·2 cm long, 1·8–2·8 cm in diameter; bracteoles ("valves") strongly protruding, at first tawny-pubescent but glabrescent at maturity.

This subspecies grows characteristically around granite tors in the Norseman district, a habitat rather different from those of subsp. *campestris*. There are a number of collections from this area and habitat but there are also forms with large infructescences and coarse branchlets in various other south-eastern localities which seem to connect subsp. *grossa* with subsp. *campestris*.

More extensive collecting and exploration may make it clearer whether these four races are in fact best treated as subspecies.

**Casuarina cristata** Miq., Rev. Crit. Cas. 70, t.10 (1848).

This widespread species will be dealt with elsewhere but it is convenient at this stage to establish formally the two subspecies into which it may be subdivided.

**1. subsp. cristata**

This comprises the populations in Queensland (except for a small area of subsp. *pauper* in the far south-west, isolated from other Queensland occurrences of the species) and in New South Wales east of a line from west of Moree to Lake Cargelligo and Barmedman. In this area, where it is known as "Belah", it occurs on heavy grey or black soils with calcium carbonate in the lower horizons. The type locality is at "Fields Plains", now the Condobolin district. For some 50 km or so to the west of this line there are occasional occurrences of forms intermediate between subsp. *cristata* and subsp. *pauper*.

**2. subsp. pauper** (F. Muell. ex Miq.) L. Johnson, comb. et stat. nov.

*C. pauper* F. Muell. ex Miq. in Ned. Kruidk. Arch. 4:98 (1859).

This subspecies, the "Black Oak" of South Australia, extends from western New South Wales (west of the transitional zone to subsp. *cristata*) through north-western Victoria and South Australia (the type locality is in Eyre Peninsula) to southern inland districts of Western Australia, where it appears sometimes to hybridize with *C. obesa* Miq.

*C. cristata* subsp. *pauper* also occurs on soils with a calcareous subsoil but these usually have a lighter-textured and more reddish or brownish surface horizon than those on which subsp. *cristata* occurs. It differs from subsp. *cristata* in the usually thicker and more waxy-surfaced branchlets and the shorter fruiting bracteoles of the infructescences, which are also often more persistently tawny-pubescent. The trees are usually smaller and of poorer form.

*C. obesa* is more closely related to the eastern Australian *C. glauca* Sieber ex Spreng. and, like that species, occurs on more or less saline soils. It is common in Western Australia but in South Australia and New South Wales it is known to persist in only two localities, whilst in Victoria it is represented only by one old unlocalized collection.

I am grateful to the past and present officers in charge of the herbaria from which specimens have been examined and to Dr R. F. Parsons for the opportunity of examining his collections. My colleague Dr Barbara Briggs has kindly made available the result of her investigation of the chromosome number of *C. scleroclada*. Mrs Eleanor Bennett has been most helpful in the provision of material and information.

**Reference**

- BARLOW, B. A. (1959)—Chromosome numbers in the Casuarinaceae. Austral. J. Bot. 7:230–237.

## New taxa and new combinations in Western Australian Pittosporaceae

By Eleanor M. Bennett

### Abstract

It is proposed that the genera *Marianthus* and *Billardiera* be combined under *Billardiera*. The necessary new combinations are made, and three new varieties described. Two new varieties are described in the genus *Cheiranthra*.

A new combination, using the earliest available epithet, is provided for the solitary species of *Pronaya*.

### Introduction

The genera *Marianthus* and *Billardiera* are here combined under *Billardiera*. These genera have been distinguished by former workers on their fruit which in *Billardiera* is a berry and in *Marianthus* is a capsule. This division does not appear to be a natural one since a separation based on floral characters would provide a quite different arrangement of species. The use of fruit characters for delimiting these two genera also makes impossible the ready identification of flowering material, as an examination of the ovary provides no clue to its future form and in fact several species have been, and continue to be, incorrectly placed.

In addition two new varieties of *Cheiranthra* are described, one in each of the two species which occur in Western Australia.

In *Pronaya*, the name *P. elegans* Hueg., which has been in common use, is antedated by the name *Spiranthera fraseri* Hook. and a new combination is made accordingly.

Species have been accepted after consulting type specimens, descriptions and dates of publication, occasionally resulting in the changing of previously accepted names.

These new combinations and varieties are being published prior to a revision of the Western Australian species of *Pittosporaceae* in a forthcoming Flora part.

### Billardiera

**Billardiera** Sm., Spec. Bot. Nov. Holl. 1:t.1 (1793). *Type: B. scandens* Sm.

*Labillardiera* Roem. et Schult., Syst. Veg. 5:330 (1819). nom. illeg. based on above.

*Marianthus* Hueg. ex Endl., Enum. Pl. Hueg. 8 (1837). *Type: M. candidus* Hueg. ex Endl.

*Oncosporum* Putterl. in Endl. et Fenzl., Nov. Stirp. Dec. 9 (1839).

*Type: C. bicolor* Putterl.

*Calopetalon* J. Drumm. ex Harv., Hooker's Journ. Bot. Kew Gard. Misc. 7:52 (1855). *Type: C. ringens* J. Drumm. ex Harv.

*Cyathomiscus* Turcz., Bull. Soc. Imp. Nat. Mosc. 36/1:562 (1863).

*Type: C. cuneatum* Turcz.

**Billardiera laxiflora** (Benth.) E. M. Bennett comb. nov.

*Marianthus* ? *laxiflorus* Benth., Fl. Austral. 1:119 (1863). *Lectotype:* Herb. Mueller, Porongurup Range, W. Australia, (holo:MEL).

*Billardiera gracilis* Diels, Bot. Jahrb. 35:213 (1904). *Type:* King George Sound, Diels 2259 and Pritzel 252 (syn:PERTH).

**Billardiera villosa** (Turcz.) E. M. Bennett comb. nov.

*Oncosporum villosum* Turcz., Bull. Soc. Imp. Nat. Mosc. 27:365 (1854).  
Type: Western Australia, *Drummond* 5th Coll., n.242 (iso:MEL).  
*Oncosporum microphyllum* Turcz., loc. cit. Type: not given.  
*Marianthus microphyllum* (Turcz.) Benth., Fl. Austral. 1:117 (1863).  
*M. rhytidosporus* F. Muell., Fragm. 2:145 (1861). Type: Near Esperance Bay, W. Australia, *Maxwell* (holo:MEL).

**Billardiera granulata** (Turcz.) E. M. Bennett comb. nov.

*Oncosporum granulatum* Turcz., Bull. Soc. Imp. Nat. Mosc. 27:366 (1854).  
Type: Western Australia, *Drummond* 3rd Coll., n.210 (iso:W).  
*Marianthus granulatus* (Turcz.) Benth., Fl. Austral. 1:118 (1863).  
*M. parviflorus* F. Muell., Fragm. 2:144 (1861). Type: Porongurup Range, W. Australia, *Maxwell* (holo:MEL).

**Billardiera candida** (Hueg. ex Endl.) E. M. Bennett comb. nov.

*Marianthus candidus* Hueg. ex Endl., Enum. Pl. Hueg. 8 (1837).  
Type: Western Australia, Huegel (holo:W).

**Billardiera coeruleo-punctata** (Klotsch) E. M. Bennett comb. nov.

*Marianthus coeruleo-punctatus* Klotsch in Link, Klotsch et Otto, Ic. Pl. Rar. 28 t. 12 (1840). Lectotype: Western Australia, 1839, *Drummond* (iso:W).  
*Pronaya pedunculosa* Turcz., Bull. Soc. Nat. Mosc. 36:560 (1863).  
Type: Western Australia, 1839, *J. Drummond* (holo:W).

**Billardiera drummondiana** (Putterl.) E. M. Bennett comb. nov.

*Oncosporum drummondianum* Putterl. in Lehm., Pl. Preiss. 1:194 (1844).  
Lectotype: Western Australia, *Preiss* 1288 (holo:W).  
*Marianthus drummondianus* (Putterl.) Benth., Fl. Austral. 1:119 (1863).  
*Billardiera dorrienii* Domin. Mém.Soc.Sc.Bohême 2:24 (1923) (holo:K, photo seen).

**B. drummondiana** var. **collina** E. M. Bennett var. nov. (L. *collinus*—occurring on hills)

Folia, caules, calyces et pedicelli dense hirsuti pilis longis unicellulosis etiam breves multicellulosis. Pedicelli 4–10 (15) mm longi.

Type: Bushmead-Kalamunda area, W. Australia, 19 Sep. 1966, *F. W. Humphreys* 24, (holo:PERTH).

Leaves stems, calyces and pedicels densely hirsute with long unicellular and short multicellular hairs. Pedicels 4–10(15) mm long.

The typical variety differs from var. *collina* in having only unicellular hairs scattered on the leaves, stems and calyces and in having long pedicels. It is found around Cranbrook and Manjimup while var. *collina* is found in the Darling Ranges.

**Billardiera bicolor** (Putterl.) E. M. Bennett comb. nov.

*Oncosporum bicolor* Putterl. in Endl. et Fenzl., Nov. Stirp. Dec. 9 (July 1839). Type: Western Australia, *Huegel* (n.v.).  
*Marianthus pictus* Lindl., Sketch Veg. Swan Riv. Col. 22 (Dec. 1839).  
Type: Western Australia (holo:CGE, photo seen).

**B. bicolor** var. **lineata** (F. Muell.) E. M. Bennett comb. et stat. nov.

*M. lineatus* F. Muell., Fragm. 1:27 (1859). Type: Murchison River, W. Australia, *F. Mueller*. (holo:MEL; iso:W).

In var. *lineata*, the pedicel is stout, the corymbs are shorter than or just exceed the leaves and the capsule is cartilaginous. The typical variety has a slender pedicel, corymbs which exceed the leaves and a crustaceous capsule.

**Billardiera erubescens** (Putterl.) E. M. Bennett comb. nov.

*Marianthus erubescens* Putterl. in Endl. et Fenzl., Nov. Stirp. Dec. 60 (1839). *Type*: Western Australia, 1837, *Roe* (holo:W).

*M. purpureus* Turcz., Bull. Soc. Nat. Mosc. 27:364 (1854). *Type*: Western Australia, *J. Drummond* 4th Coll., n.96, (n.v.).

**Billardiera ringens** (Drumm. ex Harv.) E. M. Bennett comb. nov.

*Calopetalon ringens* Drumm. ex Harv., Hooker's Journ. Bot. Kew Garden. Misc. 7:52 (1855). *Type*: Chapman, W. Australia, *J. Drummond* (n.v.).

*Marianthus ringens* (Drumm. ex Harv.) F. Muell., Fragm. 1:218 (1859).

**Billardiera sericea** (Turcz.) E. M. Bennett comb. nov.

*Pronaya sericea* Turcz., Bull. Soc. Imp. Nat. Mosc. 27:363 (1854).

*Type*: Western Australia, *J. Drummond* 4th Coll., n.97 (iso:MEL).

**Billardiera parviflora** DC., Prodr. 1:346 (1824).

*Type*: Western Australia, *Leschenault* (holo:G-DC).

*Marianthus tenuis* Benth., Fl. Austral. 1:119 (1863). *Syntypes*: Flinders Bay, W. Australia, *Collie* (K, MEL); Geographe Bay, *Leschenault* (n.v.); Cape Naturaliste, *Oldfield* (n.v.).

*M. gracilis* Ostenf., Dansk. Vidensk. Selsk. Biol. Medd. 312:67 Pl. 9. (1921). *Type*: Yallingup Cave, 26 Sept. 1914, *Ostenfeld* 1018. (n.v.)

**B. parviflora** var. *guttata* E. M. Bennett var. nov. (*L. guttatus*—spotted)

Petala caesia, fauce atro-cyaneo-maculata.

*Type*: Armadale-Jarrahdale, W. Australia, 3 Aug. 1960, *F. C. J. Lullfitz* (holo:PERTH).

The var. *guttata* differs from the typical variety in the petals having dark blue spots in the throat. It occurs in the southern areas of the Darling Range whereas the typical variety is found near Augusta.

### Cheiranthera

**Cheiranthera preissiana** Putterl. in Lehm., Pl. Preiss. 1:201 (1845).

*Type*: York, *Preiss* 1291 (iso:MEL).

*C. parviflora* Benth., Fl. Austral. 1:128 (1863). *Type*: Western Australia, *J. Drummond* n.34 and 80 (syn:MEL).

**C. preissiana** var. *planifolia* E. M. Bennett var. nov. (*L. planus, folium*—flat leaved)

Folia linearia, plana, glabra vel pilis sparsis. Surculi et folia juvenes pilis sparsis.

*Type*: Nornalup, W. Australia, *E. M. Bennett* 3184, 19 Jan. 1970 (holo: PERTH).

Leaves linear, flat, glabrous or with scattered hairs. Young shoots and leaves with scattered hairs.

The typical variety differs from var. *planifolia* in having ovate, pubescent leaves.

**Cheiranthera filifolia** Turcz., Bull. Soc. Nat. Mosc. 27:364 (1854).

*Type*: Western Australia, *Drummond* 4th Coll. n.94, (iso:MEL).

*C. tortilis* F. Muell., Fragm. 2:79 (1860). *Type*: South-west of Western Australia, *F. Mueller* (n.v.).

**C. filifolia** var. **brevifolia** (F. Muell.) Benth., Fl. Austral. 1:128 (1863).  
*C. brevifolia* F. Muell., Fragm. 1:97 (1858). Type: Phillips Range,  
F. Mueller (holo:MEL).

**C. filifolia** var. **simplicifolia** E. M. Bennett var. nov. (*L. simplex*, *folium*—  
simple leaved)

Folia plana, linearia, acuminata.

Type: Pindar, W. Australia, *C. A. Gardner* 7766 (holo:PERTH).  
Leaves flat, linear, acuminate.

This variety differs from the typical variety and from var. *brevifolia* (F. Muell.) Benth. in having flat leaves. The other two varieties have terete, canaliculate leaves.

### Pronaya

**Pronaya fraseri** (Hook.) E. M. Bennett comb. nov.

*Spiranthera fraseri* Hook., Bot. Mag. 63, sub tab. 3253 (1836).

Type: Western Australia, *Fraser* (n.v.).

*Campylanthera fraseri* (Hook.) Hook., Icones Pl. 1: tab. 82 (Mar. 1837).

*Pronaya speciosa* Endl., in Endl. et al., Enum. Pl. Huegel: 9 (April 1837).

Type: King George Sound, W. Australia, *Ferd. Bauer* (holo: W).

*Pronaya elegans* Hueg., Bot. Archiv. tab. 6 (April-May 1837).

Type: Western Australia, *F. Bauer* (n.v.). *Billardiera elegans* (Hueg.)  
F. Muell., Pl. Indig. Col. Vict. 1: 78 (1862).

**P. fraseri** var. **minor** (Benth.) E. M. Bennett comb. nov.

*Pronaya elegans* Hueg. var. *minor* Benth., Fl. Austral. 1: 126 (1863).

Type: South coast (W. Australia), *R. Brown* (n.v.).

## A revision of the genus *Lamarchea* Gaudichaud (Myrtaceae: Leptospermoideae)

By A. S. George

### Abstract

The Australian genus *Lamarchea* Gaud., containing two species and one variety, is described and discussed. One new species is described, *L. sulcata* sp. nov. from the west-central Australian deserts, and one new variety, *L. hakeifolia* Gaud. var. *brevifolia* var. nov. from near Shark Bay, Western Australia.

### Introduction

A revision of this small genus, previously thought to be monotypic, was prompted by the recognition of a new species from the inland deserts. Since the genus was described in 1829–30 from specimens collected at Shark Bay in 1818, it has received little attention, being simply enumerated or briefly described in such works as Bentham, *Flora Australiensis* (1866) and Lemée, *Dictionnaire descriptif et synonymique des genres de plantes phanérogames* (1931).

### *Lamarchea*

*Lamarchea* Gaudichaud-Beaupré in Freycinet, *Voy. Uran. et Phys.*, Bot. 483, tab. 110 (text March 1830, tab. Sept. 1829). Named after M. Lamarche, "capitaine de vaisseau, lieutenant en pied de l'Uranie, témoignage d'attachement".  
Endlicher, *Gen. Pl.* 2:1237 (1836); Bentham & Hooker, *Gen. Pl.* 1:704 (1865); Bentham, *Fl. Austral.* 3:123 (1866); Bentham, *Notes on Myrtaceae*, *J. Linn. Soc.*, Bot. 10 (1867); Lemée, *Dict.* 3:930 (1931). *Lamarckea* Reichb. *Consp.* 175 (1828).

Shrubs with the bark on older stems in papery layers. Young shoots and flowers with an indumentum of simple hairs. Leaves scattered, flat or terete, coriaceous. Flowers solitary, scattered, on stems of previous season or older stems, the buds covered by imbricate deciduous scales. Hypanthium campanulate with 5 imbricate calyx-lobes. Petals free, longer than the calyx-lobes. Stamens united in a slightly down-curved tube which is divided into 5 lobes more deeply so on the lower side, the two uppermost lobes the longest, the lowermost one the shortest, each with about 10–15 marginal hirsute filaments; anthers versatile. Style filiform, inserted in a depression on the convex summit of the ovary; stigma small, capitate. Ovary sunken in calyx-tube, 3-celled, with numerous ovules ascending from axile peltate placentae. Fruit woody, persistent, obovoid, the calyx-lobes, petals and staminal tube deciduous after flowering. Seeds  $\pm$  oblong-cuneate, angular, black or brown, many infertile.

*Type Species: Lamarchea hakeifolia* Gaud.

*Distribution:* Australia: Western Australia and Northern Territory: central west coast; Victoria, Gibson and southern Great Sandy Deserts (Figure 1).

Bentham (1866) described the ovules as "descending from a peltate placenta", but in fact the placentae are basal. Although closely allied to the large genus *Melaleuca*, *Lamarchea* has a distinctive appearance due to the solitary flowers with monadelphous stamens. The staminal tube is slightly curved with unequal lobes, giving a somewhat zygomorphic flower, while the tube and filaments are hirsute. The flowers have the general aspect of some species of *Calothamnus*, which has basifixated anthers. When flowering is

over, the petals fall first, followed shortly by the staminal tube and later the calyx-lobes.

The leaves of *Lamarchea sulcata* sp. nov. appear to be unique in the Myrta-ceae in being sulcate. Terete leaves are common, e.g. in *Melaleuca* and *Calo-thamnus*, and they are sometimes singly-channelled on one side, but no other species with sulcate leaves has been recorded.

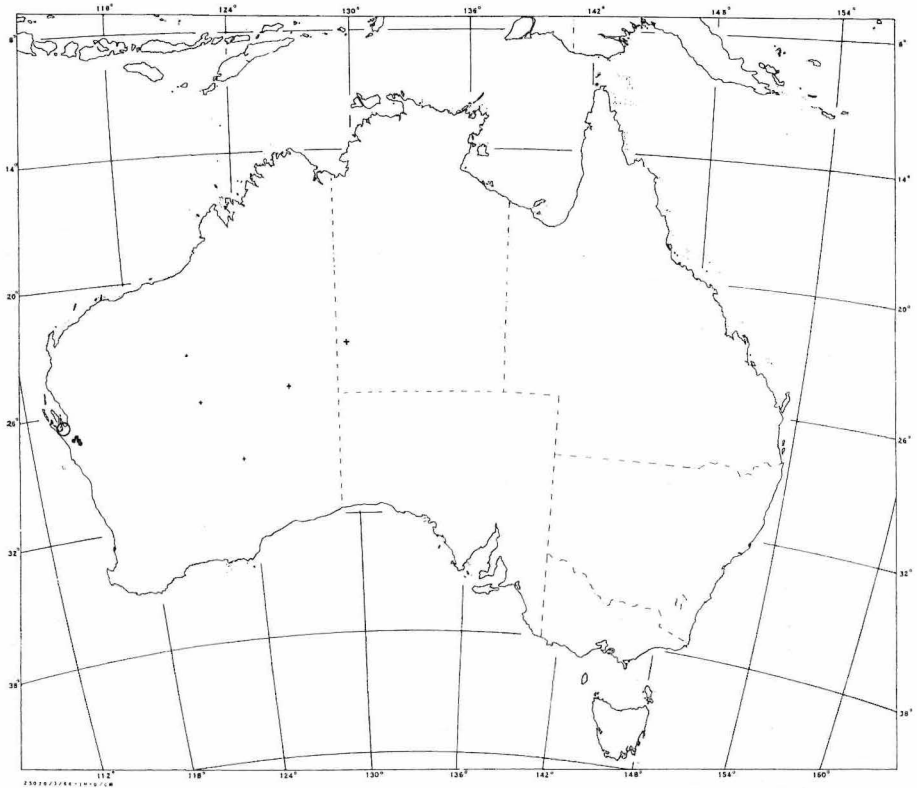


Figure 1—Distribution of *Lamarchea* species. ○—*L. hakeifolia* Gaud. var. *hakeifolia* (the localities are close together and cannot be shown individually at this scale). ●—*L. hakeifolia* var. *brevifolia* var. nov. +—*L. sulcata* sp. nov.

Until recently the genus was considered monotypic, although the former Government Botanist of Western Australia, the late C. A. Gardner, recognised the short-leaved variant of *L. hakeifolia* as a distinct taxon but did not publish it. These two taxa occur within 50 miles of the coast between the Murchison River and Shark Bay, so the occurrence of another species in the inland deserts is of interest phytogeographically. A similar situation but in a reverse direction is in the genus *Philotheca* (Rutaceae): the recently-described *P. tubiflora* A. S. George occurs on the south-western edge of the Great Victoria Desert, while the other few species are found near the coast in Queensland and New South Wales. A number of other genera are distributed chiefly in wetter parts of temperate or tropical Australia with a few outlying desert species, e.g. *Lomandra* and *Thysanotus* (Liliaceae), *Xanthorrhoea* (Xanthorrhoeaceae), *Kennedia* (Papilionaceae), *Hibbertia* (Dilleniaceae), *Baeckea* and *Calytrix* (Myrtaceae), *Microcorys* (Lamiaceae) and *Stylidium* and *Levenhookia* (Stylidiaceae).

## Key to Species

1. Leaves flat, 3 (5)—nerved
2. Leaves mostly 3–5 cm long
2. Leaves mostly 1–2 cm long
1. Leaves terete, sulcate

1a. *L. hakeifolia* var. *hakeifolia*

1b. *L. hakeifolia* var. *brevifolia*

2. *L. sulcata*

**1. *Lamarchea hakeifolia*** Gaud. in Freycinet, Voy. Uran. et Phys., Bot. 483, tab. 110 (text March 1830, tab. Sept. 1829). Gaudichaud's spelling of *hakeaeifolia* has been altered to *hakeifolia* in accordance with Art. 73 Recommendation 73 G (c) of the International Code.

*Type*: in Novae Hollandiae ora occidentali: baie des Chiens-Marins (= Shark Bay), Gaudichaud. Iso:FI.

### 1a. var *hakeifolia* (Figure 2)

A shrub to 5 m, the older stems with bark decorticating in papery layers. Young shoots densely appressed-sericeous, becoming glabrous, with sub-basal scale-leaves which are narrow-elliptic, obtuse, up to 7 mm long, pubescent outside, several-nerved in centre, margins scarious. Leaves oblong to narrow-lanceolate, sometimes broader in upper half, abruptly narrowed to an acute apex, shortly (1–2 mm) petiolate, flat, (2-) 3–5 (-6.5) cm long, 4–8 mm wide, with 3 main nerves, more prominent below, and a marginal or sub-marginal nerve. Flowers usually on the older stems from which the leaves have fallen, at first orange- or yellow-green, turning dull red. Buds covered with deciduous ovate obtuse scales which are  $\pm$  2 mm long and pubescent outside. Pedicel 1–2 mm long, pubescent. Hypanthium 3.5–4.5 mm long including upper free part, hirsute; calyx-lobes elliptic-ovate, 4–6 mm long, shortly pubescent with spreading hairs on both sides, thick but with thin, fimbriate margins. Petals and staminal tube on a slightly raised narrow disc. Petals oblong-obovate, obtuse, 11–17 mm long, appressed-pubescent outside in upper half, otherwise glabrous, thin, the margins almost scarious, ciliate. Stamens 30–43 mm long, the tube deeply divided, base glabrous, upper part and filaments hirsute except at apices; anthers linear, 1–1.5 mm long. Style 35–50 mm long, slender, glabrous, stigma  $\pm$  0.75 mm diam. Summit of ovary densely pubescent. Fruit sessile, depressed-obovoid, 9–12 mm long, 10–12 mm wide, smooth or the base slightly corky, orifice 3–4 mm diam., truncate or very shortly 5-lobed. Seed  $\pm$  oblong—narrow—cuneate, variously angular, 2–3 mm long, shining.

*Distribution*: Western Australia: central west coast, just south of Shark Bay.

Peron Peninsula, Shark Bay, 26 Aug. 1931, C. A. Gardner 2547; Shark Bay road, 5 miles N. of Tamala turnoff, 26 Aug. 1969, A. S. George 9559; Shark Bay Road, Oct. 1966, W. Rogerson 295; Nilemah Station, Hamelin Pool, 28 Aug. 1931, C. A. Gardner and W. E. Blackall 538; 15 miles NE of Tamala Station, 13 Oct. 1960, S. Davies (all at PERTH). (Figure 1).

This variety grows in red sand in tall scrub. The main flowering period is August to October, and new growth begins at this time.

The isotype at FI is in leaf only, with a single detached fruit. Gaudichaud's illustration shows flowers and buds among the leaves, but it is possible that this was a "reconstructed" specimen. The flowers are easily detached in drying and in this variety they are usually on the old stems only. The illustration also shows the lobes of the staminal tube of equal length with 7–11 filaments each, whereas the upper two are the longest, the lowest one the shortest, with the other two intermediate, and all have about 10–15 filaments.

### 1b. var. *brevifolia* A. S. George, var. nov. (Figure 3)

A varietate typica foliis 1–2 cm longis, 3–5 mm latis, floribus plerumque folia ramulorum juniorum interpositis, calycis lobis 3.5–4.5 mm longis, petalis 10–13 mm longis, staminibus 25–35 mm longis, stylo 25–35 mm longo, fructibus 8–10 mm longis 9–10 mm latis, differt.

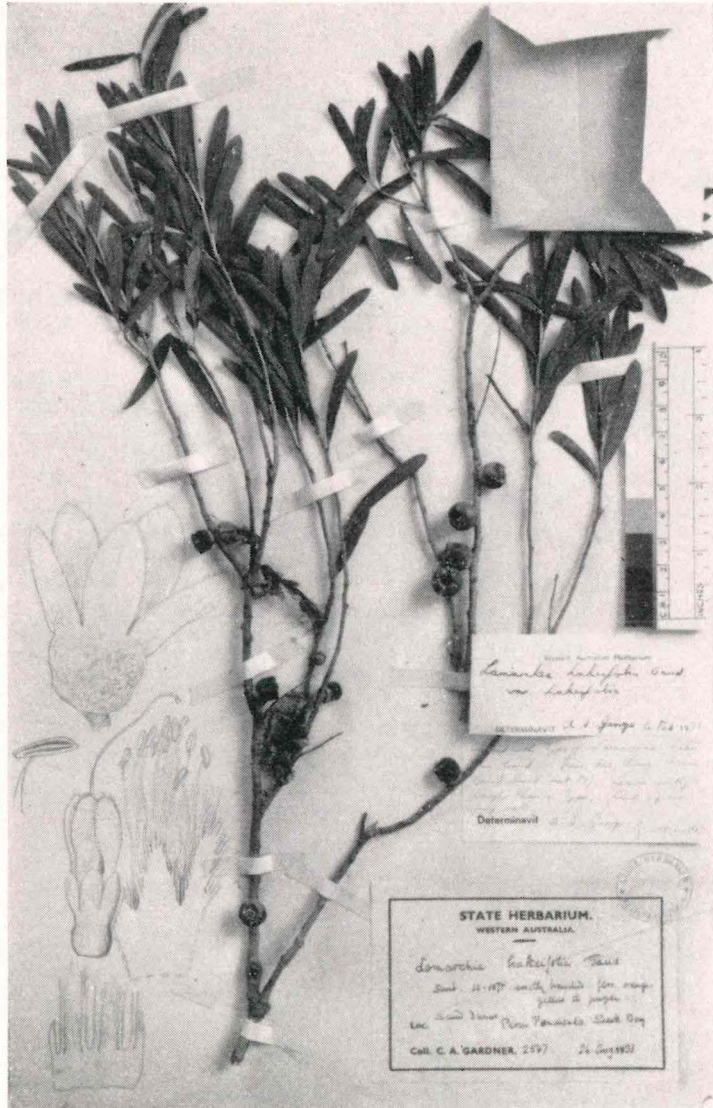


Figure 2—*Lan. arcea hakeifolia* Gaud. var. *hakeifolia*. Peron Peninsula, Gardner 2547.

*Type*: Near 413 mile peg, North West Coastal Highway ( $\pm$  100 miles N of Geraldton), Western Australia, 2 Jan., 1972, *A. S. George* 11229. Holo:PERTH, iso : PERTH, AD, BRI, CANB, K, MEL, NSW, RSA.

Differs from the typical variety in having leaves 1-2 cm long, 3-5 mm wide. *Flowers* generally among the leaves of the younger branchlets. *Calyx* lobes 3.5-4.5 mm long. *Petals* 10-13 mm long. *Stamens* 25-25 mm long. *Style* 25-35 mm long. *Fruit* 8-10 mm long, 9-10 mm wide.

*Distribution*: Western Australia, central west coast between Murchison River and Shark Bay, up to 50 miles inland.

32 miles N. of Murchison River, NW Coastal Highway, 18 Feb. 1962, *A. S. George* 3238 (in fruit); No. 2 Tank, Shark bay (road), 17 Sept. 1941, *C. A. Gardner* 6006 (in fruit);

411 mile peg, NW Coastal Highway, 3 March 1966, *E. M. Scrymgeour* 344 (in fruit); 410 mile peg, NW Coastal Highway, 19 Dec. 1962, *F. Lullfitz* 1962 (a) (in flower); 35 km NE of Kalbarri, Murchison River, 18 May 1968, *J. Bannister* (in fruit) (all at PERTH). (Figure 1).

This taxon differs from the var. *hakeifolia* mainly in the shorter leaves, but the flowers and fruit are also slightly smaller. The indumentum on the young shoots tends to be more dense and spreading, and persists for a longer time, sometimes up to a year.

It grows in sandy loam in tall scrub, but occurs to the south of the area where var. *hakeifolia* is found and farther inland. It flowers from November to January, somewhat later than the typical variety.

One collection at PERTH appears intermediate between the varieties—7 miles S. of Wannoo, N.W. Coastal Highway, 16 Sept. 1968, *M. E. Phillips*



Figure 3—*Lamarchea hakeifolia* Gaud. var. *brevifolia* var. nov. Holotype—George 11229

(duplicate of CBG 025843). It has leaves 2-3 cm long and fruit 8-10 mm long and 9-10 mm wide. Further collecting in the country between the known areas of distribution of the two varieties may reveal further intermediates from one to the other.

2. *Lamarchea sulcata* A. S. George sp. nov. (Figure 4).

A *L. hakeifolia* Gaud. habitu breviori (ad 2 m alt.) patenti, foliis teretibus 5-sulcatis differt. *Folia* (5-) 15-30 (-30) mm longa, pungentes. *Hypanthium*  $\pm$  4 mm longum, calycis lobi 4-5 mm longi. *Petala* 10-13 mm longa. *Stamina* 25-40 mm longa. *Stylus* 30-40 mm longus. *Fructus* 8-10 mm longus, 7-8 mm latus.

*Type*: 12 miles E of Todd Range, Gunbarrel Highway, Gibson Desert, Western Australia (lat. 25°43'S, long. 126°21'E), 2 Oct. 1966, A. S. George 8211. In gravelly loam with scattered *Acacia*, *Eremophila* and *Triodia*. *Holo*: PERTH, *iso*: PERTH, AD, BRI, CANB, K, MEL, NSW.

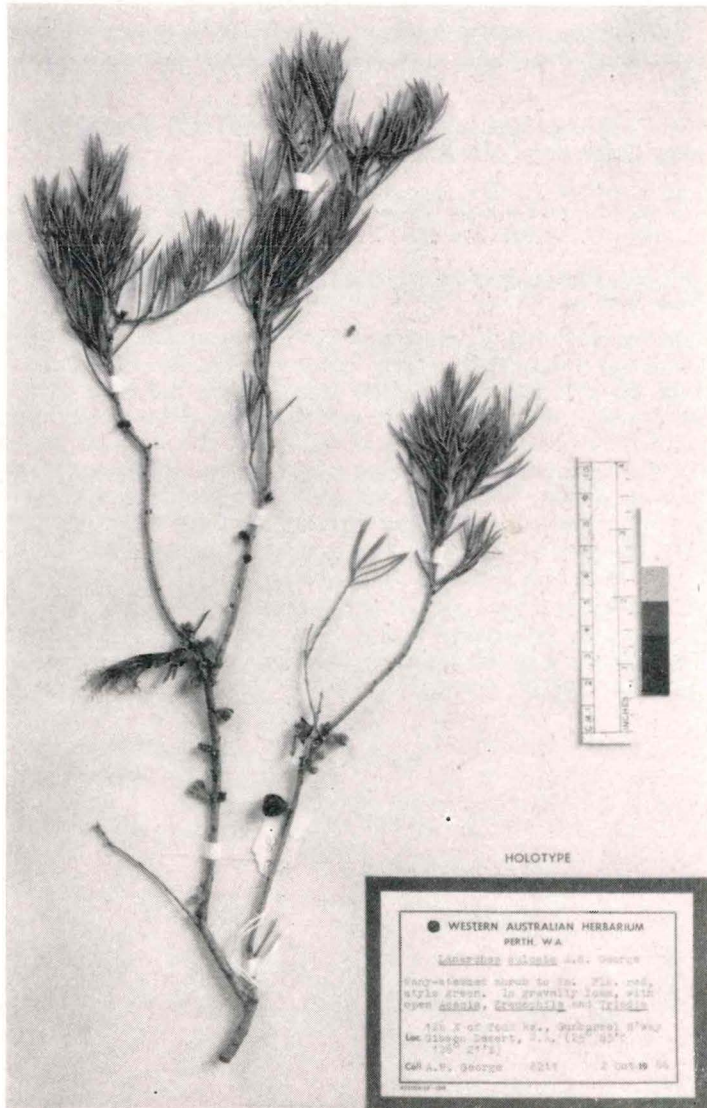


Figure 4—*Lamarchea sulcata* sp. nov. Holotype—George 8211.

A spreading *shrub* to 2 m tall with many stems. Bark on old stems in papery layers. *Young shoots* closely hirsute, becoming glabrous except for a few hairs in the sulcae of the leaves. *Leaves* terete, sulcate with 5 grooves, pungent, (5-) 15-30 (-35) mm long, slightly narrowed into a short petiole. *Flowers* scattered on older stems from which leaves have fallen, green and red. *Buds* covered by imbricate scales which are narrow to broad-ovate, hirsute outside, glabrous inside, deciduous. *Hypanthium* campanulate, densely hirsute,  $\pm 4$  mm long, calyx lobes spreading ovate, obtuse, 4-5 mm long, thick with somewhat scarious margins, glabrous within. *Petals* broadly oblong, concave, obtuse, 10-13 mm long, thin with scarious margins, hirsute outside, glabrous within. *Stamens* 25-40 mm long, the tube glabrous outside at the base, densely hirsute above including the filaments, inside hirsute throughout; lobes with  $\pm 15$  marginal filaments; anthers  $\pm 1.5$  mm long. *Style* 30-40 mm long, glabrous; stigma small. Summit of ovary densely hirsute. *Fruit* almost sessile, obovoid, 8-10 mm long, 7-8 mm diam., smooth, dark brown, orifice  $\pm 5$  mm diam., slightly undulate. Fertile *seeds* few,  $\pm$  oblong, angular, the outer ones curved on outer surface, 2 mm long, black; sterile seeds narrow, dark brown.

*Distribution:* Western Australia and Northern Territory: Victoria, Gibson and southern Great Sandy Deserts.

W.A.—9 miles N of No. 12 Well, Canning Stock Route, 5 Sept. 1942, *H. M. Wilson* 11 (PERTH); 5 miles N of Camel Well, NE of Wiluna, 8 Sept. 1958, *N. H. Speck* 1399 (CANB, PERTH); 3 miles W. of Yamarna H.S., E. of Laverton, 2 July 1963, *A. S. George* 4629 (PERTH).

N.T.—South of the Davenport Hills (26 miles E of State border on road from Giles, W.A. to Sandy Blight Junction), 25 July, 1967 *A. S. George* 8920 (PERTH, NT, RSA). (Figure 1.)

This species is readily distinguished from *L. hakeifolia* by its lower, spreading habit and the remarkable sulcate leaves. It has been collected in several habitats, viz. on a sandstone ridge (Wilson 11), on the crest of a mudstone escarpment (Speck 1399), on a gentle gravelly slope (George 8211) and on the sides of sand dunes (George 4629 and 8920). It forms small populations in widely separated localities. Flowering is apparently dependent on rainfall, as with most desert plants: Wilson 11, collected in September is in flower and bud, but Speck 1399, collected in the same month of a different year, is in bud only; George 8211, (October) is in full flower, as also is George 8920 (July); however, 4629 (July) has fruit only, with no sign of buds.

The Northern Territory record is the first for the genus outside Western Australia and is an interesting addition to the central Australian flora [G. Chippendale, Check List of Northern Territory Plants, in Proc. Linn. Soc. N.S. Wales 96, 4: 207-267 (1972)].

## A taxonomic revision of the genus *Tecticornia* (Chenopodiaceae)

By P. G. Wilson

### Abstract

An account is given of the genus *Tecticornia* and of its relationship to other genera. Two species are described as new; they are *T. verrucosa* and *T. arborea*. The third species is provided with a new combination as *T. australasica* (based on *Halocnemum australasicum* Moq.). The nomenclatural confusion which has surrounded this name is outlined.

### Introduction

The genus *Tecticornia* is a member of the tribe *Salicornieae* in the family *Chenopodiaceae*. This tribe contains those succulent chenopod genera with apparently jointed, leafless stems and usually spike-like inflorescences.

The delimitation of genera within this tribe is notoriously difficult and, as far as Australian plants are concerned, the available generic names have been somewhat haphazardly applied by different authors. From this confusion the genus *Tecticornia* does stand apart, for it has, since its inception, been recognised as being a taxon distinct from the other members of the Australian *Salicornieae*. This recognition has persisted in spite of the fact that descriptions of its supposedly diagnostic characters which have been provided by various authors, are so general as to encompass several genera, or so incorrect as to render them useless. These errors are nevertheless understandable for the earlier workers had only dried material for examination, and for an adequate study of the plants in the flowering stage fresh or pickled material is essential. Fortunately, through the efforts of several workers mentioned in the acknowledgements, this material has been made available.

### Systematic Notes

The genus *Tecticornia* was placed by Ulbrich (1934) along with *Halostachys* and *Halocnemum* in the subtribe *Halostachinae* of the tribe *Salicornieae*. This systematic arrangement was based on the presence in all three genera of free opposite and decussate bracts, a character not in this case of phylogenetic significance, for in habit, and in perianth and seed morphology, *Tecticornia* is quite different from the other two.

Free opposite bracts are also found consistently in several Australian species of *Arthrocnemum*, and a state of transition from free to united bracts may be found in other species of that genus. This character cannot therefore be used by itself to separate the subtribes or genera of the *Salicornieae* found in Australia.

The characters which, when taken together, serve to distinguish the genus *Tecticornia* from other Australian members of the tribe are: (1) the free opposite and decussate bracts which have fleshy upturned outer margins; (2) the pair of laterally placed tepals that are eventually free from each other and from the surrounding bracts; and (3) the disintegration of the spike, when mature, into its separate components of bracts, tepals, pericarp, and seed. All *Tecticornia* species are annuals or short-lived perennials (while in other Australian genera the species are either long-lived perennials or shrubs), and all have glaucous, cylindrical articles.

### Distribution and Habitat

All of the three known species of *Tecticornia* are native to Australia. Two are endemic there while the third (*T. australasica*) is found also in Java and New Guinea. They are entirely tropical or sub-tropical in distribution (north of latitude 27°S) except for a single record of *T. verrucosa* from south of latitude 33°.

Two species, *T. australasica* and *T. verrucosa*, grow along the coast in mudflats above the normal diurnal tidal level. Germination of the seed under these conditions appears to be dependent upon the seasonal rain leaching the salt from the upper soil layers. *T. arborea* has been collected a few miles from the sea on claypans but it is not found directly on the coast. Both this species and *T. verrucosa* also occur far inland where they form monospecific stands on non-saline claypans, or, in the case of *T. verrucosa*, also on moderately saline flats. None of the species occurs around the inland salt-lakes where other members of the *Salicornieae* are so common.

### Aboriginal Use

The seeds of both *T. verrucosa* and of *T. arborea* were at one time used by Aborigines as food. Further notes on this subject appear under these two species.

### TECTICORNIA Hook. f.

Hook.f. in Benth. et Hook.f., Gen. Pl. 3:65 (1880); Black, Trans. Roy. Soc. S. Austral. 43:366. tab. 37 (1919); Ulbrich in Engler et Prantl, Nat. Pflanzenfam. ed. 2. 16c:548 (1934); Backer in van Steenis, Fl. Males. ser. 1. 4:103 (1949).

Annual or short-lived *perennial*, herbaceous to suffruticose, apparently leafless plants. *Branches* apparently jointed and succulent due to the opposite leaves enveloping the stem in a cylindrical sheath; leaf-blade minute or absent. *Inflorescence* of terminal and lateral spike-like cymes consisting of 3(5) flowers in the axils of opposite and decussate rows of free (or almost free) bracts. *Bracts* closely imbricate, standing vertical to spike axis, broadly deltoid to semicircular, the outer margin fleshy with an upturned rim. *Flowers* hermaphrodite, concealed within bracts and standing vertical to spike axis, free or at first loosely united to upper bract and to each other; *perianth* succulent, of two laterally placed, plano-convex tepals which are free or slightly united along lower margin towards base, the flat sides pressed together and enclosing the ovary; *stamen* solitary, abaxial; *ovary* thin-walled; *style* slender, weak, with a pair of filiform stigmas. *Fruiting perianth*: tepals completely free and, when dry, areolate and hyaline. Utricle obovoid, with membranous pericarp. *Seed* erect, endospermous; testa thinly coriaceous; embryo on upper (adaxial) side, slender, curved; radicle inferior; seed dispersed on the drying and subsequent complete disintegration of the spike, perianth, and pericarp.

*Type species*: *T. cinerea* (F. Muell.) Baill. [= *T. australasica* (Moq.) P. G. Wils.].

Origin of name: From the Greek words *tectum*, a roof, and *cornu* a horn. Presumably alluding to the manner in which the outer margin of the bracts forms a covering to the spike. Probably also to emphasize a relationship with the genus *Salicornia*.

### Key to Species

1. Spikes predominantly terminal; seed ovate with flat sides, shortly aculeate along upper margin  
1. *T. australasica*
2. Spikes lateral, or both terminal and lateral; seed neither flat nor aculeate.  
2. Spikes lateral, sessile and decussate; seed  $\pm$  plano-convex, verruculose 2. *T. verrucosa*
2. Spikes terminal and lateral (but not sessile); seed bluntly ellipsoidal, smooth  
3. *T. arborea*

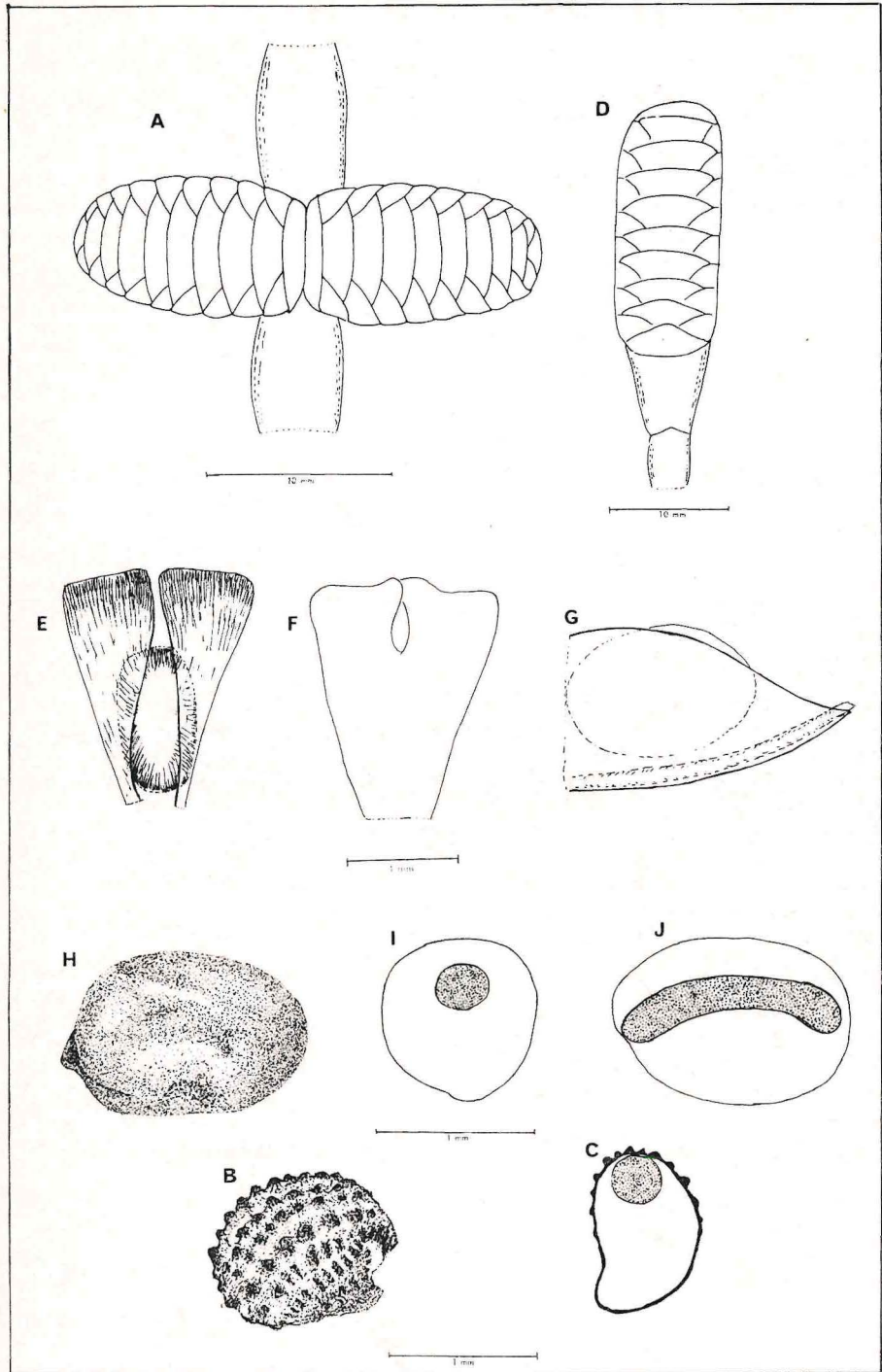


Figure 1—*Tecticornia verrucosa*: A, spike; B, seed; C, T.S. of seed. *Tecticornia arborea*: D, spike; E, flower from above, F from below, and G from side; H, seed; I, T.S. of seed; J, L.S. of seed.  
 (A–C from Maconochie 1036; D–G from Wilson 8577; H–J from Aplin B20).

### 1. *Tecticornia australasica* (Moq.) P. G. Wilson comb. nov.

*Halocnemum australasicum* Moq., *Chenop. Enum.* 110 (1840).—*Arthrocnemum australasicum* (Moq.) Moss apud Adamson, *J. South Afr. Bot.* 20:19 (1954), as to combination only.—*Salicornia australasica* (Moq.) Eichler, *Taxon* 12:296 (1963), as to combination only.—*Type*: "In nova Hollandia" (holo: P, photo seen, labelled "Nouv. Hollande—Port de Georges"). *H. cinereum* F. Muell., *Fragm.* 1:140 (1859).—*Salicornia cinerea* (F. Muell.) F. Muell. ex Benth., *Fl. Austral.* 5:203 (1870).—*Tecticornia cinerea* (F. Muell.) Baillon, *Hist. Pl.* 9:185 (1887).—*Type*: "In locis salinis terrae Arnhem's Land et Australiae centralis" (syn: "Sturt's Creek, Central Australia", F. Mueller, MEL 36057 and 36058; "Point Pearce and Sturt's Creek", F. Mueller, K, n.v., compared by D. J. McGillivray).

Succulent herbaceous to suffruticose *annual*, 12–40 cm high. Lower *branches* frequently procumbent, upper ones erect; internodes narrowly cylindrical, 7–15 mm long, bluish green and glaucous, apex shortly bilobed with a broad scarious margin. *Spikes* predominantly terminal (occasionally also lateral, in which case they are sessile and at right angles to stem), narrowly ovoid and ca. 1 cm long to narrowly cylindrical and up to 4 cm long, 5–7 mm diam. *Bracts* semicircular in shape. *Flowers* 3–5 in each bract (the lateral flowers sometimes sterile), ca. 2.5 mm long, at first fused with upper bract near base, otherwise free. *Tepals* laterally appressed, obovoid, acute, plano-convex in transverse section, at first united below (abaxially) towards base, otherwise free. *Staminal filament* slender, weak; anther oblong-cordate, ca. 1 mm long. *Seed* ovately discoidal, ca. 1.5 mm long; testa dark brown to black with about 10 indefinite rows of small, grey, translucent and aculeate tubercles along upper margin, the lower margin sparsely aculeate and the sides almost smooth. (Figure 2,4.)

*Distribution*: Coastal tropical Queensland and the Northern Territory (and Western Australia?), Java and New Guinea. (Figure 7.)

*Northern Territory*: Fog Bay 12° 48' S, 130° 21' E, S. T. Blake 16764 (BRI); Coast, 5 mi N of Finnis R., N. Byrnes 1686 (NT); Port Darwin, Holtze 355 (MEL); 21.8 mi NW of Mountnorris Bay, G. Chippendale 8168 (NT); East Alligator R., N. Byrnes 918 (NT); Oenpelli, 12° 18' S, 133° 4' E, R. L. Specht 1182 (BRI).

*Queensland*: Karumba, Burke Dist. G. W. Trapnell 200 (BRI); Cape York, B. Hyland 2507 (BRI); Trinity Bay, W. Hill 3 (MEL); Townsville, N. Michael 474 (BRI); Giru, 19° 31' S, 147° 6' E, Nov. 1968, J. Burry (BRI); Caley Valley via Bowen, 11 Nov. 1959, H. J. Lavery (BRI).

*New Guinea*: Terr. of Papua: 8 mi N of Kapa Kapa, R. Schodde 2736 (BRI); 7 mi NW of Hisiu village, P. J. Darbyshire 892 (BRI). West Irian: Merauke, H. S. McKee 1703 (NSW).

*Ecology*: Found on mudflats in coastal or near coastal situations, sometimes in association with mangroves. Mr. N. Byrnes has supplied the following notes which are derived from his personal observations: "The plant is an annual, germinating at the end of the 'wet'. It seldom grows much larger than 18 in. though some clumps can be dense. It varies between slightly procumbent to almost prostrate and begins to flower in August. It is normally found on the salt pans at the back of the mangroves along tidal creeks in pure communities or associated with *Arthrocnemum* sp."

Apparently it is not able to withstand strongly saline conditions but grows well in coastal flats seasonally inundated by fresh water.

*Notes*: The taxonomy of this species has been confused due to the poor material the earlier workers had available to them and also to the fact that the short description of *Halocnemum australasicum* provided by Moquin was insufficient for the name to be used subsequently with any certainty. J. D. Hooker (1880) equated the name with *Salicornia quinqueflora* Bunge ex Ung.-Sternb. but did not make any formal transfer. This synonymy was also accepted by C. E. Moss (1954) who considered the species to belong to the genus *Arthrocnemum* and made the necessary new combination. Moss typified the species by a collection made by Robert Brown ("no. 3080" at BM), supposedly in the

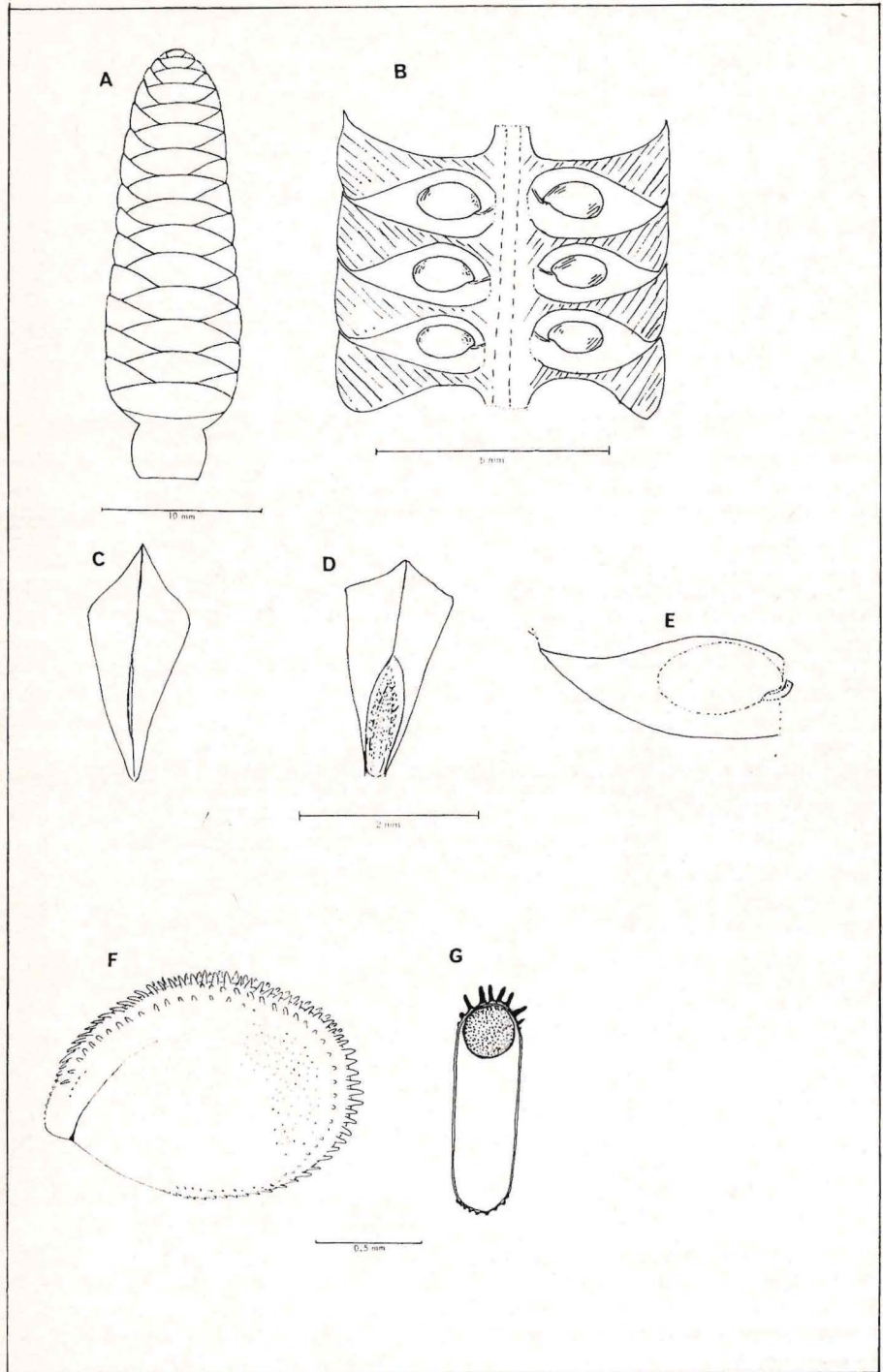


Figure 2—*Tecticornia australasica*: A, spike; B, L.S. of spike; C, flower from below, D from above, and E from side; F, seed; G, T.S. of seed. (A–E from Byrnes 1950; F–G from J. Burry, Qld.).

East Indies, and applied the name to a South African plant which was later described by H. R. Tölken (1967) as a new species, *Arthrocnemum decumbens*. A similar typification was accepted by H. J. Eichler (1963) who transferred *H. australasicum* to *Salicornia* and placed in synonymy under it *S. australis* Solander ex Benth. (1870).

The course followed by Eichler relied on the assumption that the names *H. australasicum* Moq. and *S. australis* Benth. were both based on *S. indica* [non Willd.] R. Br. (since the last name was cited by Moquin and Benth. in synonymy under their respective species), and therefore that Benth. name was a synonym of Moquin's. The citation provided by Moquin was as follows: "*Salicornia Indica* R. Brown. Prodr. nov. Holl. 1. p.411? non Willd. (v.s. in herb. Mus. Paris)". This would appear to state that Moquin considered it possible that the plant described by R. Brown under the name "*S. indica* Willd." was in fact the same as his own species, i.e. as *H. australasicum*. Moquin had not, however, seen R. Brown's material, nor did he cite it. *H. australasicum* must therefore be typified by the specimen in Paris which Moquin had studied and which he had also used to draw up his description.

J. M. Black (1921) attempted to resolve the identity of this type specimen and published a description of the spike and seed from notes provided for him by Prof. Lecomte in Paris. Here Black assumed that it was probably related to *Arthrocnemum lylei* (Ewart et White) Black, which assumption was accepted and supported by Tölken (1967). The fact that Black was also unable to apply the name satisfactorily was partly due to the still inadequate description and partly to the confusion of localities. In his original paper of 1840 Moquin gave as the plant's origin only "In novâ Hollandia". Subsequently (1849) he added "ad portum Georgii", which was interpreted by both Benth. and Black as being King George Sound, a locality on the south coast of Western Australia. A photograph of the type of *H. australasicum* shows that it consists of two portions of stem, one of which has a short lateral branch attached. Fortunately the actual specimen had previously been studied by Dr. L. A. S. Johnson who recognised it as being conspecific with *Tecticornia cinerea*. Mr. J. Carrick, while working in Europe as the Australian Botanical Liaison Officer, compared the seed with that obtained from a recent collection of the species and found them to be the same.

The locality given by Moquin, and which also appears on the herbarium label as "Port de Georges", is therefore either an error (as the species is tropical in distribution), or the name refers to a place other than King George Sound.

The only collection recorded from an inland situation was that made by F. von Mueller in 1856 along Sturt Creek, which is in the north-east of Western Australia. I have seen one other collection of a *Tecticornia* from this area; this was made by Dr. J. S. Beard in 1968 at Lake Doman (approximately 70 km west of the southern end of Sturt Creek) and is of *T. verrucosa*. Although *T. verrucosa* has been confused with *T. australasica*, all of Mueller's specimens belong in fact to the latter species. These collections constitute therefore the only inland record for *T. australasica* (if the locality data are correct), and also the only record for Western Australia.

The application of the name *Salicornia australis* Sol. ex Benth. (1870) depends on its lectotypification. Solander applied the name (in manuscript) to a specimen collected by J. G. and J. R. Forster in New Zealand. This specimen was also referred to by Benth. and, if made the lectotype, the name would probably become a synonym of *S. quinqueflora* Ung.-Sternb. (1866).

The combination "*Tecticornia cinerea*" has been variously attributed to J. D. Hooker (1880), F. M. Bailey (1901), and J. M. Black (1919). Hooker never in fact published the combination and the first person to do so was

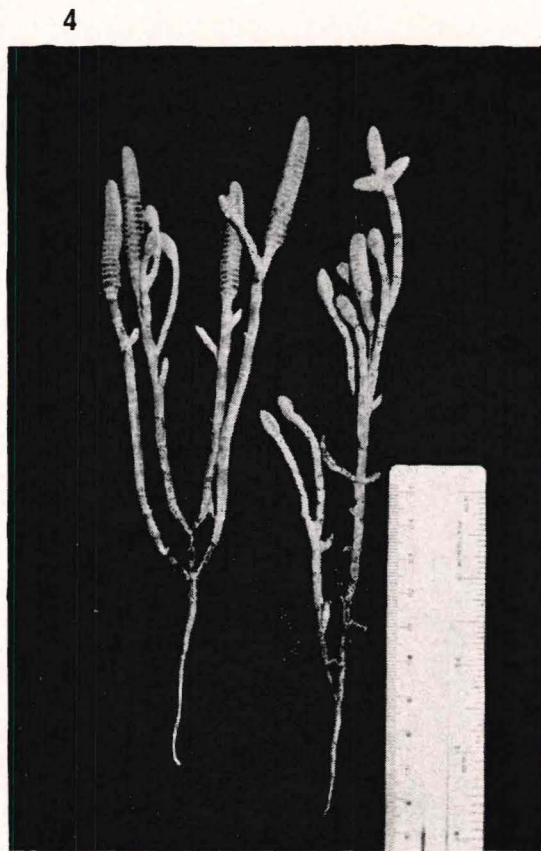
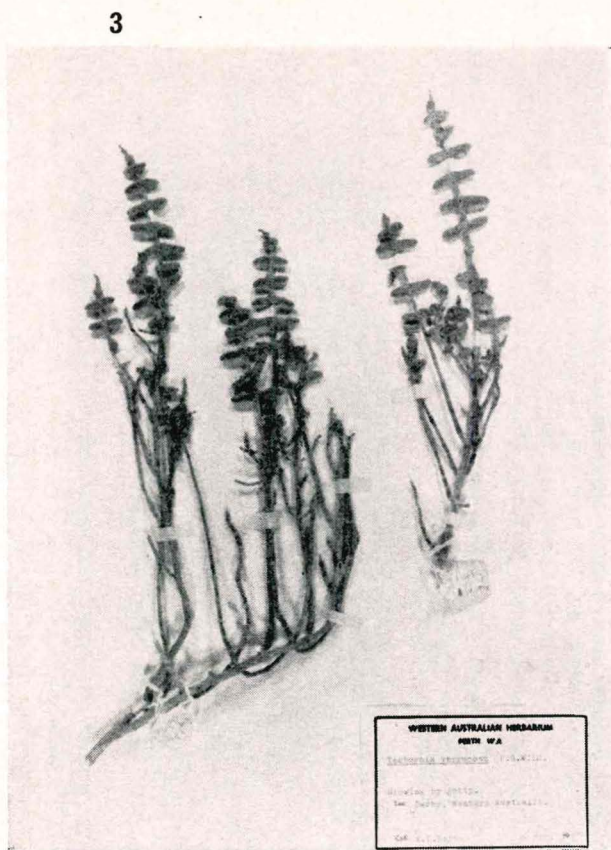


Figure 3—*Tecticornia verrucosa*, x approx. 1/4 (A. L. Payne s.n.). Figure 4—*Tecticornia australasica*, x approx. 3/4 (N. Byrnes 1950).

apparently H. E. Baillon in 1887. It was subsequently made by B. Daydon Jackson in Index Kewensis 2:1041 (1895) and then independently by both F. M. Bailey and J. M. Black.

## 2. *Tecticornia verrucosa* P. G. Wilson sp. nov.

*Spicae* oppositae et decussatae, ad axem rami verticales, sessiles, breviter cylindraceae, 10–20 mm longae, 6 mm latae. *Semina* late et obtuse elliptica vel suborbicularia, patelliformia (leviter concavo-convexa), ca. 1·8 mm longa, verruculosa.

*Type*: 9 mi SE of Rabbit Flat 20° 15' S, 130° E, Northern Territory, small erect shrub with several stems to 8 in. high, 26 May 1970, J. R. Maconochie 1036 (holo: PERTH, iso: K, MEL, NSW).

Annual or short-lived perennial, to 40 cm high, branching at the sometimes woody base. *Lower branches* often decumbent and giving rise to erect stems. *Articles* cylindrical (to obovoid), 10–14 mm long, 5–6 (18) mm diam., pale bluish green (or pale red), glaucous; apex truncate with minute lobes; margin a narrow scarious rim. *Inflorescence* of opposite and decussate lateral spikes along upper portion of branches (occasionally a very small terminal spike is present), each opposite pair being separated from neighbouring pairs by a single internode. *Spikes* sessile, standing at right angles to branch axis, shortly cylindrical, 10–20 mm long, 6 mm diam.; *bracts* at first loosely adherent laterally to each other along basal margins, eventually free. *Flowers* in triads, free from each other and from lower bract, united in basal half to upper bract, the lateral florets loosely united in basal half to lateral bracts, *Perianth* obovoid, obtuse, ca. 2 mm long, elliptical in transverse section; tepals free below (abaxially) but lightly united adaxially in lower half, eventually completely free. *Staminal filament* eventually subulate; anther oblong-cordate, ca. 1·3 mm long (sometimes aborted). *Style* slender, the stigmas filamentous and ca. 3·5 mm long. *Seed* broadly and bluntly elliptical to suborbicular, plano-convex to slightly concavo-convex, ca. 1·8 mm long, verruculose around upper margin, grading to  $\pm$  smooth below, brown to black, surrounded by and adherent to the transparent membranous pericarp. (Figure 1A–C, 3).

*Distribution*: Tropical and sub-tropical North-West and Central Australia. Also known from a single locality in the southern portion of Western Australia near Lake Grace. (Figure 7).

*Western Australia*: Derby, R. D. Royce 3336 (PERTH); *ibid.*, A. S. George 6532 (PERTH); 13 mi ESE of Wyndham township, R. A. Perry 2559 (NSW, NT); 13 mi WSW of Yeeda Station, Kimberleys, M. Lazarides 6586 (PERTH); Noblys Well, E. Kimberley, Aug. 1906, W. V. Fitzgerald (NSW 126370); Lake Doman, J. S. Beard 5601 (PERTH); Dovers Hills, ca. 30 mi S of Lake Mackay, 13 June 1962, J. Long (NT, PERTH); SE of Lake Anec, Lat. 24° S, June 1958, W. H. Moyle (PERTH); Boolathanna Station N of Carnarvon, T. E. H. Aplin B14 (PERTH); 4 mi W of Dovers Hills, northern Gibson Desert, A. S. George 9003 (PERTH); ca. 13 km ESE of Mt. William Lambert, Sept., 1971, D. Lowry (PERTH); Lake Bryde, ca. 20 mi WSW of Newdegate, T. E. H. Aplin 4793 (PERTH).

*Northern Territory*: 7 mi SE of Rabbit Flat, 130° E, 20° 15' S, J. R. Maconochie 1031 (PERTH); 75 mi W of The Granites, 21 Mar. 1963, A. J. Mahood (NT 10257); 3 mi NE of Lake Mackay, G. Chippendale 3391 (BRI, MEL, NSW, NT, PERTH).

*Ecology*: Found on coastal mudflats and also inland on fresh water claypans and slightly saline flats.

*Aboriginal Use*: A note attached to a specimen collected by J. Long from about 30 mi S. of Lake Mackay in 1962 states that the plant was used by natives as a food. A further account of its use as a food occurs in a "Report on health and nutrition of natives from Rawlinson Range to Lake MacDonald, 1958" compiled by J. J. Elphinstone for the Department of Public Health, Western Australia. In this paper Mr. W. H. Moyle contributed the following comment: "Mungiba (*Tecticornia cinerea*)

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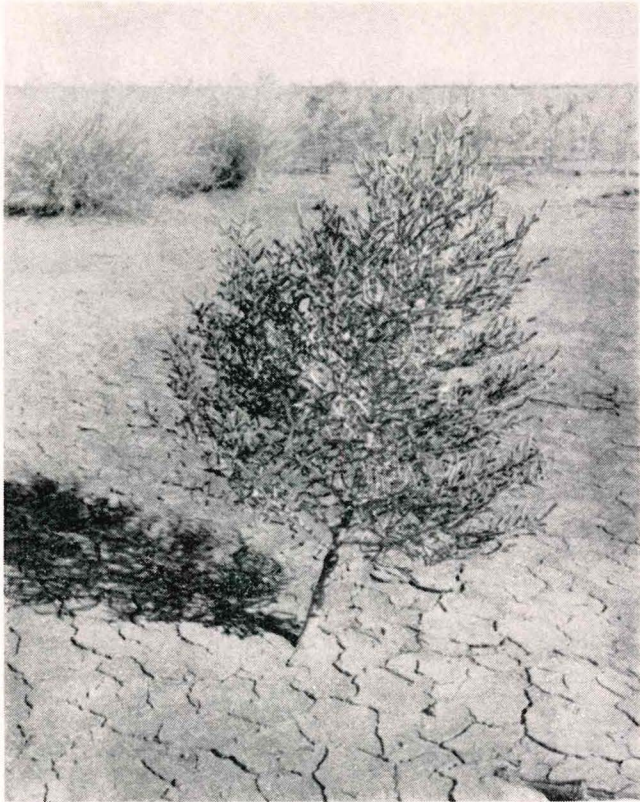


Figure 5—*Tecticornia arborea*: plant ca. 1.3 m high.

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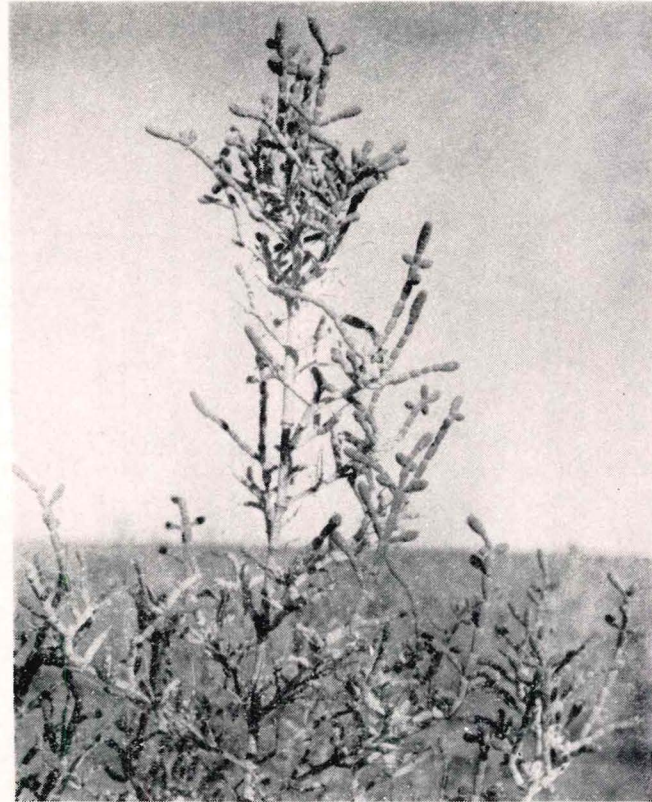


Figure 6—*Tecticornia arborea*: terminal portion of branches showing spikes. (At Bulli Bulli Clay Pan, near Cue, Western Australia).

This plant usually grows in salt pan country. The only patch we saw was in a fresh water clay pan S.E. of Lake Anec and almost on the 24° latitude. The plant is not known to natives in the Warburton-Rawlinson area, but it is a favourite source of food for those further north. The fleshy bulbs containing small seeds are eaten direct from the plant and have a pleasant, slightly salty flavour."

Specimens of the plant referred to have been lodged with the Western Australian Herbarium and are of *T. verrucosa*.

*Notes:* There is a slight variation in the shape and degree of verrucosity of the seed. In the northern collections the seed is narrower and bears more numerous but smaller verrucosities compared with seed from plants collected in inland localities.

The coastal form behaves as an annual. Its seed germinates after immersion in fresh water following the summer rains. In inland localities the plant has sometimes the appearance of being two or more years old.

### 3. *Tecticornia arborea* P. G. Wilson sp. nov.

*Spicae* terminales et laterales, pedunculatae (haud sessiles), cylindratae vel leviter fusi-formes, 10–20 mm longae, 7 mm latae. *Semina* late ellipsoidea, obtusa ca. 1.5 mm longa, laevia.

*Type:* Bulli Bulli Clay Pan, Glen Station, ca. 60 km NW of Cue, Western Australia; erect pine-like plants up to 172 cm high (average about 135 cm), well-spaced on hard reddish brown clay, the only species present; 5 Aug. 1969, P. G. Wilson 8577 (holo: PERTH, iso: AD, B, BRI, CANB, GH, K, L, MEL, NSW).

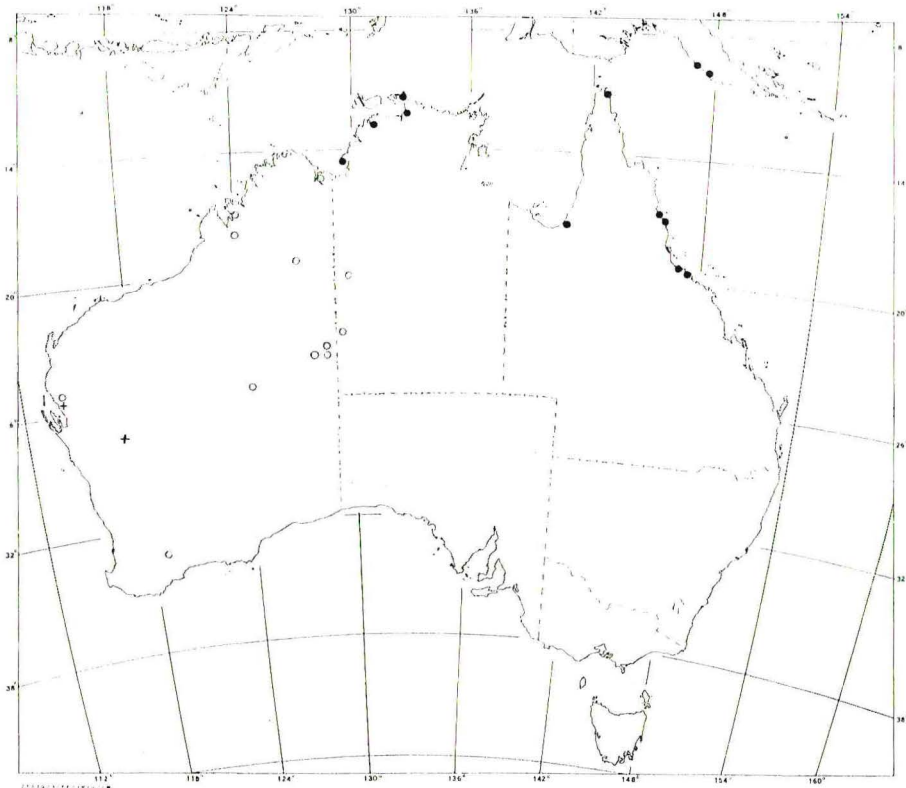


Figure 7—Distribution of *Tecticornia* species. *Tecticornia australasica* ● *T. arborea* + *T. verrucosa* ○.

Erect pyramidal-shaped plant, loosely branched and with a single stem, to ca. 150 cm high, woody towards base. *Articles* on branchlets cylindrical,  $\pm$  truncate, 1-3 cm long, 5-12 mm diam., green to purple, glaucous. *Spikes* terminal to main and lateral branches (not sessile), cylindrical or slightly fusiform, 10-20 mm long, ca. 7 mm diam. smooth, bracts free, reniform. *Flowers* protogynous and arranged in triads, free from each other and from bracts. *Perianth* deltoid-shaped from above (broadest at apex), ca. 3 mm long, dorsiventrally flattened at apex, distal half thick and succulent, proximal portion thin; *tepals* separated on upper (adaxial) side, united in basal two-thirds on lower side, eventually free, slightly imbricate at apex. *Staminal filament* subulate; anther cordate-oblong, ca. 2 mm long. *Seed* broadly ellipsoidal, rounded at both ends, ca. 1.5 mm long, with long axis vertical to spike axis; testa smooth, reddish brown, glossy; embryo near upper margin of seed surrounded by copious endosperm. Pericarp, eventually tearing at base and forming a loose cap to the ripe seed. (Figure 1D-J, 5, 6).

*Distribution*: Known from only two localities in subtropical Western Australia between approximately the 24° and 27° of latitude. (Figure 7).

W end of Weld Range, 15 June 1961, S. Davies (PERTH); *ibid.*, Apr. 1969, Pat. Lindsey (PERTH); 23 mi E of Kalli, N. H. Speck 1066 (PERTH); Boolathanna Station N of Carnarvon, T. E. H. Aplin, B. 20 (PERTH); Carnarvon, Apr. 1962 J. N. Hutchinson (PERTH).

It is probable, in spite of the varied locality data, that the plant has in fact been found in only two places, the one about 60 km north-west of Cue and the other north of Carnarvon.

*Ecology*: In the two localities where it has been recorded it grows in fresh-water claypans as a monospecific stand.

*Notes*: This species is remarkable because of its erect tree-like habit. It appears to be capable of living for several years although precise data on this point are lacking. A vigorous stand was observed at the type locality in August 1969 but a year later all the mature plants were dead and no young ones were found. Presumably regeneration from seed would have commenced with the first good rain of the new season.

*Aboriginal Use*: The seed is large compared with that of other samphire species, and was at one time collected by aborigines for use as a food. They gave it the name of "bulli bulli".

#### Acknowledgements

Several people have substantially assisted in the study of the genus *Tecticornia*. Mr. N. Byrnes of the Northern Territory Administration at Darwin has sent fresh material of *T. australasica*, while Mr. J. R. Maconochie of the Northern Territory Administration, at Alice Springs and Mr. A. L. Payne of the W.A. Department of Agriculture at Derby have both provided fresh material of *T. verrucosa*.

During his period as Australian Botanical Liaison Officer at Kew Mr. D. J. McGillivray arranged for a photograph of the type of *Halocnemum australasicum* (which is in Paris) to be sent to me and also compared the syntypes at Kew of *Halocnemum cinereum* with recent collections of this species. Mr. J. Carrick, who later occupied the same position, kindly compared the seed on the type specimen of *H. australasicum* with that from several species in the *Salicorniaceae*.

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## Taxonomic notes on Western Australian species of *Pityrodia*, *Beaufortia* and *Verticordia*

By A. S. George

### Abstract

The correct application of the name *Pityrodia axillaris* (Endl.) Druce is shown and a new combination, *P. terminalis* (Endl.) comb. nov. is provided for the species to which the former name was incorrectly applied. *Beaufortia macrostemon* Lindl. var. *incana* Benth. is raised to specific rank.

The following names are shown to be correct for three species of *Verticordia* which have commonly been otherwise referred to—

*V. brachypoda* Turcz., *V. chrysostachys* Meisn. and *V. helmsii* S. Moore.

### Introduction

These notes are intended to provide the correct names for several commonly-collected plants. Preliminary work is being done towards a revision of the genus *Verticordia* but it is unlikely that this or similar studies of *Beaufortia* and *Pityrodia* will appear for some years.

### *Pityrodia* R. Br. (Dicrastylidaceae)

***Pityrodia terminalis*** (Endl.) A. S. George comb. nov.

Basionym: *Dasymalia terminalis* Endl., in Endl. et Fenzl. Nov. Stirp. Dec. 12 (15 May 1839).

Type: Interior of S.W. Australia, Roe. Holo: W.

Synonyms: *Pityrodia racemosa* (Turcz.) Benth., Fl. Austral. 5:50 (1870)—*Quoya? racemosa* Turcz., Bull. Soc. Imp. Nat. Mosc. 2:194 (1863). Types: Western Australia, Drummond Coll. 3:141 and Coll. 5:73. Isosyntypes of 5:73 at PERTH, K.

*Chloanthes stachyodes* F. Muell., Fragm. Phyt. Austral. 5:50 (July 1865)—*Quoya stachyodes* F. Muell. l.c. nomen pro syn. Type: In fissuris rupium graniticarum Australiae occidentalis interioris longitudine 113° 45', latitudine 30° 15'. ?coll.

*Chloanthes grandiflora* Moldenke, Phytologia 2:310 (22 April 1947). Type: Western Australia, J. Mauritson, Sept. 1936. Holo: S.

This is the species which for many years has been incorrectly referred to as *Pityrodia axillaris* (Endl.) Druce, and before the publication of that combination as *P. racemosa* (Turcz.) Benth. Examination of the types and original descriptions shows that *P. axillaris* is the species which was recently described as *P. spectabilis* C. A. Gardn. (see below). The other names cited above all apply to the same species, and Endlicher's epithet is the earliest available.

***Pityrodia axillaris*** (Endl.) Druce, Rep. Bot. Exch. Cl. Brit. Isles 1916:640 (1917)—*Dasymalia axillaris* Endl., Nov. Stirp. Dec. 11 (15 May 1839). Type: Interior of S.W. Australia, Roe. Holo: W.

Synonym: *Pityrodia spectabilis* C. A. Gardn., Journ. Roy. Soc. W. Austral. 47:63 (1964). Type: in distr. Irwin prope Buntine in arenosis lutosus, fl., m. Decem., Gardner 12023. Holo: PERTH.

As mentioned above, the name *Pityrodia axillaris* has been incorrectly applied to the species which should be called *P. terminalis*. This led C. A. Gardner to describe as a new species the plant to which the name was originally applied. Endlicher described the stamens as included, but this was due to his examining unopened buds, the dissections of which are still present on the Holotype sheet.

### **Beaufortia** R. Br. (Myrtaceae)

*Beaufortia incana* (Benth.) A. S. George comb. et stat. nov.

Basionym: *Beaufortia macrostemon* Lindl. var. *incana* Benth., Fl. Austral. 3:167 (1866). Type: Swan River (Western Australia), *Drummond*. Holo: K.

This differs in several important respects from typical *Beaufortia macrostemon* Lindl., and deserves specific rank. It is a tall rigidly-branched shrub of 1-2 m without a lignotuber, *i.e.* killed by fire and regenerating from seed. The leaves are narrow-linear, 1-nerved or nerveless, and densely appressed-pubescent, broader on new growth. The calyx-lobes are triangular, obtuse,  $\pm 1$  mm long (about half the length of the petals), densely pubescent, with inconspicuous nerves. The fruiting capsule is  $\pm 2$  mm diam. *Beaufortia macrostemon* is a shrub of 20-50 cm with many relatively slender branches arising from a lignotuber and regenerating from this after fire. The leaves are narrow-lanceolate, 1-nerved and often with 1-2 lateral nerves, the latter sometimes marginal, and the indumentum of short and long hairs, very spreading and much less dense than in *B. incana*. The calyx-lobes are almost subulate,  $\pm 3$  mm long (as long as the petals), sparsely hirsute-pubescent, and 3-nerved. The fruiting capsule is  $\pm 3$  mm diam.

*Beaufortia incana* is frequent on gravelly heaths between Pingelly and Nyabing, while *B. macrostemon* occurs in open woodlands along the Darling Scarp between Mogumber and Pinjarra.

### **Verticordia** DC. (Myrtaceae)

Attention is drawn to the correct names for the following species of *Verticordia*:

**Verticordia brachypoda** Turcz., Bull. Soc. Nat. Mosc. 20, 1:158 (1847). Types: (Western Australia) *Drummond* Coll. 3:28 (BM, FI, K); *Gilbert* 30 (n.v.).

Synonyms: *Verticordia fimbriopetala* Turcz., Bull. Soc. Nat. Mosc. 22, 1:19 (1849). Type: *Drummond* 4:47 (FI, K, NSW, W.).

*Verticordia stylotricha* Diels, Bot. Jahrb. 35:403 (1904). Type: pr. Tammin in arenosis fruticulosis apertis flor., m. Oct., *Diels* 5052 (BM, E, K, P.).

Note that *V. multiflora* Turcz. is a distinct species differing from *V. brachypoda* in the bright yellow flowers and in floral morphology. The two were considered conspecific by W. E. Blackall in *How to Know Western Australian Wildflowers* Vol. 1, p. 278 (1954), but the varietal combination cited there (*V. multiflora* var. *stylotricha*) has never been validly published.

**Verticordia chrysostachys** Meisn., Journ. Linn. Soc. Bot. 1:41 (1857). Type: (Western Australia) *Drummond* Coll. 6:46 (Holo: NY, iso: BM, CGE, E, FI, K, P. W.).

Note that this is the correct spelling, not *chrysostachya* as used by Bentham and subsequent workers.

**Verticordia helmsii** S. Moore, Journ. Linn. Soc. Bot. 34:190 (1898). Type: Nr. Gnarlbine, fl. Nov., *S. Moore* (K, NY); ad Warangering, *Helms* "in Herb. Kew" (n.v.).

Synonym: *Verticordia adenocalyx* Diels, Bot. Jahrb. 35:404 (1904). Type: pr. Karalee inter fruticeta praecipue Acaciarum in arenosis, fl. m. Nov., *Diels* 5566 (n.v.).

Although the type of *V. adenocalyx* has not been found, the description, and area and time of collection, agree well with those of *V. helmsii*.

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